Overview of Holistic Analysis of Environmental Management Risks and Opportunities, Business Impact, and Strategies

In this section, we list and disclose risks and opportunities, business impact, and analysis of related strategies, for each category for which disclosure is required by the TCFD recommendations (June 2018), new TCFD guidance (October 2021), v1.0 of the TNFD recommendations (September 2023), and other standards.
There are many areas where climate change and natural capital cannot be assessed separately because they are interrelated, and we must therefore adopt integrated strategies to solve these issues. Accordingly, we provide information concerning risks and opportunities, business impact, and strategies for categories common to both frameworks. We have also provided information related to containers and packaging under categories that we have deemed relevant.
We assume that readers will refer to the information in this part as a single whole together with the information disclosed in "Holistic Environmental Management Information Disclosure Based on the TCFD Framework, TNFD Framework Draft, etc." (→P.15～P.40).
We also assume, however, that there are many occasions where readers will only refer to this part independently, and we have therefore reiterated the same tables, graphs, figures, etc., in both parts as necessary.

We plan to meet TNFD disclosure standards over a period of approximately five years.
The following is a rough overview of our schedule starting in 2022.

2022	Became a global pioneer with disclosure compliant with the LEAP approach advocated in beta v0.1 of the TNFD Framework
2023	Trial scenario analysis at New Belgium Brewery, US, with the participation of TNFD members Assessment of the financial impact of natural capital Trial assessment of risks and opportunities related to natural capital Detailed analysis of tea farms in Sri Lanka Trial of holistic disclosure with TCFD
2024	Holistic risk and opportunity assessment and determination of priority regions in accordance with v1.0 of the TNFD recommendations Detailed assessment of priority regions Holistic disclosure of natural capital, climate change, and the circular economy
2025	Revision of the "Action Plan for Sustainable Use of Biological Resources" to reflect the results of the assessment of natural capital Conduct a detailed analysis of some material natural capital identified Review of the natural capital roadmap
2026	Completion of detailed analysis for identified material agricultural products and priority regions Establishment and start of execution of our natural capital roadmap

Climate change scenarios

		Kirin Group Scenario 3 4℃ scenario. SSP3, RCP8.5	Kirin Group Scenario 1 2℃ or 1.5℃ Scenario. SSP1, RCP2.6
Scenario		●Laws and regulations related to climate change are strict in developed countries, but insufficient globally, resulting in failure to achieve the required reduction in GHG emissions. ●Higher temperatures, droughts and heavy rains, and reductions in daily temperature ranges lead to significant decreases in the yield and quality of agricultural products. Natural disasters caused by climate change also become frequent and severe. ●The financial impact on companies of compliance with laws and regulations and energy usage is small, but it becomes difficult to use low-cost, high-quality natural capital. ●Global warming also leads to an increase in infectious diseases, heatstroke, etc.	●Governments around the world enact strict laws and regulations related to climate change, resulting in a sufficient reduction in GHG emissions. ●The rise in temperature is curbed, natural disasters do not increase much more than current levels, and the impact on agricultural yields is also limited. Natural disasters do not change significantly from current levels. ●The financial impact on companies of compliance with laws and regulations and energy usage is large, but the cost of using natural capital is acceptable. ●The impact of global warming on health is minimal.
Analysis results		●Significant decline in yields of major agricultural products. Possible decline in quality. Increase in procurement costs. ●Damage to agricultural production areas, production stoppages, and delivery difficulties due to floods and droughts caused by climate change. ●The increase in energy costs and agricultural prices due to carbon taxes is minimal. ●There is major harm from infectious diseases and heatstroke due to global warming.	●The impact on yields of agricultural products and procurement costs is minimal. ●The impact of floods and droughts caused by climate change on agricultural production areas, production, and delivery is minimal. ●The impact of energy costs and agricultural prices due to carbon taxes is major. ●The impact of infectious diseases and heatstroke due to global warming continues.
Scientific basis	Agricultural products	●Decreases in global beer supply due to extreme drought and heat, Nature Plants, VOL.4, NOVEMBER 2018, 964–973 (Xie, et al.) ●IPCC (2019) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems Chapter 5: Food Security ●Risk of increased food insecurity under stringent global climate change mitigation policy. Nature Climate Change,volume 8, pages 699–703 (Hasegawa T, Fujimori S, HavlíkP, Valin H, BodirskyBL, DoelmanJC, FellmannT, Kyle P et al. 2018) ●Zebish et al (2005) “Climate Change in Germany Vulnerability and Adaptation of climate sensitive Sectors” FAO “Food and agriculture projections to 2050” etc.	
	Drought risk	●Aqueduct 3.0 (current risk), Aqueduct 2015 (risk assessment combining future projections, climate scenarios RCP4.5 and RCP8.5, and socioeconomic scenarios SSP2 and SSP3), etc.	
	Flood risk	●AIR Touchstone version 8.2	
	Agricultural products (impact of global warming on prices and carbon taxes)	●IPCC (2019) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems Chapter 5: Food Security and Risk of increased food insecurity under stringent global climate change mitigation policy. Nature Climate Change,volume 8, pages 699-703 (Hasegawa T, Fujimori S, HavlíkP, Valin H, BodirskyBL, DoelmanJC, FellmannT, Kyle Petal. 2018)	
	Energy	●IEA “World Energy Outlook 2019” Annex A (rate of decline in future electric power emission factors), IEA WEO 2019 (Kirin Group Scenario 3: Current Policies Scenario, Group Scenario 1: SD Scenario, 1.5℃ Scenario: IPCC Special Report on Global Warming of 1.5℃)	

Natural capital scenarios

		Kirin Group Scenario 3 4℃ scenario. SSP3, RCP8.5
Scenario		Original scenario
Scope of analysis	Dependence	●Order of assessment: tea, cardboard, soybeans, cartons, palm oil, hops, barley, wine grapes, and coffee beans
	Impact	●Order of assessment: coffee beans, hops, tea leaves, soybeans, palm oil, cartons, barley, cardboard boxes, and wine grapes
Scientific basis	GHG emissions by agricultural product	●Carbon footprint: CarbonCloud	ClimateHub database ●Agricultural production data: FAO average over the past five years, emissions models based on PCC guidelines, and global warming factors applied to IPCC GWP100 ●Paper: CFP data from the Japan Paper Association (because it is not in the ClimateHub database)
	Land use footprint	●Area harvested (ha) per crop and production quantity: t): Calculation of acreage per unit yield (ha/t) using 2022 data in FAO FAOSTAT ●Paper: Calculated using data from papers related to global forest product footprint estimation (because it is not included in FAOSTAT)
	Water footprint by agricultural product	●M. M. Mekonnen and A. Y. Hoekstra (2011) The green, blue and grey water footprint of crops and derived crop products Hydrol. Earth Syst. Sci., 15, 1577–1600 If not included in this, the water footprint was identified in another paper by Schyns et al. ●Joep F. Schyns, Martijn J. Booij, Arjen Y. Hoekstra (2017) The water footprint of wood for lumber, pulp, paper, fuel and firewood Advances in Water Resources Volume 107, September 2017, Pages 490-501
	Commodity risk	●Judged based on whether or not agricultural products are included in the SBTN's High Impact Commodity List ●Judged based on whether or not they are included in the list of commodities covered by the European Regulation on Deforestation Free Products (EUDR)
	Agricultural products and water risk by region	●Assessed by cross-referencing data on food production, demand, trade, prices, and hunger in countries and regions around the world from the WRI's Aqueduct Food and the International Food Policy Research Institute (IFPRI)

Details of physical risks

Climate change | Natural capital | Containers and packaging

Declining yields of agricultural products and increase in procurement costs [medium to long term]

Yields of agricultural raw materials may decline significantly owing to global warming and reductions in daily temperature ranges caused by climate change.

We assessed financial impacts caused by lower yields using the 25-75 percentile range of the distribution of forecast data of changes in prices. We forecast that procurement costs for agricultural products would increase by approximately 1.3 billion yen to 3.4 billion yen in 2050 under the 2℃ scenario, and approximately 3.6 billion yen to 13.7 billion yen under the 4℃ scenario (Graph: Impact of lower yields on procurement costs for agricultural products in 2050). The price range of 25-75 percentile under the 4℃ scenario was approximately 4 times larger than that of the 2℃ scenario. The difference implies that uncertainty and risks under the 4℃ scenario is higher than the 2℃ scenario. A British academic book* forecasts that European hops' yields will fall by 4-18% and the bitterness component (alpha acid) content will fall by 20-31% by 2050.

Additionally, we identified, in surveys related to water risk and water stress, severe levels of drought risk and flood risk in areas producing agricultural raw materials. The risks may impact agricultural products (Table 9).

We estimated the financial impact due to declines in agricultural yields using data from 2023 for Kirin Brewery, Kirin Beverage, Mercian, Lion (Oceania region only), Kyowa Kirin, and Kyowa Hakko Bio, referring to academic papers. Our estimates covered the following agricultural products: barley, hops, tea leaves, grape juice, starch, lactose, corn, and cassava.

Climate change | Natural capital | Containers and packaging

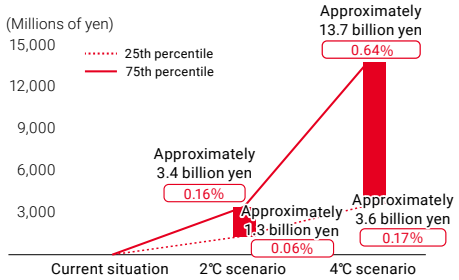
Change in the status of nature [medium to long term]

At tea farms in Sri Lanka, soil erosion and soil runoff have become problems owing to factors such as heavy rainfall caused by climate change and development in areas surrounding the farms due to economic growth. In addition, there is soil pollution caused by the use of agricultural chemicals and other problems, and these factors may change ecosystems and reduce yields of agricultural raw materials.

