Practical guide for Scenario Analysis in line with the TCFD recommendations 3rd edition

Ministry of the Environment, Government of Japan
Climate Change Policy Division
March 2021

Contents

[Structure and Use of this Practical Guide]

Composed of “The TCFD recommendations,” “Key points for scenario analysis,” “Practical examples,” and “Appendix”

Corporate Needs	Chapters and the Practical Guide and Their Summaries
Companies want to know what the TCFD recommendations are and what scenario analysis is in terms of the TCFD recommendations in the first place.	**CHARTER 1. Introduction** This chapter explains the purpose of this practice guide, outlines the TCFD recommendations and significance in the background, and positions of scenario analysis.
Companies want to know the specific promotion means and practical points for scenario analysis.	**CHAPTER 2. Scenario Analysis - Key Points of Practice** This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.
Companies want to know the actual scenario analysis conducted by Japanese companies for each step in the analysis.	**CHAPTER 3. Scenario Analysis - Practice Examples** This chapter explains how scenario analysis is carried out based on the support cases of the Ministry of the Environment (18 companies).
Companies want to know the reference tools and literature for scenario analysis.	**Appendix.** Provide useful materials for scenario analysis based on the support cases

- TCFD's approach for scenario analysis in this Practical Guide has been developed based on a technical supplement to scenario analysis ("TCFD Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities" (2017.6)) as well as its own methodology and interpretations.
- Figures for each case are based on information at the time of acquisition.
- Examples of projects supported by the Ministry of the Environment are examples of projects supported by the “Project to Analyze Scenarios of Climate Risks and Opportunities in Accordance with TCFD” implemented in FY2018, FY2019 and FY2020.

1. Introduction

Chapter 1. Introduction

This chapter explains the purpose of Practical Guide, concept and significance of the TCFD recommendations, and positioning of scenario analysis

1. Introduction

1-1. Purpose of this Practical Guide

1-2. Significance of the TCFD recommendations / positioning of scenario analysis

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[Challenges for companies in implementing scenario analysis]

Respond to the challenges of scenario analysis with "Practical Points" and "Practical Examples by Sector"

■There are roughly 5 difficulties that companies face in implementing scenario analysis

① Scenario analysis is roughly understood, but **no specific implementation process is known.**

② **The processes and departments** involved in scenario analysis differ for each company and product, and the level of implementation of scenario analysis cannot be determined uniformly.

③ **Efforts are required to ensure that internal management understands** the purpose and the results of scenario analysis.

④ **Utilizable external data for scenario analysis is lacking.**

⑤ **Companies don't know which direction to take for making scenario analysis more sophisticated.**

■ The above issues can be resolved in this Practical Guide.

- ✓ ①②: Understanding of "**Practical Points**" and "**Practical Examples by Sector**" in this Practical Guide.
- ✓ ③: Have management understand the significance of the TCFD recommendations and scenario analysis through **"Significance of the TCFD recommendations / positioning of scenario analysis"** in this Practical Guide.
- ✓ ③: After this, scenario analysis is conducted using parameters within a known range. Start dialogue with the management team based on the result.
- ✓ ④: Describe **the external data and parameter** in **Appendix**.
- ✓ ⑤: Understand the direction to take for making scenario analysis more sophisticated (example: after the second year) through **"Practical Points"** in this Practical Guide, and perform implementation.

■ The key is to begin scenario analysis with what you understand, and progress and deepen your knowledge and experience.

- ✓ Example: First, conduct qualitative scenario analysis. Then, try quantitative scenario analysis.
- ✓ Example: First, apply scenario analysis to a certain segment. Then, apply to a greater part of your company.

■ The goal of scenario analysis is to "respond to climate-related issues" and to "increase corporate value" at the same time.

- ✓ It is important not only to conduct scenario analysis, but also to continue the "cycle" which is to disclose information and hold dialogues with management.
- ✓ Seize opportunities by continuing the cycle and incorporate it into business plans.

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1-2. Significance of the TCFD recommendations / positioning of scenario analysis

Chapter 1. Introduction
This chapter explains the purpose of this practice guide, outlines the TCFD recommendations and significance in the background, and positions of scenario analysis.

[Background of the TCFD]
Climate change risks could destabilize the financial system and become a possible threat to financial institutions

- **"The financial risks that could result from the process of adjustment towards a lower carbon economy could prompt a reassessment of the value of a large range of assets with a large volume of greenhouse gas emissions and destabilize the financial system." Speech made by Mark Carney, Chair of the Financial Stability Board (FSB), Then Governor of the Bank of England**
- **Dr. Carney also refers to the possibility that a sudden reassessment could destabilize markets like the subprime loan crises.**

Speech by Mark Carney, Chair of the Financial Stability Board (FSB), Then Governor of the Bank of England (September 2015)

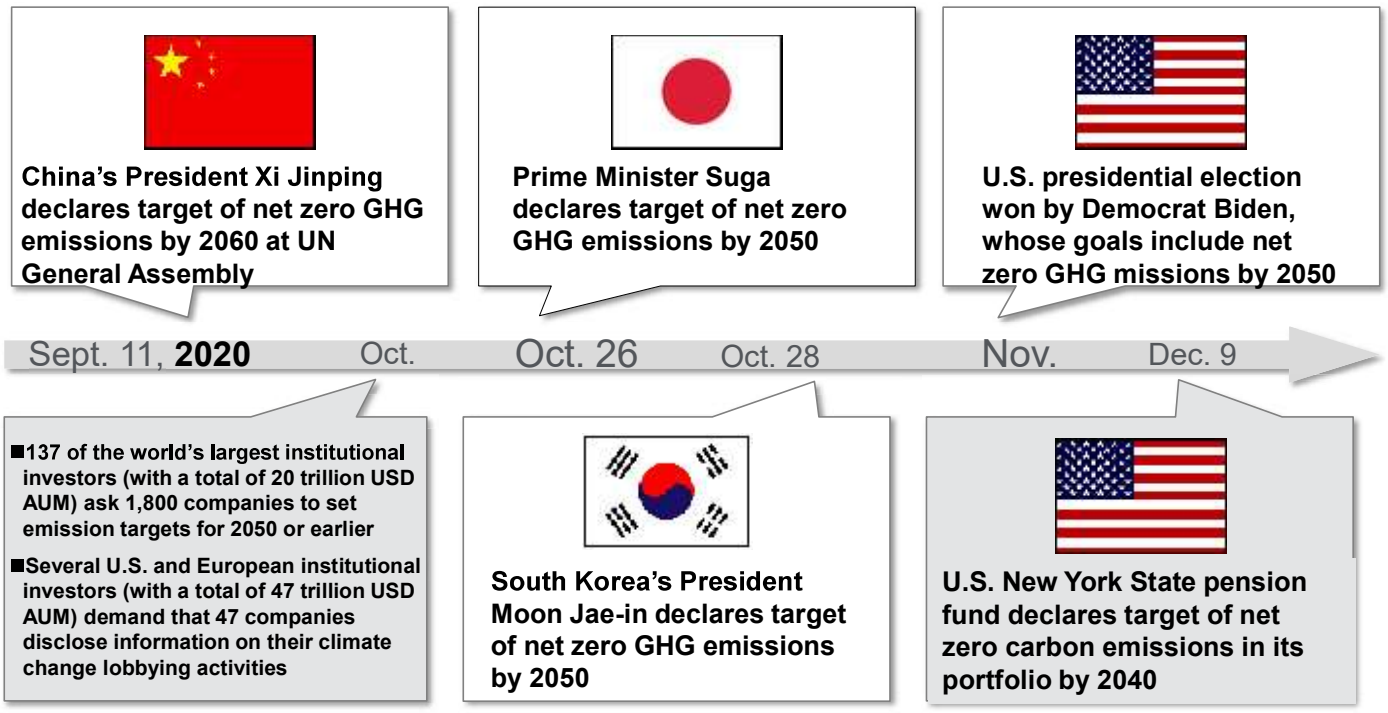
There are three broad channels through which climate change **can affect financial stability**:

- **Physical risks** : The direct impacts on property from climate related events, such as floods and storms and indirect impacts on blocked global supply chain or depletion of resources;
- **Liability risks** : The impacts that could arise if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible;
- **Transition risks** : The risks which could result from **reassessment of the value of a large range of assets with a large volume of greenhouse gas emissions during the process of adjustment towards a lower carbon economy.**

Source: Financial Times Online, September 30, 2015

[Trends toward Decarbonization]