1 Impact of climate change on yields of key agricultural products (forecast for 2050 unless otherwise specified)

Agricultural products	Kirin Group Scenario3: 4℃, unwanted world, 2050			
	America (North and South)	Asia	Europe and Africa	Oceania
Barley	Canada -12% (2100) U.S. +9%(2100)	West Asia -5% to +10% Korea +0.5%	Finland -5.9% (spring barley) France -10% or more(Winter barley) -20% or more(Spring barley) Mediterranean coast (West)-0.3%(Portugal, Spain, France, Italy) (East)+4.4% Germany -14% to +18%	Western Australia -10 to -30%
Hops	U.S. (Washington) -16% (2100)		Czech Republic -8.5%	
Tea leaves		Sri Lanka Decline in yields in lowlands, low impact in highlands India (Assam region) 3.8% decline in yields per 1°C increase above average temperature of 28°C India (Darjeeling region) -40% to -80%	Kenya Change in suitable land from 1500 to 2100 meters above sea level to 2000 to 2300 meters above sea level. Drastic reduction in suitable land in the western part of Kenya, with land remaining suitable in the mountainous area of Kenya Malawi Chitipa 80% reduction in suitable land Nkhata Bay 60% reduction in suitable land Mulanje 70% increase in suitable land Thyolo 20% increase in suitable land	
Wine grapes	U.S. (California) 60% reduction in suitable land U.S. (Northwest) 231% increase in suitable land Chile 25% reduction in suitable land	Japan(Hokkaido) Increase in suitable land, Pinot Noir cultivation possible Japan (Central) Increase in suitable land while also anticipating obstacles from high temperatures	Northern Europe 99% increase in suitable land Mediterranean 68% reduction in suitable land Spain Change in overall wine production for each 1°C rise -2.1% (Spain as a whole) -4.6% (Andalusia) -4.8% (Duero River Valley) -34.6.% (northern Mediterranean)	New Zealand 168% increase in suitable land Australia (southern coast) 73% reduction in suitable land Australia (ex. southern coast) 22% reduction in suitable land
Coffee beans	Brazil 55% reduction in land suitable for arabica 60% reduction in land suitable for robusta	Southeast Asia 60% reduction in land suitable for arabica 52% reduction in land suitable for robusta	East Africa 13% reduction in land suitable for arabica 16% reduction in land suitable for robusta	
Corn	U.S. (Southwest) -27% U.S. (Midwestern Iowa) -5% to -12% U.S. -46/5% (2100) Brazil -19/4% (2100) Argentine -28.5% (2100)	China -27.4%	Ukraine -40.6% (2100)	
Soybeans	U.S. -10% (2080) Brazil -20% (2080) Argentine +40% or more	China +16% to +50% (2100) India -80%		

2 Impact of lower yields on procurement costs for agricultural products in 2050



Estimated for the main agricultural raw materials at Kirin Brewery, Kirin Beverage, Mercian, Lion, Kyowa Kirin, and Kyowa Hakko Bio.
Figures in ▭ show the percentage of revenue

* Recalculated with 2023 data

*Climate-induced decline in the quality and quantity of European hops calls for immediate adaptation measures | Nature Communications
https://www.nature.com/articles/s41467-023-41474-5

●Beer brewing technology that does not rely on barley (adaptation measures)

Nodogoshi Nama, which Kirin Brewery sells in Japan, is an alcoholic beverage that tastes like beer and is brewed using soybeans. We believe that the technical knowledge to achieve a beer-like flavor without relying on barley will serve as an adaptation measure for a potential decline in barley yields due to climate change in the future. We have also conducted surveys and analyses related to high-fructose corn syrup and protein sources, which are required to brew low-malt and no-malt beer products, not just *Nodogoshi Nama*, while referring to numerous academic papers, and as a result (Table 4), we have judged that there are no major issues at present.

In 2021, an international research team, including Japan's National Institute for Environmental Studies and the National Agriculture and Food Research Organization (NARO), reported that average global yields of corn, a raw material for high-fructose corn syrup, will fall by approximately 24% by the end of this century (2069 to 2099) compared with the present (1983 to 2013) under the 4°C scenario (approximately 18% increase in wheat yields). In addition, according to a study by Tigchelaaret et al., the probability of a simultaneous decline of at least 10% in yields in the four major production areas (US, China, Brazil, Argentina) is 80% or more under the 4°C scenario (2075 to 2132), 10% under the 2°C scenario (2042 to 2055), and 0% at present, indicating the possibility of avoiding a decline in yields by limiting global warming (Table 3). We anticipate that yields of sugar cane, which can act as a substitute for high-fructose corn syrup besides corn, will fall in Brazil, the leading producer, but will rise in parts of China and India.

Although there will be some variation in yield depending on the variety, we expect yields of potatoes to rise in India and the US, and overall, we do not expect yields to fall.

As for soybeans, which are a raw material for *Nodogoshi Nama*, we forecast that yields will either rise or fall depending on the region, but we have judged that there will be no significant change in global yields as a whole. We believe that it will be possible to respond to changes in the yields of these agricultural products by diversifying production areas, changing raw materials, and leveraging production technologies.

3 Probability of simultaneous 10% or 20% decline in average yield compared to the current level due to climate change in the four largest corn exporters

	2℃ scenario		4℃ scenario	
Country	>10%	>20%	>10%	>20%
United States	68.6	29.5	100.0	96.9
China	46.2	16.8	98.8	89.2
Argentina	50.0	9.9	96.9	86.9
Ukraine	51.8	19.2	98.2	85.0

4 Impacts of climate change on raw materials for high-fructose corn syrup and soybean yields (4° C scenario, 2050, unless otherwise noted)

Agricultural Products	Regional Harvest Forecasts		
	North America	South America	Asia
Sugarcane	–	Brazil -9.6%~+1.4%	Pakistan +1.6%~+4.1% China +22~+40%(2060)
Potatoes	United States No fertilizer effect Atlantic -20%~-27% Russet Burbank +0~+5% Fertilizer effective Atlantic 0~-5% Russet Burbank +18%	–	India +5.7%~+6.2% China Rainfed agriculture - Dabaihua +21.8% (2060) Irrigated agriculture, Kexin-1 +20.9% (2060)
Soybeans	United States (Central) No effect of fertilizer application -33.3% (2080) Fertilizer application +4.4% (2080)	Brazil -20%(2080)	China +50%(2080) India -8.24%

●Support for farms to acquire certification for sustainable agriculture (adaptation measures)

We will continue to support the acquisition of sustainable farm certification in order to secure production areas for agricultural products that are resilient to climate change.

Training for obtaining certification involves methods of reducing soil runoff against torrential rain by planting undergrowth on farmland and of using pesticides and fertilizers on white lists with adequate the amounts of use.

In the future, we will promote regenerative agriculture in order to minimize environmental impacts while also working to restore the nature.

●Mass plant propagation technologies (adaptation measures)

We will continue efforts to accumulate knowledge concerning applications for "mass plant propagation technologies" developed by the Kirin Central Research Institute, to prepare for falling yields of agricultural products as a result of climate change. We expect the knowledge can be used if heat-tolerant agricultural breeds are developed.

It would be difficult for the Kirin Group to transition to a business model that is completely independent of barely and hops, but we anticipate that "mass plant propagation technologies" will have a positive impact on the stability of agriculture through the cultivation of agricultural breeds suited to global warming.

The propagation technology uses "plastic bag-type culture vessel technology," which the Kirin Group has developed proprietarily. The vessel technology enables us to significantly increase growth rates of healthy seedlings with no diseases and seedlings that are genetically identical to their parents (clones) by multiples of tens or hundreds of thousands. We propagate plants by aerating a solution containing nutrients necessary for plant growth inside a bag, enabling us to use water effectively and cultivate plants in areas with high levels of water stress. In this way, we expect that we can reduce our impact on regional problems related to water.

The Kirin Central Research Institute has also developed a technology for the mass production of hops, an ingredient in beer, after successfully developing a globally pioneering approach for promoting the formation of axillary buds for hops.

More information→P.40

●GHG emissions reduction (mitigation measures)

In order to minimize the risk of falling agricultural yields, we will promote initiatives aimed at achieving Net-Zero emissions by 2050 and our science-based 1.5℃ target by 2030, in accordance with renewable energy targets under RE100 by 2040.

Details of physical risks

Climate change | Natural capital | Containers and packaging

Improper disposal of used containers [medium to long term]

If used containers of our businesses are disposed into the environment without proper recycling, they may cause damage to the natural environment and it is possible that we will face penalties associated with such damage. If we internalize externalities associated with ocean plastic pollution, we estimate that it will amount to approximately 1.1 billion yen in the future. We multiplied the "impairment cost of marine ecosystem services per ton of marine plastic," as described in a paper by Beaumont et al., by the amount of Kirin Beverage's PET materials released into the ocean. As a result, we calculated negative externalities caused by ocean pollution from sales of the Kirin Group's PET bottle products. In addition to the possible expenses described above, the PET disposal may cause stricter recycling regulations, criticism to use of plastics, and an decline in corporate brand value if companies do not respond appropriately to the plastic problems.

Response strategy

●Building a society that recycles plastics

In accordance with the "Plastic Policy" that we established in 2019, Kirin Group is progressively increasing the ratio of recycled PETresin used in its bottles to 50% by 2030 and to 100% sustainable container use by 2050. To ensure proper collection of used PET bottles, we are working with other companies and local governments to improve the efficiency of sorting and collection. At present, mechanical recycling is the mainstream, but we are also promoting the development of practical applications for chemical recycling to recycle PET products other than PET bottles and dirty PET bottles into high-quality PET bottles. Lion has also developed a "Sustainable Packaging Strategy" to promote recycling in Australia and New Zealand. In order to promote this strategy, Lion launched the "Lion's Sustainable Packaging Project Steering Group," and is promoting activities in partnership with the APCO (Australian Packaging Covenant Organisation) to achieve these goals.

Details of physical risks

Climate change | Natural capital | Containers and packaging

Disruption of operations owing to floods [short to long term]

Significant impacts, including disruptions to brewing and manufacturing, may occur as a result of damage from typhoons, heavy rainfall, and other disasters caused by climate change.
The Kirin Group has operated businesses in Japan and Australia, two countries where the level of water stress differs significantly. As such, we have developed an understanding rooted in experience of the fact that problems related to water differ between countries and regions, and that they largely depend on basins and specific locations. Since 2014, the Kirin Group has been conducting regular scientific surveys.
In 2024, we conducted surveys and analyses of water risk at brewing and production sites using Aqueduct 4.0, hazard maps created by local governments, and other resources (Figure 6: Manufacturing Site Water Risk/Stress). As a result, we found that water stress and water risk have worsened at many business sites. Floods and other forms of water risk are high at six plants or breweries in Australia and two plants or breweries in the U.S. Lion's Castlemaine Perkins Brewery in Australia, which we assessed as having a high level of water risk, has experienced flooding due to very heavy rainfall twice in 10 years, despite being in an area with high water stress. The Colorado River, used by New Belgium Brewery, a craft brewery in Colorado, the U.S., spans five states and each state has agreed upon restrictions on the use of water. In 2023, we held a scenario analysis workshop together with TNFD members. At the workshop, we confirmed that New Belgium Brewery is working with the community to solve issues related to water.
Our management benchmark for the financial impact of flooding on breweries and plants is approximately 1.0 billion yen to 5.0 billion yen, in line with the actual amounts of flood damage in the past (Table 6).
We are also using wind and water damage simulation systems to forecast losses from the risk of flooding. Our exposure to general 200-year disasters (the total of 20 business sites in Japan) is approximately 1.0 billion yen. There may be a possibility of flood damage at our business sites from a rise in sea levels caused by global warming, but although there are forecasts for a rise in sea levels of 0.46 to 0.97 meters with a 4℃ increase in temperature in Japan, we think it is still difficult to form a quantitative assessment. Going forward, we will continue paying close attention to the results of research.*1

5 Manufacturing Site Water Risk/Stress

* For water risk, water stress, and water pollution, we have referred to the following items, using the latest Aqueduct 4.0 (WRI).
Water stress: Baseline Water Stress
Water risk: Physical Risks Quantity
Water pollution: Untreated connected wastewater
See (→P.114) for the number of business sites.

6 Water risk (Actual damages in past factory flooding events)

Country	Operating companies	Plant	Cost of damage*2	Sales ratio
Australia	Lion	Castlemain Perkins Brewery	Approx. 1 billion yen	0.05%
Japan	Kirin Brewery	Sendai Plant	Approx. 5 billion yen	0.27%

7 Results of wind damage simulation

Recurrence period (years)	Flood AEP(JPY)*3
1000	21,768,643,347
500	16,373,304,101
200	1,030,581,609
100	2,590,244
50	52,859

*1 Japan Meteorological Agency: Observed facts and future projections of sea level, storm surge and high waves - from "Climate Change in Japan 2020".
https://www.mlit.go.jp/kowan/content/06.pdf
*2 The amount for the Sendai Brewery is from tsunami and earthquake damage in the 2011 Great East Japan Earthquake
*3 Aggregate Exceedance Probability

Kirin Brewery Nagoya Plant

Castlemaine Perkins Brewery

Response strategy

●Sharing of knowledge on responses to floods (adaptation measures)

At breweries and plants in areas where, comparatively, there is leeway in terms of time until flooding occurs, we will minimize damage in ways such as shutting down power sources in advance. When flooding occurred at Castlemaine Perkins Brewery in 2011, there was some time between the flood alert and the actual flooding. We shut down power sources in the brewery in advance immediately after the flood alert, and as a result, we prevented harm from short-circuiting to electrical equipment in the brewery, and were able to reduce the amount of damage and quickly restart operations. Similar countermeasures were effective against partial flooding at the Kirin Brewery Nagoya Brewery in 2000.

●Insurance for flooding (adaptation measures)

We will consider insurance at business sites as an effective measure against natural disasters, including floods.
In 2020, we used the natural disaster model AIR to simulate wind and water damage for our main 20 business sites in Japan, thereby estimating loss percentages and amounts of damage for each recurrence period. For 200-year disasters (a disaster occurring once every 200 years), the total exposure across the Kirin Group was approximately 1.0 billion yen. At KYOWA PHARMA CHEMICAL, however, we calculated that the annual amount of damage from a wind and water disaster of a scale occurring once every 500 years would be equivalent to 42% of the value of its property. Accordingly, in 2022, we conducted on-site surveys, and confirmed that the amount of damage would be precisely equivalent to 17%. We also conducted risk surveys at Thai Kyowa Biotechnologies, which is located in an area where flood and other water risks are expected, in 2023 (Table 7).
Going forward, we will continue gradually conducting on-site risk surveys and assessing the possibility of insurance for business sites that we have judged to be at high risk of future flood damage, based on our wind and flood simulation system.

●Addressing flooding at facilities (adaptation measures)

We assume that flooding would have a serious impact on the continuity of our businesses, and we will therefore promote physical countermeasures as necessary at business sites where we must fulfill our responsibility to supply customers without interruption.
At Kyowa Kirin, we have judged that the amount of damages from recovery, production disruption, and business opportunity losses would be considerable in the event that water damage, etc., caused long-term disruptions to operations at Kyowa Kirin's own pharmaceutical plants, commissioned manufacturers of drug substances, and packaging material suppliers.
At Kyowa Kirin's own sites, we have formulated policies on countermeasures against water damage, and have taken measures to prevent flooding (geographically distributed storage of important assets related to production, waterproofing of buildings, moving important facilities to high floors and locations, the installation of flood walls, etc.). In the future, we intend to continue to address these issues through investment in our facilities. We will assess and address the impact across the supply chain as a whole, and take steps to avoid production disruptions and minimize damages.
At the same time, there will be a significant impact on companies commissioned to manufacture drug substances, packaging material suppliers, etc., so we will gather information about water damage countermeasures at each partner company, identify issues, and consider measures such the formulation of BCPs and disaster response drills.

*1 We have assessed risk related to flooding in a multifaceted manner, using multiple systems. Aqueduct can be used to assess risks, not just at the present but also including future forecasts. Aqueduct is the most widely used water risk assessment tool today, so one of its advantages is that it has a high potential for comparisons, but we do not know all aspects of the grounds for its assessments in details, and in some aspects it does not fully reflect Japan's complex water systems. Hazard maps provide an assessment of the worst expected damage by local governments with a deep understanding of the area. We believe that when hazard maps and Aqueduct are used together, it enables more accurate risk assessments. With simulation systems, it is possible to estimate loss percentages and amounts of damage for each recurrence period, so we use them to identify our exposure and make judgments concerning insurance.

Climate change | Natural capital | Containers and packaging

Impact on transportation from floods [short to long term]

There may be an impact on product distribution and the transportation of raw materials from typhoons, heavy rainfall, and other disasters caused by climate change. In 2018, the West Japan Torrential Rain Disaster resulted in long-term disruptions to railroads and roads in the Chugoku region, and there were major obstacles to the transportation of products from breweries and plants to customers. In 2022, we conducted a survey concerning flooding risk and countermeasures in major barley shipping ports overseas. As a result of this survey (Table 8), we found that flooding risk was low in Canada, Australia, and the United Kingdom, and that while there was a risk of future floods of between 0.5 and 5 meters in the Netherlands and Germany, planned countermeasures have been formulated and implemented. We also found that, even when flooding risk is not high in the bays themselves, disasters affecting railroads and roads linked to the bays, as well as adjacent cities, would cause obstacles to the functioning of the ports.

Response strategy

Sharing of knowledge on responses to floods (adaptation measures)

We are developing a manual for responding when we anticipate disruptions to logistics over a wide area from natural disasters, etc. Immediately after we recovered from major damage to logistics networks from the 2018 West Japan Torrential Rain Disaster, we created a manual for responding to similar events. As a result, we were able to avoid any significant impact from subsequent typhoon damage on product distribution, including Typhoon Faxai, which caused significant damage, particularly in Chiba Prefecture, and Typhoon Hagibis, the first typhoon to receive the designation of a Disaster of Extreme Severity (both occurred in 2019) and a Specified Anomalous Disaster.

Diversification of suppliers (adaptation measures)

We reduce risk by having multiple suppliers. We work with our suppliers as part of endeavors to sustain our supply chain, to ensure that we can stably deliver safe and secure products to customers, at the optimal price. We have diversified our procurement of malt, the main ingredient of beer, across three continents: North America, Europe, and Australia. We combine procurement measures for hops, such as adopting long-term contracts with producers, as part of efforts to secure the necessary amounts, and minimize the impact of market prices.

8 Assessment of water risk at main barley exporting ports

Country	Coast name	Flood risk	Recent disaster information	Flood control measures
Canada	Vancouver Bay	Risk of floods between 0.5 and 1m in 2100	Full-scale disruptions occurred to rail freight transportation and highways connected to the bay as a result of flooding and landslides caused by heavy rainfall in 2021	In cooperation with local NPOs, flood management strategies have been formulated and coastal lines have been repaired
Australia	Fremantle Perth Bay	Risk of floods between 0.7 and 2m between 2010 and 2080, and risk of floods between 0.5 and 5m from 2080 onward	No information about coastal disasters	On-site analysis is being conducted concerning the risk of climate change. Separately to climate change, there have been repairs to piers, bulkheads, and important facilities
United Kingdom	Southampton Bay	Low risk of flooding prior to 2050. Risk of floods between 0.5 and 5m in 2080	No information about coastal disasters. Damage from heavy rainfall occurred in the city in 2021	Coastal development is being promoted, including flooding countermeasures, and there are plans to complete the construction of bulkheads in rivers with a particularly high level of risk
The Netherlands	Rotterdam Bay	Risk of floods between 0.5 and 5m between 2010 and 2080	No information about coastal disasters	The government and companies collaborated to launch a program for managing flood risk in 2015. They are strengthening protective barriers and embankments, as it is urgently required
Germany	Bremerhaven Bay	Risk of floods between 0.5 and 5m between 2010 and 2080	No information about coastal disasters. Damage from heavy rainfall occurred in the city in 2021	Measures such as building and strengthening sea embankments and protective barriers are being implemented in accordance with plans. Repairs to 1.3km of quay walls were completed in January 2022

Details of physical risks

Climate change | Natural capital | Containers and packaging

Disruption of operations owing to droughts [short to long term]

Water is essential in brewing and manufacturing processes for alcoholic beverages, soft drinks, pharmaceutical products, and biochemical products. Accordingly, there may be disruption or obstacles to brewing and manufacturing in the event of severe droughts caused by climate change. In our assessment of water stress at manufacturing and brewing sites based on Aqueduct 4.0, other resources, water stress such as drought is elevated at seven plants in Australia, one in the U.S., and one in Thailand. We have identified the estimated financial impact of droughts on breweries and manufacturing sites based on the volume decline in brewing and manufacturing under certain assumptions at business sites with a "high" level of water stress. We estimated that the financial impact was between approximately 30 to 600 million yen, but in past examples, we have been able to minimize the impact of droughts, so we have judged that the risk is negligible.

More information on business site water risk assessments→P.74

Climate change | Natural capital | Containers and packaging

Impact on agricultural products from floods and droughts [short to long term]

There is a possibility that water risk and water stress from climate change, as well as disasters, may result in a decline in agricultural yields and an increasing financial impact related to procurement. In 2017, we used Aqueduct 2.1 to conduct detailed surveys of water risk in areas that produce agricultural raw materials, and we found that water stress would increase in many production areas (Table 9). In 2021 and 2022, such concerns became apparent in many regions around the world.

Response strategy

●Advanced technologies for water use reduction (adaptation measures)

We will appropriately reduce our use of water, taking into consideration the amount of water stress. The Kirin Group has operated businesses in Australia, where there is extremely high-water stress, and Japan, where water is relatively abundant. As such, we have known from our experiences that water risk and water stress differ between countries and regions. Since as early as 2014, we have been conducting regular surveys of water risk and water stress, and we have continued these surveys as part of our scenario analysis since 2017. We conserve water in ways suited to the differing levels of water stress in each country and region, based on our understanding of the scientific evidence. Lion experienced severe long-term droughts in Queensland. We collaborated with the state government to establish a reverse osmosis (RO) plant to collect and reuse water that has been used in brewing processes at Castlemaine Perkins Brewery in 2011, and we maintain a water consumption rate that is close to the top in the world.

More information→P.46

●Sharing of knowledge on responses to droughts (adaptation measures)

The scope to which we are able to utilize such insights differs depending on the details of the business, but we will enhance the resilience of each business while sharing insights on droughts. Thai Kyowa Biotechnologies, which faced water intake restrictions due to drought in 2020, has been able to limit water intake and avoid damage from droughts by holding large inventories and switching temporarily to products that use less water. By sharing this knowledge within the Kirin Group, we are reinforcing our ability to respond.