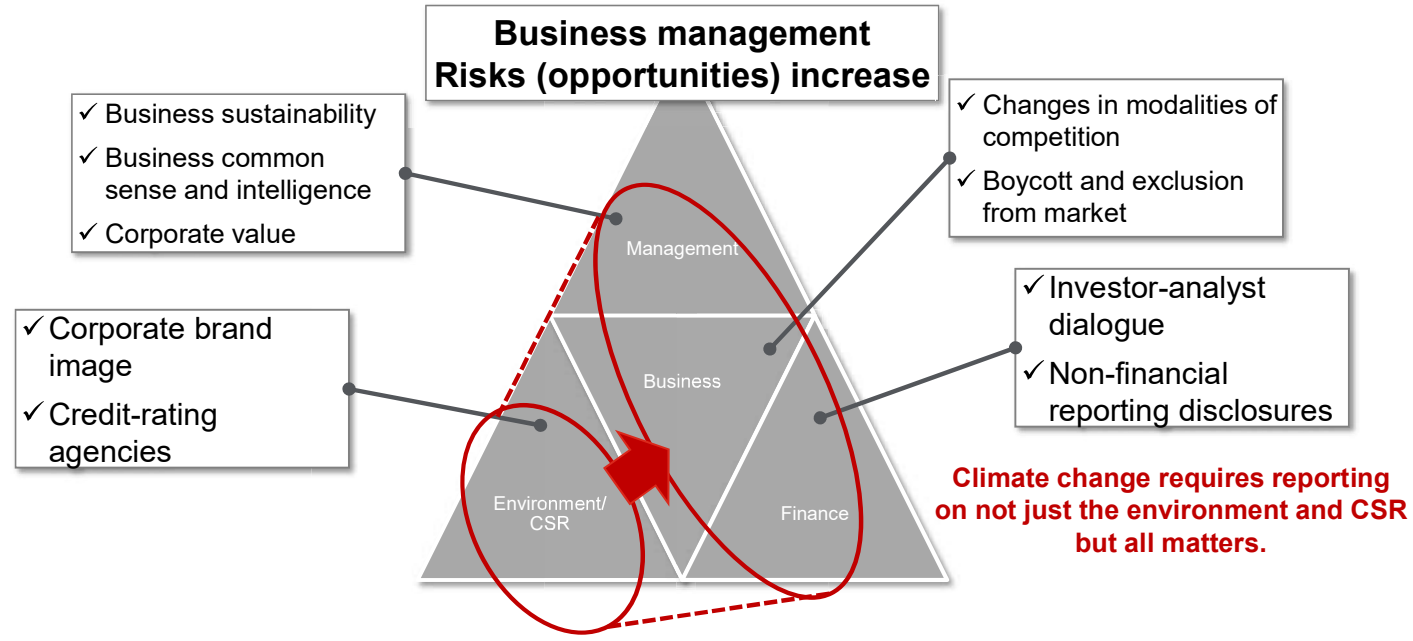
Various countries and institutional investors have declared decarbonization targets, and companies are also being required to decarbonize their operations



Sources: Websites for various countries and organizations, news websites such as NHK, Reuters, and AFP news

[Corporate Management and Climate Change]

For corporate management, climate change has the potential to become a clear risk and opportunity for the company as a whole



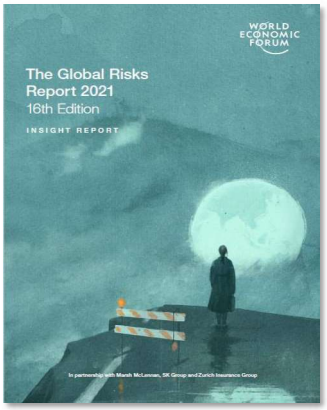
The environment and CSR department has responded to the climate change, however, there is a growing need for a company to respond to the issues as a whole, as climate-related issues can be risks and opportunities in the field of "corporate value", "business sales", and "fund raising."

[Management and Climate Change Risks]

Management around the world also considers environmental/social risks related to climate change to be important, and environmental risks rank at the top in terms of likelihood of occurrence

Top 10 risks in the World Economic Forum (WEF) “Global Risks Report 2021”

■: Environmental risks
■: Societal risks



	Top 10 Risks By “Likelihood”	Top 10 Risks By “Impact”
1	Extreme weather	Infectious diseases
2	Climate action failure	Climate action failure
3	Human environmental damage	Weapons of mass destruction
4	Infectious diseases	Biodiversity loss
5	Biodiversity loss	Natural resource crises
6	Digital power concentration	Human environmental damage
7	Digital inequality	Livelihood crises
8	Interstate relations fracture	Extreme weather
9	Cybersecurity failure	Debt crises
10	Livelihood crises	IT infrastructure breakdown