●Responses to water stress in areas producing agricultural raw materials (adaptation measures)

At tea farms in Sri Lanka, we began water source conservation activities on the farms in 2018, and as a result, by the end of 2022, we have conserved water sources in 15 locations. In 2020, we began similar support for the acquisition of certification at coffee farms in Vietnam. We are accumulating knowledge, and as part of training for the acquisition of certifications, we teach subjects such as ways to ensure that the ground does not dry out in the event of droughts, as well as methods to store water to prepare for droughts.

More information→P.45

●Prevention of soil runoff in areas producing agricultural raw materials (adaptation measures)

Training on activities to support sustainable agriculture certification on Sri Lankan tea plantations, including how to prevent soil runoff from torrential rains by planting deep-rooted undergrowth. Our teaching is based on methods with a scientific core, such as working with local universities to develop methods that enable farm laborers to distinguish the correct type of plants, because they must choose plants that do not harm the cultivation of tea trees. At present, we have not taken any specific measures in relation to major agricultural products in Europe and Australia, where we anticipate significant water risk and water stress, but we hope to utilize the knowledge we have accumulated through our initiatives in Sri Lanka and elsewhere.

More information→P.35,P.45

9 Water stress in major agricultural product production areas (around 2050)

Agricultural products	America (North and South)	Asia	Europe/Africa	Oceania
Barley	Canada High~Extreamly high	Japan Medium to high	Ukraine High~Extreamly high United Kingdom Low in the North, high in the South Germany medium~High Czech Republic Medium to high in Moravia, low to medium in Bohemia Belgium High France High	Australia Extremely high in the East and Southeast Medium in the Southwest
Hops	United States Medium to high in Oregon, medium to high in Idaho (partially Extremely high)	Japan Medium to high in Tono, Yokote, Yamagata Low to medium in Odate	Germany Medium~High Czech Republic Medium to high in Moravia, low to medium in Bohemia	Australia Extremely high New Zealand Low
Tea leaves		Sri Lanka Extremely high in the North, and medium to high in the South and central highlands India Low in Darjeeling and Assam, low to Medium in Nilgiri Indonesia Extremely high in Java, low in Sumatra Low in Sumatra	Kenya Low Malawi Low	
Wine grapes	Chile Extreamly high Argentine Extreamly high		Spain High in the North, extremely high in other areas	
Coffee beans	Brazil Low to medium in the Northeast, low in other regions		Tanzania Medium to high in the North, low in other areas	

Details of physical risks

Climate change | Natural capital | Containers and packaging

Impact of diseases and air pollution on agricultural products [short to medium term]

In major forest fires in California, the grapes that the Kirin Group procures were exposed to smoke that made them unusable in the making of red wine. In Sri Lanka, air pollutants from neighboring India have also caused damage to tea leaves in lowlands. We expect grapevine diseases to spread as global warming progresses.

Response strategy

●Research measures from a long-term perspective (adaptation measures)

We believe that comprehensive pest management is an effective way to control agricultural diseases, and we have already begun trials in some vineyards and tea farms. It seems likely that ecosystems will become stable when a variety of creatures live in the fields. We have also begun research concerning the possibility that the enrichment of ecosystems through hedgerow-style cultivation may suppress diseases, as well as focusing on the early detection of insects and mites that are vectors of diseases.

Long-term, ongoing research is necessary to solve various issues related to climate change and natural capital. In the Kirin Group, we have our own vineyards, and we have established strong relationships of trust with tea farms in Sri Lanka through long-term engagement. We will leverage our strength of having fields where we are able to conduct surveys and various types of tests to solve various issues related to the environment through a scientific approach and research and development with a long-term perspective.

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Carbon pricing and energy procurement costs [medium to long term]

Energy procurement and logistics costs may spike if governments introduce systems such as carbon taxes, emissions trading schemes, and carbon border adjustment mechanisms. In Japan, we anticipate initiatives such as the introduction of an emissions trading scheme by the GX League, and the introduction of systems that require generators of electric power to purchase emission allowances in the future. Such initiatives may result in additional costs. The Kirin Group will minimize the risk of cost increases by steadily reducing emissions to meet the SBT 1.5° C scenario and Net-Zero target.

Table 10 shows the results of our estimation of the financial impact of carbon pricing on energy procurement.

We estimated tax savings in 2030 of approximately 2.6 billion yen under the 4℃ scenario, 4.7 billion yen under the 2℃ scenario, and 5.1 billion yen under the 1.5℃ scenario, in the event that we achieve our science-based 1.5℃ target. Estimates for both the 4° C scenario and the 2° C scenario were larger than last year's estimates as a result of revisions to reflect recent developments to carbon price projections for each country used in the calculations. In order to reduce risk and lower our procurement costs, an effective way is to achieve or bring forward our GHG emissions reduction targets.

When assessing the impact of carbon pricing on energy procurement, we estimated the impact at Kirin Brewery, Kirin Beverage, Mercian, Lion, Kyowa Kirin, and Kyowa Hakko Bio in 2023. For power emissions factors and carbon taxes, we applied the 1.5℃ (Net-Zero) scenario, 2℃ scenario, and 4℃ scenario from the IEA scenarios, and set the basis of forecast carbon prices for all three scenarios.

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Response strategy

●Profit and loss neutral reduction of GHG emissions in brewing and manufacturing

In order to minimize the financial impact of carbon pricing, we will first reduce GHG emissions in accordance with our roadmap, under the basic principle of profit and loss neutrality as a group, as we work toward our 2030 "SBT 1.5° C" target for Scope 1 and Scope 2 emissions. Specifically, the merit from saving energy will offset depreciation and amortization from the investment and the procurement costs increase of renewable energy. Since the outlook for technological innovations in areas such as energy conversion and trends in energy costs are currently unclear, we cannot accurately estimate costs for 2030 onward. We will, however, incorporate measures to reduce GHGs aimed at achieving our RE100 renewable energy target by 2040 and the net-zero target by 2050 into our business plan.

Lion has already achieved carbon neutrality in both Australia and New Zealand. For information on our approach to environmental investment to reduce GHG emissions, financing, investment amounts, and ICP, please refer to the pages on "Transition Plans."

→P.20～P.24

●GHG emissions reduction through logistics optimization

In order to reduce GHG emissions in logistics departments, we will develop the various initiatives such as modal shifts, joint deliveries with industry peers, and higher loading ratios.

GHG emissions from upstream transportation (category 4), including the transportation of products, account for approximately 12% of total Scope 3 emissions, and are a major target for the reduction of emissions. In recent years, reducing the impact of transportation has also been an important initiative from the perspective of reducing the risk that we will not be able to transport products owing to the shortage of truck drivers.

More information→P.63

10 Assessment of impact of carbon pricing

	Scenario	4℃ Scenario		2℃ Scenario		1.5℃ Scenario	
	Year	2030	2050	2030	2050	2030	2050
If GHG emissions are not reduced	Carbon taxes (Billions of yen)	51	55	94	127	102	158
If we reduce GHG emissions in line with targets	Carbon taxes (Billions of yen)	26	0	47	0	51	0
Carbon taxes	Tax savings (Billions of yen)	26	55	47	127	51	158

*1 We have revised carbon tax assumptions for each country to reflect recent developments and recalculated using 2023 data.

11 Main Initiatives

Initiatives	Description and effects (2020～)
Introduction of large-scale solar power generation facilities with the PPA method	Already introduced at all eight Kirin Brewery plants in Japan, excluding the Yokohama Brewery (through 2023). Introducing at Kyowa Kirin Ube Plan, Mercian Fujisawa Plant (operating from 2023 for each), Kyowa Hakko Bio Hofu Plant (operating from 2024), and Kirin Beverage Shonan Plant (operation planned from 2024) More information→P.60
Achieved a proportion of 100% renewable energy in purchased electric power	Achieved a proportion of 100% renewable energy in purchased electric power at all Kirin Brewery plants and operating sites (through 2024), and achieved a proportion of 66% of renewable energy across all electric power used. Kyowa Kirin has achieved a proportion of 100% renewable energy in purchased electric power at its plants and laboratories (through 2023), and by end-2023, achieved a 55% reduction in CO_2 emissions compared with end-2019. At all three Mercian wineries, we achieved a proportion of 100% renewable energy in purchased electric power (2022) More information→P.59
Joint deliveries*2	Reduced GHG emissions by approximately 2,700 tons per year through joint deliveries using railroad containers in the Hokuriku region Reduced GHG emissions by approximately 330 tons per year through a similar initiative in the east Hokkaido area More information→P.63
Joint collection of beer pallets*2	Reduced GHG emissions by a total of 5,158 tons of CO_2 per year (approximately 37% compared with previous levels) across four beer companies More information→P.63

*2 Calculation procedures for joint delivery and joint collection of beer pallets are described in "Contribution to Avoided Emissions through the Global Value Chain, Sixth Edition, Keidanren (Japan Business Federation)"
http://www.keidanren.or.jp/policy/2018/102.html

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Financial impact on the procurement of agricultural products from carbon pricing [medium to long term]

The prices of agricultural products may spike if governments introduce carbon taxes and carbon border adjustment mechanisms.
Figure 12 shows the results of our estimation of the financial impact of carbon pricing on agricultural product prices. In 2023, we estimated the impact for Kirin Brewery, Kirin Beverage, Mercian, Lion, Kyowa Kirin, and Kyowa Hakko Bio. Our estimates covered the following agricultural products: barley, hops, tea leaves, grape juice, starch, lactose, corn, and cassava.
In our estimates, we calculated that the impact would be approximately 0.9 billion yen to approximately 4.4 billion yen under the RCP2.6/SSP1 scenario and approximately 2.4 billion yen to 8.8 billion yen under the RCP8.5/SSP3 scenario in 2050. The range of the 25-75 percentile was twice as large for the RCP8.5/SSP3 scenario than the RCP2.6/SSP1 scenario, from which we can conclude that uncertainty is higher and the risk is more significant.

Climate change | Natural capital | Containers and packaging

Impact on currently held assets [medium to long term]

There is a possibility that various policies and regulations, as well as demands from society for decarbonization will mean it may be difficult to continue to use existing facilities that use fossil fuels, etc., for the period that we initially expected. Under the Kirin Group roadmap, we plan to transition in the future from natural gas to green hydrogen and other sources of GHG-free energy as the fuel for boilers that are the heat source used in the boiling stage, etc., in brewing and manufacturing. It may become necessary to renew boilers and other facilities earlier than expected. In the same way, there is a possibility that we are required to transition the trucks we use for transportation to electric vehicles sooner than initially expected, but we believe that the impact will be small even if renewal becomes necessary before assets are fully depreciated.

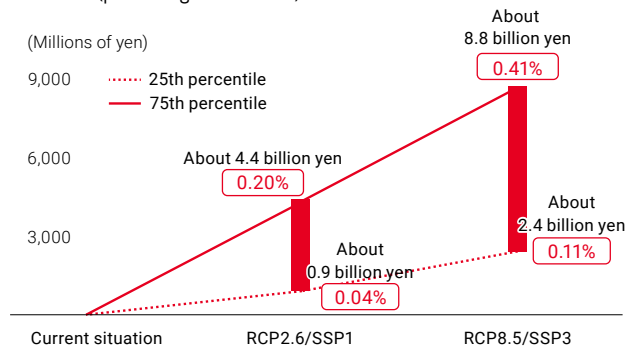
Response strategy

Mass plant propagation technologies and support for farms to acquire certification for sustainable agriculture

We consider that mass plant propagation technologies and support for farms to acquire certification for sustainable agriculture are effective as countermeasures.
Competition between alcoholic/non-alcoholic beverages and biofuels for raw materials will increase as carbon pricing causes demand for corn, soybeans, etc., as biofuels, a form of renewable energy, to increase. Mass plant propagation technologies may be able to contribute to an increase in crop acreage in response to this risk.
Carbon pricing may cause soaring prices of natural gas, which is a raw material in nitrogen fertilizer, which will impact fertilizer prices. We think that training for farmers on appropriate fertilizer management as part of support for the acquisition of sustainable agriculture certification will act as a countermeasure to minimize this impact.

More information on mass plant propagation technologies→P.39
More information on support for the acquisition of certification→P.35~P.36,P.39

12 Impact on agricultural product procurement costs from carbon pricing in 2050 (percentage of revenue)



*1 The socioeconomic systems in the papers we used for our estimates differ from the Kirin Group scenarios, so we have created and disclosed our estimates under the RCP2.6/SSP1 and RCP8.5/SSP3 scenarios in these papers (sources are listed in reference documents).
*2 Recalculated with 2023 data

Identification of trends in technology and renewal of our roadmap

The use of hydrogen, etc., will require technological innovation and infrastructure development, and we expect that full-fledged transition will not take place until 2030 or later. Until then, we think the probability is low that regulation, etc., will require us to renew our existing boilers and other brewery and plant equipment, and trucks, before they are depreciated. If we misjudge the timing of the introduction of new technology, our technology and facilities may become obsolete as a result of regulatory and social trends. Accordingly, we will address this issue by formulating roadmaps for long-term facility renewal and introduction, and constantly update the roadmaps.

More information→P.21

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Cost of regulatory response [medium to long term]

In 2023, the International Sustainability Standards Board (ISSB) finalized the IFRS Sustainability Disclosure Standards, which will serve as the global baseline for the disclosure of information related to sustainability. Based on these standards, jurisdictions around the world are creating legislation concerning information disclosure requirements for companies. The Kirin Group has business sites in Japan, Australia, the US, and the EU, and in the future, it is likely that we will be required to report sustainability-related information in accordance with the requirements of each jurisdiction. The Kirin Group believes that natural capital and climate change are among the sustainability issues for which we should disclose information. Specifically, we must explain the impact of these issues on corporate value, and our response to risks and opportunities. To achieve this, we must establish systems that enable us to accurately and quickly collect information from across the value chain and utilize it in management.
In Japan, in response to the "30by30*" target agreed at COP 15, the government will create a legal framework for "Nationally Certified Sustainably Managed Natural Sites" (to be promulgated in April 2024, and enacted in April 2025). We expect increases in labor and financial costs associated with responding to these regulations.

* Target to make at least 30% of land and sea conservation areas by 2030

Response strategy

●Development of infrastructure for the disclosure of information

Since January 2024, the Kirin Group, through our subsidiaries, has been working to establish a system for identifying and sharing non-financial information in order to immediately respond to regulations and stakeholder requirements in each global jurisdiction, as part of our efforts to provide disclosure that is compliant with the standards of the International Sustainability Standards Board (ISSB).

●Enhancements to the sustainability of raw material production areas

Since 2013, the Kirin Group has continued to support the acquisition of Rainforest Alliance certification by tea farms in Sri Lanka. This certification is a certification system for sustainable farms that focuses on environmental protection and social aspects at farms.
At present, the Kirin Group has begun working with the Rainforest Alliance on the development of "The Regenerative Tea Scorecard," in order to further enhance the sustainability of tea farms in Sri Lanka. The scorecard will serve as a tool for tea farms to start regenerative agriculture on their own initiative. Using knowledge and data obtained from pilot testing at Sri Lankan tea farms, we are considering the possibility of expanding the scorecard to other areas producing tea leaves outside of Sri Lanka in the future.

●Nature Positive through businesses

By converting derelict farmland into hedgerow-style vineyards at Château Mercian, we have created grasslands, which are valuable for Japan at the present time, and contributed to the expansion of Japan's traditional rural Satochi-Satoyama landscapes. In joint research with the National Agriculture and Food Research Organization (NARO), we showed that these initiatives enrich the ecosystems of each vineyard and contribute to Nature Positive. In particular, at Mariko Vineyard, a certified "Nationally Certified Sustainably Managed Natural Sites", we are conducting joint research with NARO to accurately identify greenhouse gases emitted from vineyard soil, evaluate the carbon storage effect of biochar by utilizing pruning debris, etc. In the future, we will look for the possibility of applying the findings to other agricultural production areas.

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Lack of research and development resources and lack of long-term perspective [short to long term]

If we cannot achieve technological development and the development of commercial applications, such as reducing the weight of containers and packaging and chemical recycling, at the required time, there is a risk that it will be difficult to maintain leadership based on our technology, and that subsequent technology development and procurement will suffer.
Concepts such as "The Climate Nature Nexus" and "NbS (Nature-based Solutions)" have emerged as adaptation measures for climate change, but since they target nature, they generally require long-term research and technological development. If we begin taking action after the risks have become clear, we risk falling behind competitors and making it difficult to recover over the long term.

Climate change | Natural capital | Containers and packaging

Decline in ability of engineering departments to respond and lack of appropriate investment [short to long term]

There is a possibility that our engineering systems aimed at achieving decarbonization are insufficient, a possibility that those systems are not appropriately applied because technical expertise is not passed on.
The effective utilization of waste heat is essential for the efficient utilization of energy. This requires not only the introduction of modern equipment and facilities, but also engineers and technology with a deep understanding of the manufacturing process.
Technological progress is rapid, and if we cannot determine the timing for introducing technology or make quick investment decisions, we may not be able to achieve reductions in GHG emissions as planned.
While momentum for the decarbonized society is rapidly increasing, there is a possibility that we will be unable to introduce renewable energy at an appropriate time and appropriate price in Japan, where the places for installing renewable energy facilities are particularly limited.

Response strategy

In-house packaging development technology

The Kirin Group has the Institute for Packaging Innovation, where we develop packaging and containers in-house, as one of the few research laboratories of its scale owned by a global food and beverage, and pharmaceutical company. We think we will be able to utilize this strength to develop advanced containers and packaging with lower GHG emissions across the value chain.
Based on the technologies it has accumulated in the development of glass bottles, cans, PET bottles, cardboard cartons, and other containers and packaging, the Institute for Packaging Innovation utilizes AI, kansei (sensibility) engineering, and other technologies. Taking advantage of the strength of having this large-scale research facility, we are able to provide technical support necessary for commercialization and develop new containers.
As part of the recycling of PET bottles, we are focusing on technical development related to chemical recycling. We have estimated that the negative impact on natural capital of PET bottles in the domestic alcoholic beverages and nonalcoholic beverages businesses amounts to approximately 1.1 billion yen (results of estimation in 2019). We aim to use recycled resin for 50% of domestic PET bottles by 2027, and we will thereby contribute to reducing social costs by transitioning to a circular economy.

Research and development on climate change and natural capital

Hops are vulnerable to climate and cultivation conditions, and there are concerns that climate change could reduce yields and alter the taste of hops. For this reason, research is underway on improvements to breeds to adapt to climate change. In 2022, Kirin developed mass plant propagation technology for hops, and we intend to build a sustainable supply system for raw materials by combining improvements to breeds and mass plant propagation technology.
At Château Mercian Mariko Vineyard, we launched a joint study in cooperation with NARO in March 2024, to assess the effects of carbon storage as a climate change mitigation measure. In this research, we intend to engage in initiatives such as assessing the carbon storage effect of biochar utilizing pruning debris from vineyards, etc.

Strengthen engineering functions

We have assigned personnel with engineering skills in each group company and ensure that we are maintaining and managing brewing and manufacturing facilities, while also training engineers and transferring technical expertise on an ongoing basis.
In the Kirin Group, engineers with a deep knowledge of brewing and manufacturing processes, production technologies, and safety technologies reliably support brewing and manufacturing facilities. Furthermore, the Kirin Group owns Kirin Engineering, a general engineering company, and we have engaged in engineering specialized in the construction of plants producing beer, non-alcoholic beverages, pharmaceuticals, and other products over many years. Through this company, we have been conducting the new expansion and remodeling of large-scale manufacturing facilities for companies both within and outside the group. By performing engineering in various businesses in-house, we make it possible for engineers to transfer expertise and technical capabilities related to building facilities. These technical capabilities that we have developed and our engineers will support the growth and development of our business domains, ranging from food and beverages to pharmaceuticals.

Understand technological trends and flexibly introduce facilities and equipment

The Kirin Group will intensively watch technological trends and social conditions in the engineering department of Kirin Brewery, and reflect these trends in the roadmap for measures against climate change, enabling us to determine what kind of equipment will be effective where in the Group, and flexibly introduce technology after close communication with each Group company.

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Environmental and economic incompatibility due to rapid agricultural policy transitions [short to long term]

Sri Lanka's sudden ban on the import of chemical fertilizers and agricultural chemicals in the first half of 2021 (later withdrawn) caused a decline in yields of many agricultural products and caused great damage to the Sri Lankan economy. Political and macroeconomic influences can cause indirect changes in the use of land as a result of changes to crops produced and reduced yields per unit area. This could encourage deforestation. Without sufficient preparation, the transition to organic farming may weaken agriculture itself and result in destruction to the natural environment in the area surrounding agricultural land.

Response strategy

●Support for training farmers in sustainable agriculture

In Sri Lanka, there have been frequent cases where organic fertilizers introduced in place of chemical fertilizers were of poor quality and could not be used. It could be said that efforts to transition to organic agricultural methods without preparation did not just harm agricultural production that was stable, but also harmed the interrelated economy.
There is a risk that one such type of harm will spill over into another, which will severely harm ecosystems. In response, we believe we must learn about climate change and natural capital and adopt a holistic approach.
In our support for the acquisition of Rainforest Alliance certification, we provide training on how to properly use agricultural chemicals and fertilizers, to ensure that farms can continue to operate despite climate change and other external impacts. In the case of Sri Lanka, the Rainforest Alliance is rapidly establishing systems to reduce the impact on farms.

●Appropriate engagement with experts and policymakers

The Kirin Group, in collaboration with the Rainforest Alliance, supports tea farms in Sri Lanka and coffee farms in Vietnam in obtaining sustainable certification. The Rainforest Alliance has extensive knowledge of agriculture and ecosystems in tropical regions in Asia and Africa, among others as well as a network of scientists, etc., and it has secured the trust of local farms. NARO, with which Kirin conducts joint research in the form of ecological surveys at Mariko Vineyard, etc., has trained many researchers on agriculture. We will leverage these valuable networks to respond even if events occur such as what happened when the Sri Lankan government banned the import of chemical fertilizers, etc. It is not easy to influence policies for agricultural production areas overseas, but we believe that there is a suitable environment to enable us to participate in global rulemaking.
Global rulemaking for climate change and natural capital utilizes open innovation. We will seize these opportunities and actively participate in discussions and pilot testing to contribute to ensuring that global rules are appropriate.