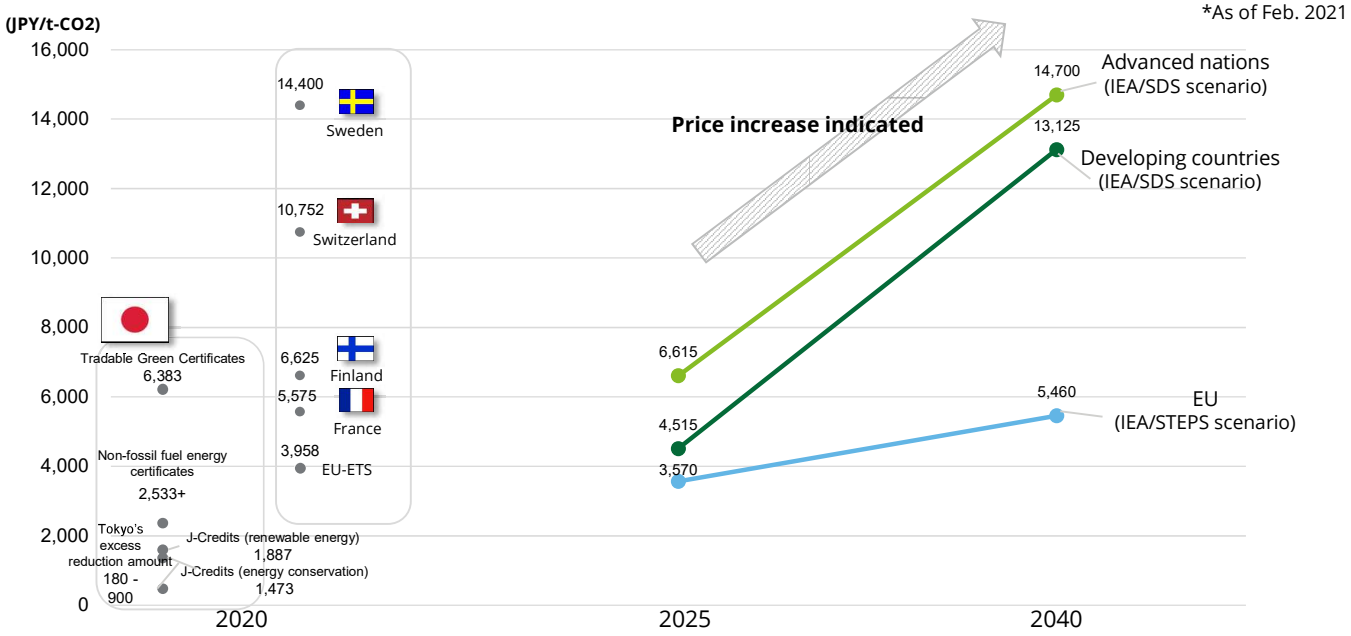
Source: World Economic Forum “The Global Risks Report 2021”
http://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf

[Climate Change Risks/Opportunities: Projected Changes in Carbon Pricing]

Carbon pricing may increase to as much as 10,000 to 20,000 JPY; this could become both a risk and an opportunity

Market prices for each country (2020) and future predictions

*As of Feb. 2021



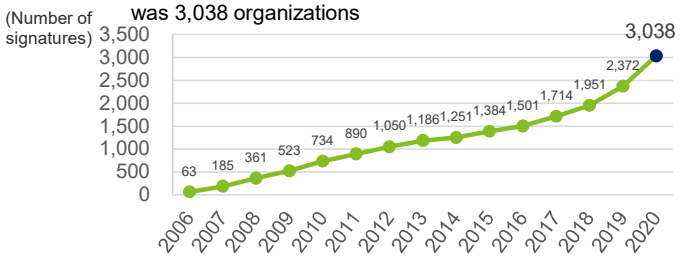
*1 USD = 105 JPY, 1 EUR = 128 JPY (as of 2/10/2021)
*Tradable Green Certificates have been temporarily determined as 3 JPY/kWh
*For the CO2 emission factor for electricity, we used the substitute values “0.00047(t-CO2/kWh)” (https://ghg-santeikohyo.env.go.jp/calc) from “Emission factors by electric utility (for calculating greenhouse gas emissions of specific emitters) – FY2019 results – published 1/7/2021 by the Ministry of the Environment and the Ministry of Economy, Trade and Industry
*See Section 4 for details on each scenario

Sources: JEPX: “Notification of FY2020 transaction results for the non-fossil value trading market”: http://www.jepx.org/market/nonfossil.html, “Average value of winning bids” (J-Credit Scheme): https://japancredit.go.jp/ (renewable energy: 6/22/2020 – 6/29/2020, energy conservation: 1/62020 – 1/10/2020), “Assessed value of Tokyo’s excess reduction amount” (PPS-NET): https://pps-net.org/co2_price, “Overview of carbon taxes in other countries”: http://www.env.go.jp/council/06earth/01_shiryou1.pdf (exchange rates are average of 2018 – 2020 exchange rates (TTM) as indicated in the sources. For EU-ETS, the exchange rate listed above for February 2021 was used), “World Energy Outlook2020” (IEA): https://www.iea.org/reports/world-energy-outlook-2020

[Increased Decarbonization Awareness in Investors(1)]
ESG investments continue to increase, with investments reaching 103 trillion USD globally, and 336 trillion JPY in Japan

Number of PRI signatures (globally)

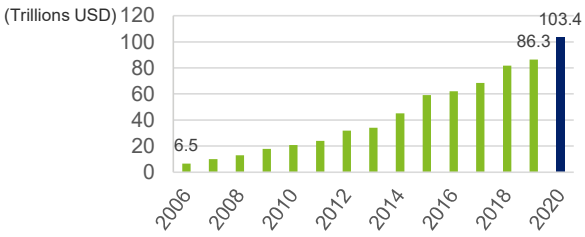
■ The number of PRI signatures as of the end of March 2020 was 3,038 organizations



Source: https://www.unpri.org/pri/about-the-pri (PRI website)

ESG assets under management (globally)

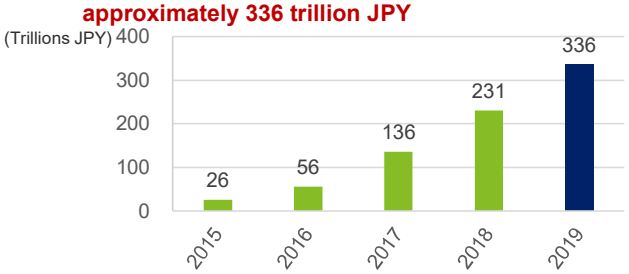
■ As of late March 2020, the total amount of AUM was **approximately 103 trillion USD**



Source: https://www.unpri.org/pri/about-the-pri (PRI website)

ESG assets under management (Japan)

■ As of late March 2019, the total amount of AUM was **approximately 336 trillion JPY**



Source: https://japansif.com/survey#toc5 (JSIF (Japan Sustainable Investment Forum) website)

1-9 *1 USD = 105 JPY (as of February 10, 2021)

[Increased Decarbonization Awareness in Investors (2)]
Trends can be seen where institutional investors make requests for companies to set specific decarbonization targets, and declare targets for net zero CO2 emissions in portfolios

Institutional investors' requests for decarbonization

■ Major institutional investors call for emission reduction targets

- **137 of the world's largest institutional investors,** including AXA Group and Nikko Asset Management **(with a total of approximately 20 trillion USD AUM)**, have asked 1,800 companies with high greenhouse gas emissions to **set targets for reaching zero emissions by the middle of this century (2050)** (October 2020)
- Larry Fink, CEO of the world's largest asset manager BlackRock of the U.S., publicly released the letter that he sends every year to the top management of the companies that BlackRock invests in. In this letter, **he requested that the companies disclose their business strategies for achieving carbon neutrality** (January 2021)

■ U.S. and European institutional investors demand disclosure of information on climate change lobbying activities (October 2020)

- U.S. and European institutional investors (**with a total of approximately 47 trillion USD AUM**) sent a joint letter to the CEOs and board chairs of 47 major U.S. companies with high CO2 emissions demanding that they **disclose their lobbying activities concerning climate change.** This was aimed at **highlighting lobbying against the Paris Agreement**

■ UK government plans to request scenario analysis for large pension funds (2021)

- A conference for requiring reporting in line with the TCFD recommendations, previously held in August 2020, is currently underway (as of January 2021). Obligations to be introduced for pension scheme trustees will only **apply to pension schemes with AUM of 5 billion GBP or more, with the threshold expected to become 1 billion GBP starting in October 2022**

Institutional investors set targets for zero CO2 emissions

■ Nippon Life Insurance Company aims to reach zero CO2 emissions in its portfolio by 2050 (January 2021)

- Nippon Life Insurance Company, one of the largest private-sector institutional investor in Japan, **aims to achieve zero overall CO2 emissions by 2050 for its investments in corporate bonds and stock.** It plans to encourage the companies it invests in to make efforts toward reducing emissions, and **will consider divesting if they do not take sufficient action**

■ U.S. New York State pension fund declares a target of net zero CO2 emissions in its portfolio by 2040 (December 2020)

- New York State manages the third largest pension fund in the U.S. at 226 billion USD (about 23 trillion JPY). It has announced that it will **gradually reduce the number of coal and oil industry shares from its investment portfolio, and that it will achieve net zero CO2 emissions for its portfolio companies by 2040. Currently, just over 1% of its portfolio (or 2.6 billion USD) is invested in coal or oil-related companies**


New York State Pension Fund Sets 2040 Net Zero Carbon Emissions Target

NEWS

NEW YORK STATE PENSION FUND SETS
2040 NET ZERO CARBON EMISSIONS TARGET

Source: Sustainable Japan: https://sustainablejapan.jp/2020/11/05/climate-lobbying/55503, Reuters: https://www.reuters.com/article/climate-change-investors-idJPL4N2H414W, NHK news: https://www3.nhk.or.jp/news/html/20201210/k10012756381000.html, https://www.nikkei.com/article/DGXZQODF228IG0S1A120C2000000, Office of the NEW YORK STATE COMPTROLLER: https://www.osc.state.ny.us/press/releases/2020/12/new-york-state-pension-fund-sets-2040-net-zero-carbon-emissions-target , Responsible Investor: https://www.responsible-investor.com/articles/uk-government-releases-draft-tcfd-reporting-guidance-for-pension-schemes, BlackRock website: https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter