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Social resistance to fossil-derived raw materials [medium to long term]

Interest in problems related to plastic is spreading to issues related to all aspects of climate change, not just ocean pollution. As a result, there is a possibility that people may have a stronger negative impression than before of containers and packaging using raw materials derived from fossils. In Japan, the "Act on Promotion of Resource Circulation for Plastics" was enacted on April 1, 2022, and interest in problems related to plastics has been increasing. Plastics are a raw material derived from oil, and we expect that as interest in problems related to climate change increases, people will focus on GHG emissions when they are burned, as well as problems related to the depletion of resources from raw materials derived from oil.

Response strategy

Plastic resource recycling

In accordance with the "Kirin Group Plastic Policy," which we formulated in 2019 with the aim of resolving problems related to plastics, the Kirin Group will promote PET bottles that use recycled PET resin. In this policy, we have set forth our target of increasing the percentage of recycled resin to 50% of PET bottles in our operations in Japan by 2027.
We have promoted the utilization of recycled PET resin through mechanical recycling. As of April 2024, we are using "R100 PET bottles," which use 100% recycled PET resin, for some products in the Kirin Nama-cha line. We will promote technical development related to practical uses for chemical recycling to create high-quality recycled PET resin by recycling dirty used PET bottles and other PET resin. In addition, we will create systems to recover used PET bottles and other PET resin.

More information→P.60

Climate change | Natural capital | Containers and packaging

Concerns about deforestation [medium to long term]

As awareness spreads of the importance of forests as GHG sinks, concerns about business activities that lead to deforestation are more prevalent than ever before, potentially resulting in stronger negative impressions of forestry and agriculture.
The worst forest fires in Australian history, which occurred between 2019 and 2020, and the frequent wildfires in California and other cases have brought attention to the relationship between climate change impacts and forests. The United Nations Food System Summit was held in 2021, the EU's "Farm to Fork" strategy and Japan's "Green Food System Strategy" have been formulated and announced, and there is a stronger focus on sustainable agricultural production than ever before. The spread of COVID-19 and geopolitical issues have also increased people's interest in food security. It is assumed that interest in sustainable agriculture due to these factors will lead to interest in forest issues.

Promotion of sustainable forestry and agriculture

The Kirin Group is continuing initiatives to expand sustainable forestry and agriculture, and we plan to increase the proportion of certified paper and raw materials from certified farms that we use. With regard to sustainable forestry, we are promoting an initiative to expand the use of FSC (Forest Stewardship Council)-certified paper. In 2020, we adopted FSC-certified paper for 100% of paper containers at Kirin Brewery, Kirin Beverage, and Mercian. In 2021, we revised our Action Plan for the Sustainable Use of Biological Resources, and we set forth our intention to expand our use of sustainable paper to all our businesses around the world. In terms of sustainable agriculture, we support the acquisition of Rainforest Alliance certification, which is a certification for more sustainable farming, at tea farms in Sri Lanka and coffee farms in Vietnam. Since August 2021, we have also been selling a year-round product in the *Kirin Gogo-no-Kocha* line that uses tea leaves from farms with Rainforest Alliance certification.

More information→P.44～P.45,P.48,P.50,P.55,P.61

Climate change | Natural capital | Containers and packaging

High energy prices [medium to long term]

As initiatives targeting decarbonization accelerate around the world, it is possible that demand for natural gas may increase and prices may rise in the short term, owing to such factors as the transition toward sources of energy with low GHG emissions and divestment from coal. We have referred to "Net-Zero by 2050: A Roadmap for the Global Energy Sector" and "World Energy Outlook 2021 (WEO 2021)" by the International Energy Agency (IEA), and have researched future natural gas prices based on three scenarios (Table 13): NZE (Net-Zero Emissions by 2050 Scenario: an ambitious scenario in which the 1.5℃ target is achieved), APS (Announced Pledges Scenario: a scenario in which all commitments already announced by the governments of each country are executed), and STEPS (Stated Policies Scenario: a scenario that only reflects implemented policies in each country).
In each scenario, we forecast that demand for natural gas will increase through 2025, and we subsequently only expect it to fall significantly in the NZE scenario. In our analysis, we forecast that natural gas prices will fall approximately 4% from current levels in the APS scenario, and rise approximately 8% in the STEPS scenario by 2050. In the NZE scenario, we expect prices will fall by around half by 2030, but these price forecasts do not reflect investment and expenses related to Carbon dioxide Capture, Utilization and Storage (CCUS), so there is a possibility that we cannot expect a significant price decline when these costs are taken into consideration.

Response strategy

Steady implementation of our roadmap to achieve our science-based 1.5° C target

We must surely execute our roadmap for countermeasures against climate change, which is based on our science-based 1.5℃ target, as we look to reduce our use of natural gas. In the Kirin Group roadmap, we plan to shift our energy mix to electric power as much as possible, and use renewable energy as the source of that electric power.
We will transition away from steam produced from gas to electric power for the heat source for heating processes. We will continue to use steam for processes and equipment where it is difficult to transition, but we plan to transition away from gas for the energy source for steam toward hydrogen produced from renewable energy.

More information→P.21~P.22

13 Forecast fluctuations in natural gas prices

Scenario	Current price 2020 USD/GJ	Future price 2030 USD/GJ	Future price 2050 USD/GJ
Net-Zero Emissions by 2050	8.3	4.6	4.4
Sustainable Development	8.3	5.7	5.6
Announced Pledges	8.3	8.0	7.2
Stated Policies	8.3	9.0	9.4

World Energy Outlook 2021 (WEO 2021)

Climate change | Natural capital | Containers and packaging

Opportunity loss due to ethical consumption [medium to long term]

If we fail to provide products that respect the environment and human rights in terms of climate change, natural capital, and containers and packaging, we risk being surpassed by competitors and losing out on opportunities to generate earnings through ethical consumption. Based on scenario analysis related to climate change and natural capital, we have concluded that a rapid expansion of the market for ethical consumption is unlikely at this time. If, however, young people interested in sustainability become the main consumers, they may choose ethical products. In addition, because issues related to containers and packaging are familiar and easily recognized by consumers, we believe that if we do not respond appropriately, it is likely to lead to criticism.

Environmentally friendly products

In the Kirin Group, we mark our relevant products as environmentally friendly. On most Kirin Brewery and Kirin Beverage paper containers, we display FSC-certified labeling to indicate the fact that we use FSC-certified paper. We use tea leaves from Rainforest Alliance-certified farms in Sri Lanka for *Kirin Gogo-no-Kocha Straight Tea 250ml (LL Slim)*, so we display a label for this certification on the product. We also use recycled PET resin for Kirin Beverage PET bottles, so we display our own labels. Lion has labels on carbon zero beer that it sells in Australia and New Zealand, and New Belgium Brewing has labels on carbon neutral beer that it sells in the US, which inform consumers about the carbon zero and carbon neutral aspects of these products.
A low level of awareness is a common issue for certification labels. Therefore, we are conducting activities to raise awareness among young people, who are our main target for such products. We enhance the awareness of elementary school students and younger children by encouraging them to look for environmental marks through a program called the "Environmental Mark Discovery Notebook." For junior and senior high school students, we hold Kirin School Challenge workshops, based on the themes of Rainforest Alliance certification and the FSC certification. Each of these programs has more than 1,000 participants.

* We refer to carbon neutral beer as "carbon zero beer" in accordance with the name used for certification.

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Assessment by consumers [short to long term]

There is a possibility that our corporate brand value may decline if our initiatives related to climate change and other aspects of sustainability are inferior, and if we cannot engage in appropriate communication. Since 2020, the SDGs have been incorporated into Japanese national curriculum. Consumer awareness of environmental issues has risen, particularly among young people.

Climate change | Natural capital | Containers and packaging

Concerns about renewable energy [short to long term]

In order to achieve our target of Net-Zero emissions, we must introduce renewable energy, but the inconsiderate construction of power plants may cause harm to scenery, nature, and human rights, and cause disasters, possibly resulting in criticism from society. For example, violations of indigenous peoples' rights when using land, harm caused by noise and vibrations from wind power generation, and deforestation caused by the procurement of raw materials for biomass energy. If measures that we implement based on an inappropriate assessment negatively impact the living environment of local residents, it is highly likely that it may result in claims for compensation.

Climate change | Natural capital | Containers and packaging

Trust from long-term investors [short to long term]

We believe there is a high risk of losing the trust of stakeholders if we lack appropriate disclosure on climate change, natural capital, the circular economy, and other environmental issues. The Kirin Group has declared our aim to be “a global leader in CSV, creating value across our world of Food & Beverages to Pharmaceuticals,” and we aim to expand our business in the Health Science domain. We believe that the support of long-term investors is necessary for long-term business transformation and environmental investment.

Response strategy

Appropriate communication to consumers

We promote our communications, we will prioritize engagement with young people who will take responsibility for the next generation. Since 2014, we have held Kirin School Challenge workshops for junior and senior high school students, based on the themes of our support for the acquisition of Rainforest Alliance certification at tea farms in Sri Lanka and the use of FSC-certified paper in paper containers. In these workshops, we do not just introduce certification systems. We prioritize communication with junior and senior high school students, as well as discussion, thinking, and sharing information among junior and senior high school students about what they should communicate to members of their own generation, and how they should do it.

We are also teaming up with multiple companies on the free distribution of the SDGs Start Book (300,000 copies per year), which teaches elementary school students and junior high school students about the SDGs and introduces our activities in Sri Lanka as an example of actions for SDGs.

For children in elementary school and younger, we are collaborating with organizations such as after-school care clubs, Girl Scouts, and Boy Scouts on the “Environmental Mark Discovery Notebook” initiative, which starts from children learning to recognize environmental marks and finding out their meanings.

Introduction of renewable energy that does not have a negative impact on the environment or local communities

In July 2021, the Kirin Group established our policy on the introduction of environmental value, with the basic policies of the “responsible introduction of renewable energy” and “additionality” when introducing renewable energy.

With regard to the “responsible introduction of renewable energy,” we prioritize ethics and select that which “causes no harm to the environment and does not violate human rights when power plants are constructed and fuel is procured,” and we also set forth examples of expected risks in relation to each source of power, including solar power, wind power, and biomass, and we check these risks in advance.

With regard to “additionality,” our policy is to “replace thermal power by creating new renewable energy power generation facilities in society, and thereby contribute to the creation of a decarbonized society.”

More information→P.60

Appropriate disclosure in line with the TCFD and TNFD recommendations

We expect that by disclosing information in a holistic, appropriate manner, in relation to climate change and the mutually related themes of natural capital and the circular economy, investors who support these initiatives will provide funds. The Kirin Group has disclosed detailed information related to climate change and other environmental factors in our Integrated Report and Environmental Report. We have also continued to disclose information in line with the recommendations of the TCFD since 2018. In our disclosure of information, we have referred to the beta version of the TNFD framework since 2022, and the ISSB Exposure Draft since 2023.

We have won a “Gold Award” three times, in 2019, 2020, and 2024, in the environmentally sustainable company category of the “ESG Finance Awards Japan.” We received the highest number of votes in 2022 and 2023, and the second highest number in 2024, from investment management institutions in the selection of "superior TCFD disclosure" requested to investment management institutions to which the GPIF outsources domestic equity management.

Details of transitional risks

Climate change | Natural capital | Containers and packaging

Responsibility for pollution of the natural environment [short to long term]

Failure to comply with environmental regulations may result in damage to the natural environment around manufacturing, brewing, and logistics sites and related regions, resulting in liability, fines, and administrative dispositions. Specifically, this could include cases where we have polluted the surrounding environment, such as air or water, in excess of legal or in-house standards, and cases where we have not appropriately entrusted waste treatment.
If genetically modified organisms and the like harm the natural environment by escaping to the outside or cause unexpected changes to ecosystems as a through "genetic disturbance" caused by hybridization, it will violate the Cartagena Protocol.
In addition to compensation, fines, and administrative dispositions, we believe these risks could also lead to a decline in public trust, an impact on sales, and even boycotts.

Response strategy

Environmental management systems

We believe that the establishment and proper operation of environmental management systems will enable us to prevent pollution to the natural environment.
In order to manage of legal requirements, we strictly manage records of revisions and abolishments at each business site, and we set voluntary management standards that are stricter than those set by laws and regulations, thereby thoroughly working to prevent environmental pollution. In addition to general pollution and health and safety issues, legal requirements include responses to waste and the Cartagena Protocol.
We operate environmental management systems to maintain compliance with these laws and regulations, and we have provided for these environmental management systems in the Principle for Kirin Group's Global Environmental Management (KGEMP).
Under the KGEMP, a Group general environmental manager has been appointed as the chief executive officer for all Group environmental matters. As of April 2023, this role is held by the Senior Executive Officer of Kirin Holdings Company, Limited with responsibility for CSV strategy. The KGEMP requires the appointment of a general environmental manager, who has responsibility and authority for environmental matters in each operating company.
In addition to monitoring to ensure that the company and its constituent companies are conducting their environmental activities appropriately, the general environmental manager conducts management reviews, identifies issues for improvement, and gives necessary directions to the relevant departments. In the event of an environmental crisis, the general environmental manager of each company will have full authority to resolve the crisis. The KGEMP stipulates that all business sites comply with laws and regulations and other rules relevant to the business's environmental activities, reduce environmental load, such as GHG emissions and water intake, and prevent pollution. All business sites must also conduct internal environmental audits to ascertain the appropriateness and legal compliance of their systems and confirm how well targets are being met. The results of these audits will then lead into management reviews. We integrate the management of environment-related processes with company management processes in a manner suited to the companies' respective regions. We incorporate environmental targets into goal-setting for each organization and individual, as well as responsible managers, and assess the degree to which those goals are achieved in assessments of performance.
The Kirin Group is working toward its declared goal of the implementation and firm establishment of thorough appropriate management of waste. To this end, we established the Kirin Holdings Waste Management Rules and are promoting the appropriate treatment of waste within the common Group systems. These rules standardize contract templates and the frequency and contents of contractor audit programs, and by keeping an updated list of staff in charge of waste management, we provide education to all staff who require it, based on standardized textbooks.
In Japan, Kirin Holdings collectively manages information on all waste disposal contractors for the Group, so in the unlikely event that a problem arises, we can immediately search for and confirm details about the contractor, its permits, the waste it is being contracted to handle, and other details. We have standardized operations in this way so that anyone who is newly assigned to waste-related work will be able to perform it with certainty.

Details of systemic risk

Climate change | Natural capital | Containers and packaging

Damage to ecosystems owing to reduction in agricultural land for food [short to long term]

There have been cases of agricultural land for the production of food being converted to agricultural land for biofuels because of high selling prices of biofuels. Appearance, taste, the health of consumers, and other factors do not matter for agricultural products for biofuel, so the production of agricultural products for biofuel tends to focus only on economics. This results in large-scale changes to the use of agricultural land, monocropping, and the use of large amounts of agricultural chemicals and fertilizers, all of which are likely to have a negative impact on agricultural land and surrounding ecosystems.

Response strategy

●Engagement with agricultural production areas

In production areas in developing countries, there are limited direct contracts with individual farmers, and it may only be possible to procure products through auctions. Where direct engagement is possible, however, through support for the acquisition of certification, as in the case of tea farms in Sri Lanka, we are able to develop an understanding of local issues and find solutions together. Our policy is to engage with farms in other areas producing agricultural raw materials as needed.

Subsidy schemes in producing countries and regions are often behind the conversion to the cultivation of agricultural products for biofuels. It is difficult to have a direct impact on rules in producing countries, so we will try participating in global rulemaking and approach farms through suppliers. We will also consider measures to respond through suppliers, such as leveraging the collection of information to distribute procurement.

Climate change | Natural capital | Containers and packaging

Ecosystem damage due to the abandonment of farmland [short to long term]

In Japan, the number of abandoned farmlands is increasing, owing mainly to the aging farmers. These abandoned lands quickly become covered with strong weeds and transition to simple ecosystems, which may result in disease in nearby farmlands. Production areas in Asia and elsewhere face problems such as soil runoff due to changes in land use associated with economic development, causing water pollution in basins and the destruction of ecosystems, with the risk of negative impact spreading to downstream areas.

●Engagement with agricultural production areas and provision of training

At tea farms in Sri Lanka, our support for obtaining certification contributes to both the conservation of nature and profitability improvements. Through many years of engagement with Sri Lankan tea farms, we support the continuation of tea leaf cultivation in ways suited to local characteristics. In addition, we offer environmental education programs and other programs in cooperation with local nature conservation organizations and the government, in order to promote appropriate actions by farmers.

In Japan, farmers, the government, and Kirin have deployed activities based on engagement, in order to prevent the abandonment of cultivation by hop farmers in Tono due to the aging population. We are taking steps to create a brand around Tono hops, and are promoting initiatives such as the utilization of these hops in craft beer and other products.

Climate change | Natural capital | Containers and packaging

Ecosystem damage due to the excessive use of agricultural chemicals [short to long term]

Examples have been confirmed of grape cultivation with pergolas where the application of defoliants to the soil for many years for operational reasons destroys the existing ecosystem in vineyards. We know that even if there are mountains and fields nearby and the ecosystem is very abundant, once an ecosystem completely collapses, it is difficult to recover easily.

●Ecosystem restoration activities focusing on hedgerow-style cultivation

In ecological surveys at vineyards, we confirmed that even if the seeds that we sow for slope greening and hedgerow-style cultivation contain invasive species, native species will gradually enter and become dominant if the environment is favorable.

Therefore, even if ecosystems are destroyed, we believe that it is possible to restore abundant ecosystems by restoring grassland through hedgerow-style cultivation.

Details of business opportunities

Climate change | Natural capital | Containers and packaging

Increasing interest in infectious diseases caused by global warming [short to long term]

WHO forecasts

A report from the WHO forecasts that if climate change continues, between 2030 and 2050 approximately 250,000 additional people will die each year as a result of the spread of infectious diseases. It also forecasts that the number of cases of dengue fever will increase significantly. In Japan, the habitat of the Aedes albopictus, which carries dengue fever, was confirmed to have spread as far north as Aomori in 2015.

The results of analysis of the impact of the spread of dengue fever based on WHO scenarios concerning climate change and the impact on people's health project that a total of 1 billion people will be at risk of infection in East and Southeast Asia. On the other hand, if we take economic growth into consideration, we project that the population at risk will decrease by approximately 25% by 2050 in high-income countries in Asia and the Pacific and in East Asia. It appears that economic growth may result in the expansion of markets related to immunity. In consumer surveys that we conducted in Japan in 2021, people's health awareness was most heightened in relation to their "interest in immunity."

Climate change | Natural capital | Containers and packaging

Increase in heatstroke caused by global warming [short to long term]

Heatstroke cases are expected to increase as a result of the impact of global warming. Based on observational and forecast data on climate change from the National Institute for Environmental Studies, under the RCP8.5 scenario (equivalent to the 4℃ scenario in Kirin Group Scenario 3), the number of heat-related excess deaths in Japan between 2080 and 2100 will be between almost four times and over 10 times the number between 1981 and 2000. In Kirin Group Scenario 3 (the 4℃ scenario), we have estimated that the Japanese market for beverages that prevent heatstroke will grow by between 94 billion yen and 188 billion yen, assuming that it correlates with the number of persons requiring emergency services as a result of heatstroke caused by climate change.

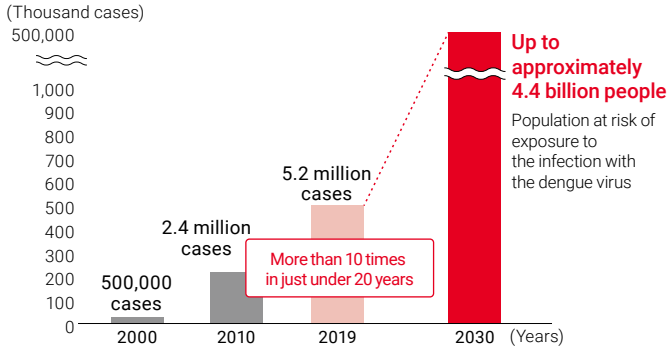
Response strategy

Contribution to Health Science domain

In 2021, we expanded our lineup of FFC products that "help maintain the immune system in healthy people." We began selling such products under the *Nama-cha* and *Gogo-no-Kocha* brands, which have a high level of brand awareness among consumers, in addition to yoghurt and supplement products. Additionally, in our BtoB business, we licensed and provided materials to external partner companies in Japan and overseas and sold a wide range of products, including snacks, protein, etc. As a result, annual sales increased 40% in 2022 compared with the previous year.

In order to offer products to more consumers, we began selling immune-related beverages in 100ml PET bottles at general merchandise stores, drugstores, and convenience stores nationwide from the end of March 2022. In anticipation of the expansion of the market for immunity-related products, we invested approximately 10 billion yen in enhancing manufacturing facilities for small PET bottles at the Kirin Beverage Shonan Plant, thus developing a supply system for immune-related beverages in small PET bottles, including 100ml PET bottles.

14 Number of dengue fever cases reported to the WHO



Estimated based on the WHO's "Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s" report.