[Increased Decarbonization Awareness in Investors(3)]

Financial institutions also support lending based on a company's initiatives against climate change, and efforts toward the TCFD recommendations is one of their evaluation criteria

Lending based on information disclosure on environmental considerations such as the TCFD recommendations (example)

"Mizuho Eco Finance"

- Mizuho Bank, Ltd. and Mizuho Information & Research Institute, Inc. **promote appropriate information disclosure on environmental considerations** toward the transition to a decarbonized society
- They perform evaluations using an environmental evaluation model **based on globally reliable environmental certifications and assessments, and have also incorporated TCFD compliance as an evaluation item**

- **Mizuho Bank will provide loans** to customers who meet or exceed a certain score
- Mizuho Information & Research Institute will use monitoring to **give advice to customers for improving or maintaining their scores**

Product name	Mizuho Eco Finance
Launch date	June 28, 2019
Environmental assessment model	• Looking at benchmarks mainly pertaining to disclosure of information as the main criterion (listed below), Mizuho will score companies on a 5-step scale from AA (best) to D by evaluating each company's environment-related disclosure of information in light of the social conditions and characteristics of the relevant industry. We are launching this service with the intention of promoting appropriate disclosure of information related to environmental considerations based on the expertise that Mizuho Information & Research Institute has cultivated through research and consulting work for the public and private sectors. • Mizuho Eco Finance is a service that can only be offered to companies and other entities that have obtained an A evaluation or higher. (1) Support of the Task Force on Climate-related Financial Disclosures (TCFD) (*1) (2) S&P/JPX Carbon Efficient Index (*2) (Status of disclosure of carbon emissions) (3) S&P/JPX Carbon Efficient Index (Decile classification) (4) Has set officially approved Science Based Targets (SBT) (*3) / SBT commitments (5) Content of long-term environmental vision for greenhouse gases (*4) (6) Greenhouse gas emissions (Scope 1 + 2) (*5) (7) Greenhouse gas emissions (Scope 3) (*5)

Source: https://www.mizuhobank.co.jp/release/pdf/20190628release_jp.pdf 、https://www.mizuhogroup.com/information-and-research/news/2019/06/announcing-the-launch-of-mizuho-eco-finance.html (Mizuho Bank, Ltd. website)

[Evaluation of climate change measures]

The CDP's questions also include the recommended disclosure items in the TCFD recommendations, and initiatives toward the TCFD recommendations may lead to increased corporate value

- The CDP sends out questionnaires **at the request of institutional investors and companies that make ESG investments, and evaluates companies' environmental responses**
- The climate change questionnaire **conforms to the recommended disclosure items in the TCFD recommendations,** and asks for information on companies' risks, opportunities, and impact related to climate change

The CDP's climate change questionnaire: there are questions related to the TCFD recommendations in C3.1,etc.

C3 Business strategy

Business strategy

(C3.1) Have climate-related risks and opportunities influenced your organization's strategy and/or financial planning?

(C3.1a) Does your organization use climate-related scenario analysis to inform its strategy?

(C3.1b) Provide details of your organization's use of climate-related scenario analysis.

(C3.1c) Why does your organization not use climate-related scenario analysis to inform its strategy?

(C3.1d) Describe where and how climate-related risks and opportunities have influenced your strategy.

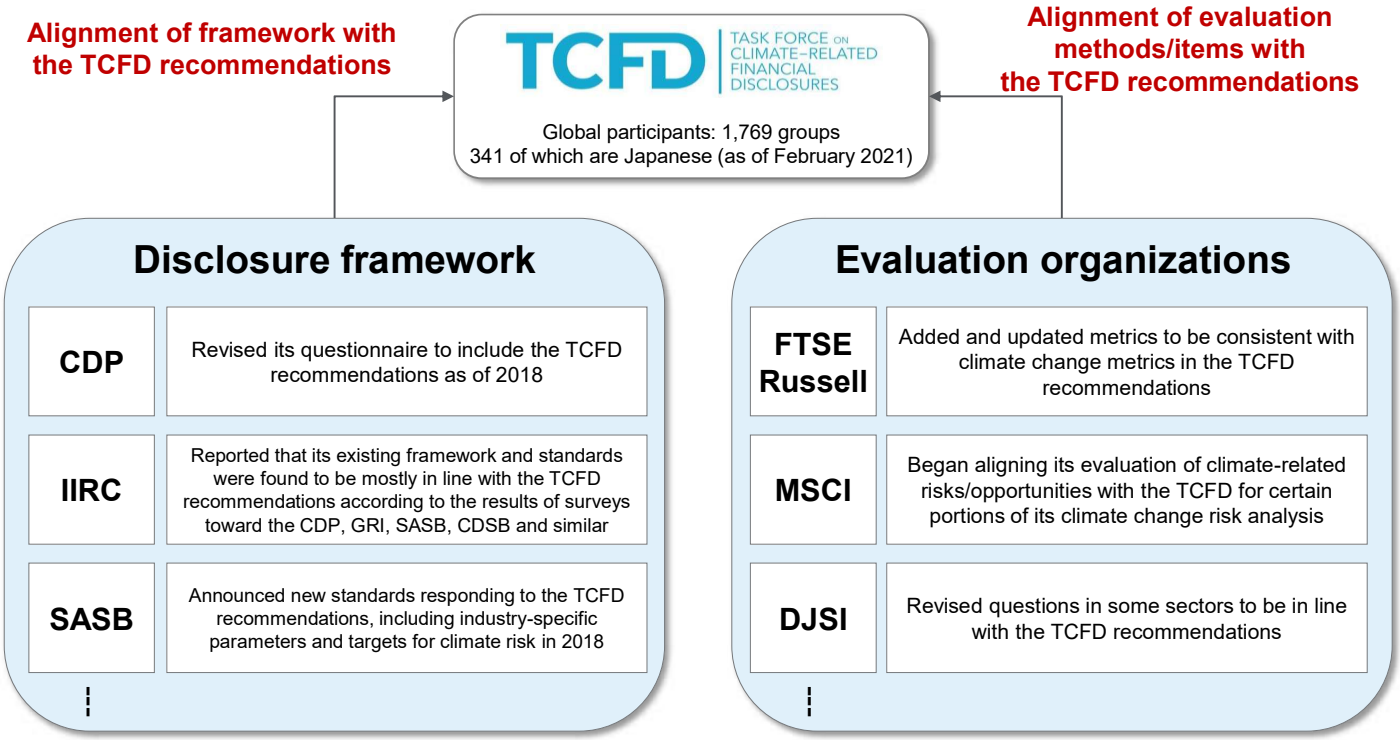
(C3.1f) Provide any additional information on how climate-related risks and opportunities have influenced your strategy and financial planning

(C3.1g) Why have climate-related risks and opportunities not influenced your strategy and/or financial planning?

Source: CDP website

[Positioning of the TCFD recommendations in information disclosure]

Disclosure frameworks/evaluation organizations are making revisions and reviews to align with the TCFD recommendations, and the TCFD recommendations are becoming the standard for each framework/evaluation



Sources: TCFD Guidance 2.0, FTSE Russell: "How the TCFD recommendations are incorporated into FTSE Russell's ESG Ratings and data model"
MSCI website: https://www.msci.com/our-solutions/esg-investing/climate-solutions/climate-risk-reporting

[Impact on companies who do not implement responses to the TCFD recommendations]

Failure to implement responses to the TCFD recommendations has a possibility of impairing the sustainable management of companies in the short, medium, and long term

<Possible Impacts>

Short term

- **Increased financing costs**: Perceptions of inadequate measures against climate change will lead to increased financial costs due to withdrawn investments and lost opportunities for ESG investment and green financing
- **Environmental reputation/branding**: Decline in environmental reputation and branding due to lack of compliance with international disclosure rules
- **Lawsuits**: Litigation by shareholders and other stakeholders for failure to uphold obligations for reporting material information