Contribution with products to counter heatstroke

SALTY LITCHI is widely known as a beverage that prevents heatstroke. At Kirin Beverage, "heatstroke countermeasure advisors," who have received certification for completing training courses held by the Heat Illness Prevention - Communication Project, hold seminars on heat stroke countermeasures at schools and other institutions. Through this initiative, we are raising awareness about measures against heatstroke and providing more people with correct knowledge and countermeasures.

| Business opportunities | Products and services

Details of business opportunities

Climate change | Natural capital | Containers and packaging

Products that contribute to decarbonization [medium to long term]

As interest in decarbonization grows, there is a possibility that demand will increase for products that contribute to decarbonization or the shift to a low-carbon society. In the U.S., Australia, and New Zealand, carbon-neutral products are sold, and are somewhat popular in their respective markets. Although interest in carbon-neutral products may not be high in Japan at present, awareness of the SDGs has grown rapidly. As such, it appears there is a strong possibility that interest in ethical products will increase in the future.

Response strategy

●Decarbonization products

New Belgium Brewing successfully made FAT TIRE ALE, one of its main brands, the first carbon-neutral beer in the U.S. Lion launched XXXX Zero, the first carbon-neutral alcohol-free beer in Australia. Lion sells Steinlager, which is certified as a zero-carbon under the New Zealand government's Toitu program.
In Japan, we have judged that consumers do not yet require decarbonized alcoholic or non-alcoholic beverages. Under the CFP program operated and managed by the Japan Environmental Management Association for Industry, however, product category rules (PCR) have been established for calculating the carbon footprint of beer and soft drinks. The Kirin Group believes that it will be possible for us to calculate the carbon footprint based on this PCR.

More information→P.64

| Business opportunities | Resource efficiency

Details of business opportunities

Climate change | Natural capital | Containers and packaging

Sustainable logistics [short to long term]

In order to reduce GHG emissions, it is important to improve transportation efficiency. By doing this, we can also expect to solve chronic driver shortages. Transportation distances from breweries and plants to areas of consumption are tending to become longer owing to factors such as a decline in the number of breweries and plants and the concentration of breweries and manufacturing plants for small-lot product varieties. In recent years, however, it has become difficult to secure drivers for long-distance journeys. It is inefficient to transport products for long distances using trucks, and it increases GHG emissions. Therefore, we must solve these problems related to logistics.

Response strategy

●Reduction in costs from more efficient transportation

We are implementing various initiatives to make deliveries more efficient and contribute to reducing logistics costs and GHG emissions, such as a modal shift, joint deliveries, and more efficient loading. We actively promote joint deliveries with other companies by positioning the logistics functions as non-competitive fields, instead of competitive fields. For example, we are using joint deliveries with railroad containers to transport products from breweries and plants in the Kansai area to the Hokuriku region, and plan to complete a modal shift away from long-distance truck transportation equivalent to 10,000 vehicles a year, which will enable us to avoid long-distance truck transportation, and we expect this to contribute to reducing annual GHG emissions by approximately 2,700 tons.

More information→P.62~P.63

Climate change | Natural capital | Containers and packaging

Reduction of container and packaging raw materials and stable procurement [short to long term]

Society continues to demand that companies address the issue of the 3Rs for containers and packaging. At the same time, this will contribute to reducing GHG emissions, make resource use more efficient, and reduce costs.
Beer and soft drinks are products that represent mass production and mass consumption, and they thus use a large number of containers and packaging. The amount of paper containers used in the Japan Non-alcoholic Beverages Businesses is 120,000 tonnes, and the amount of PET bottles used is 65,000 tonnes.

●Reducing the weight of containers and packaging

The Kirin Group has the Institute for Packaging Innovation, where we develop packaging and containers in-house, as one of the few research laboratories of its scale owned by a global food and beverage, and pharmaceutical company. We leverage this strength to promote lighter containers and packaging. For example, our "204-diameter can lids" for aluminum beer cans have reduced weight by approximately 29% for 350ml cans compared with when we used "209-diameter can lids." We also use beer bottles that reduce weight by 21% for large bottles and 19% for medium-size bottles. Furthermore, "R100 PET bottles," which use 100% recycled PET resin, make it possible to reduce the use of resin derived from oil by 90% in manufacturing, and reduce GHG emissions from manufacturing by 50-60%. And, the introduction of smart-cut cartons, a type of cardboard packaging developed for alcoholic beverages in Japan, has contributed to cost savings of 0.17 billion yen per year, while lighter 2.0-liter PET bottles have contributed to cost savings of 0.16 billion yen per year.

More information→P.51~P.54

| Business opportunities | Energy source

Details of business opportunities

Climate change | Natural capital | Containers and packaging

Reduction in reliance on fossil fuels [short to long term]

It will be possible to stabilize our energy procurement by reducing our use of fossil fuels and transitioning to renewable energy.
As prices of fossil fuels spike, and producing countries are concentrated in places with high geopolitical risk, reducing our reliance on fossil fuels will contribute to reducing risk.

Response strategy

●Achievement of an energy mix to achieve Net-Zero emissions

We will shift our energy mix to “electric power” and utilize electric power generated from renewable energy.
In the Kirin Group roadmap, we plan to make progress on energy conservation by 2030, while also shifting our energy mix toward “electric power” by promoting the shift to electric power for heating processes as much as possible, and utilizing electric power generated from renewable energy.
It will be possible to lower our direct reliance on fossil fuels in our businesses by reducing our use of natural gas, and reduce our reliance on the fossil fuels of thermal power plants by increasing the proportion of renewable energy in the electric power that we use.

More information→P.21,P.61

Climate change | Natural capital | Containers and packaging

Stable procurement of renewable energy [short to long term]

There are various methods for introducing environmental value, each of which have their own merits and demerits, including in-house power generation, purchasing from electricity retailers, purchase of certificates that power is derived from renewable energy, and corporate PPAs. We will acquire environmental value that satisfies the criteria set forth in RE100 by introducing renewable energy, but in Japan, we expect the balance of supply and demand to grow tight over the long term as demand for renewable energy increases.

●Use of renewable energy with a focus on additionality

When introducing renewable energy, we prioritize “additionality,” which indicates the actual increase in the supply of renewable energy. We will replace thermal power plants and contribute to creating a decarbonized society by increasing renewable energy power plant facilities in society.
Specifically, we have been introducing solar power generation at breweries using the PPA model, and we have completed installation at all breweries (excluding the Yokohama Brewery, where we introduced such facilities in-house). PPA stands for Power Purchase Agreement, and it refers to a type of business model where a PPA business operator installs solar power generation facilities at no charge on land, buildings, etc., owned by the party that requires the power, and sells the power-generated by those facilities to the party that requires the power.
Installing solar panels in our own breweries and plants ensures that the power plants can reliably add renewable energy, without any negative impact on the local community, while at the same time enabling us to use such energy in a stable manner.

More information→P.21,P.60

| Business opportunities | Resilience

Details of business opportunities

Climate change | Natural capital | Containers and packaging

Strengthening the supply chain [short to long term]

We expect that our initiatives targeting the procurement of agricultural raw materials and the reduction of Scope 3 emissions will contribute to strengthening the supply chain.
It is possible that by enhancing our engagement with suppliers and producing areas, identifying various issues, and working to solve them, it will contribute to improving the resilience of suppliers, producing areas, and the Kirin Group.

Response strategy

●Enhancement of engagement

In addition to producing regions, we will enhance our engagement with suppliers.
Every year, we visit tea farms in Sri Lanka, where we engage with local managers. As part of these initiatives, we have gained an understanding of the severity of heavy rainfall associated with climate change that is affecting tea farms in Sri Lanka, which is contributing to strengthening our training to prevent soil outflow and our water source conservation activities. We have conducted detailed surveys related to the reduction of Scope 3 emissions, in addition to making requests and performing checks based on the Sustainable Supplier Code, and we base our engagement with stakeholders on the results of these surveys. In addition, we launched the Kirin Supply Chain Environmental Program in 2024 together with suppliers with high emissions, and we will jointly solve issues as we target decarbonization through initiatives such as the mutual disclosure of data, setting of targets that meet the SBT standards, and the identification of new measures.

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Assessment of impact of carbon pricing

Estimation of impact of carbon pricing

1) We calculated the rate of decline in future electric power emission factors from the IEA "World Energy Outlook 2019" Annex A (Current Policies Scenario and SD Scenario).
2) We calculated actual electric power emission factors from the actual energy usage and GHG emissions of the Kirin Group in the base year (2019), and estimated future electric power emission factors under the two scenarios (Current Policies Scenario and SD Scenario) by multiplying actual emission factors by the rate of decline in emission factors calculated in Step 1.
3) We used the electric power emission factors that we calculated to forecast GHG emissions in the Kirin Group in 2030 and 2050. We categorized these forecasts depending on whether or not we take measures to reduce emissions.
4) We applied the IEA WEO 2019 Current Policies Scenario to the Kirin Group scenario 3, and the SD Scenario for the Kirin Group scenario 1, while also setting the IPCC "Special Report on Global Warming of 1.5℃" as our new 1.5℃ scenario, and we set the carbon prices indicated in each data source as the basis for the future carbon prices for each scenario (IEA WEO 2019 P758 and IPCC Special Report on Global Warming of 1.5℃ 2.5.2.1 Price of carbon emissions).
5) We calculated the future impact by multiplying the forecasts of future GHG emissions that we calculated in Step 3 by the carbon prices that we set in Step 4. We calculated the increase in costs if we did not implement initiatives to reduce GHG emissions from the difference in impact depending on whether or not we take measures to reduce emissions.

External diseconomies related to Kirin Group PET bottles

We estimated that impairment losses related to marine ecosystem services would be approximately 0.36 to 3.56 million yen (approximately 3,300 US$ to 33,000 US$) per ton of plastic in 2011, based on the estimations of Beaumont et al. We estimated that the median proportion of PET bottles that flowed into the ocean from Japan would be 0.5%, based on the "Annual Report on the Recycling of PET Bottles" by the Ministry of the Environment. We set the total amount of PET materials used by Kirin Group major domestic companies at 66,894 tons in 2018, and multiplied this amount by the above estimates.

- Beaumont et al. (2019) Global ecological, social and economic impacts of marine plastic
- Ministry of the Environment (2018) Recent Trends Surrounding Ocean Waste, and the Council for PET Bottle Recycling, (2018) Annual Report on the Recycling of PET Bottles

Increasing interest in infectious diseases caused by global warming

- WHO: "Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s"
- WHO: "Dengue and severe dengue" 10 January 2022

Increase in heatstroke caused by global warming [short to long term]

- S-8 2014 Report by Project Team of Comprehensive Study on Impact Assessment and Adaptation for Climate Change
- National Institute of Infectious Diseases, Expansion of Aedes albopictus in Japan (IASR Vol. 41 p92-93: June 2020 edition)

Financial impact of transition risks related to natural capital (procurement of certified products)

- Estimated by multiplying by royalties, etc., if coffee and tea leaves are procured as certified products.

Financial impact of transition risks related to natural capital (reduction in agricultural chemicals and chemical fertilizers at tea farms)

- Estimated based on the results of on-site interviews, taking into account prices of chemical and organic fertilizers, as well as respective personnel expenses for the application of these fertilizers.