Medium term

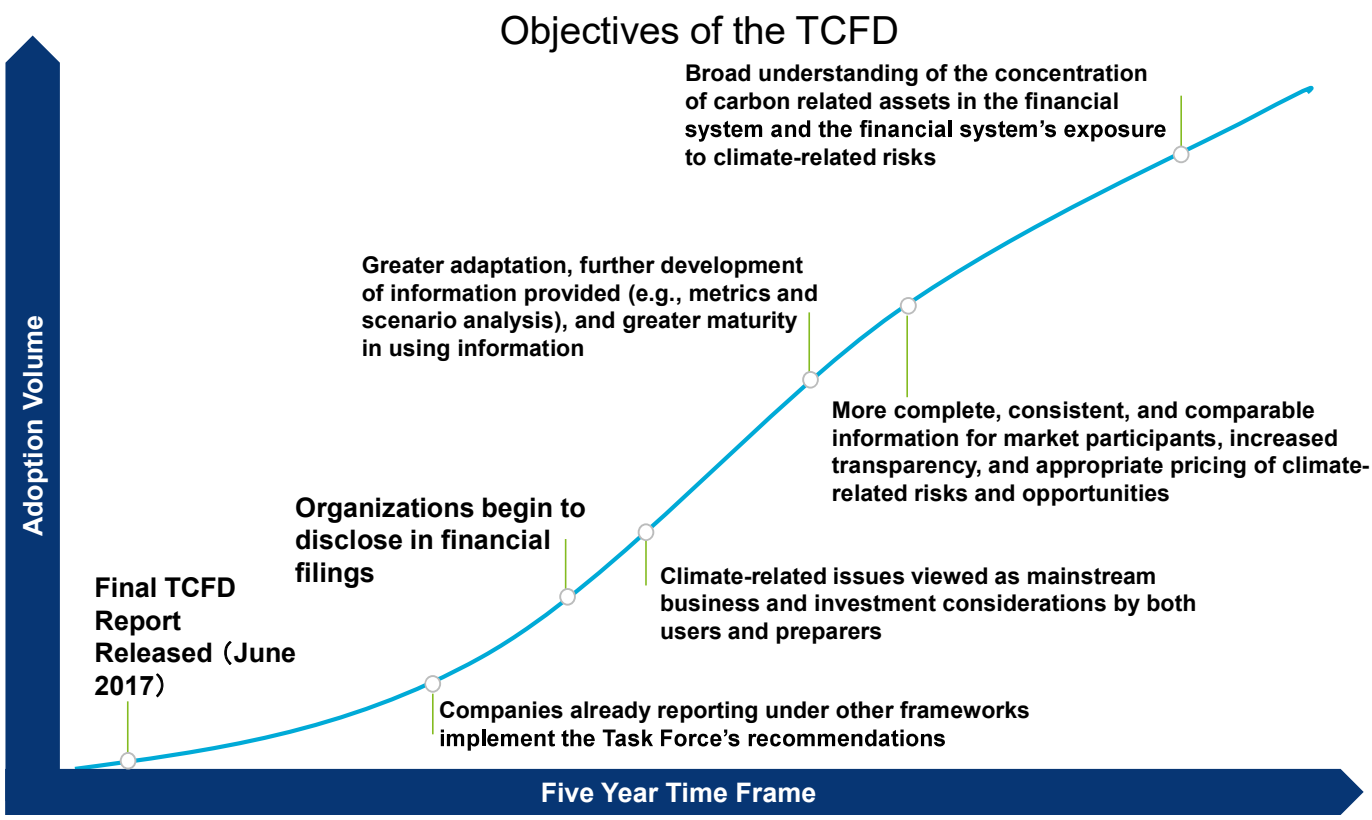
- **Regulations**: Disclosure rules, regulations for stock exchanges, etc., and accounting standards are being enacted, which will require responses over the entire company

Long term

- **Weakening of business itself**: If the company fails to cope with the uncertainties of climate change, it will lose opportunities / be exposed to risks that may jeopardize its long-term survival

【Objectives of the TCFD】

The TCFD recommendations expect companies to gradually adopt the recommendations.



Resources: Task Force on Climate-related Financial Disclosures, 2017

1-15

【Status of the TCFD recommendations in Each Country】

The TCFD recommendations have been institutionalized in advanced nations and are becoming the global standards

EU — **EU revised its directive to comply with the TCFD recommendations**

- Published a draft revision in March 2019 toward the "revision of guidelines for non-financial reporting directive"
- On June 20, 2019, the draft revision of the guidelines and supplementary materials was announced. TCFD compliant (June 2019)

United Kingdom — **UK requests its regulators to support the TCFD recommendations**

- The UK Green Finance Taskforce, established by the government to transition to a low-carbon society
- On November 9, 2020, the UK announced the gradual introduction before 2025 of obligatory TCFD information disclosure rules for companies and financial institutions. Starting in 2021, the following are also expected to be covered: corporate pension funds with AUM of 5 billion GBP or more; banks; insurance companies; and companies listed on the premium market of the London Stock Exchange (October 2020)

Canada — **Compiled recommendations on sustainable financing, including the TCFD recommendations**

- Expert Panel established by the Ministry of the Environment and Climate Change and the Ministry of Finance
- Publication of the Final Report on the Issues and Recommendations on Institutionalization of Sustainable Finance, etc. (June 2019)
- In addition, banks and other financial institutions and CSA (Canada Standard Authority) are taking the lead in discussing a unique Canadian taxonomy (October 2019).

France — **Started standardizing and developing frameworks for non-financial data as a whole to disclose the TCFD recommendations**

- Economic and Finance Minister consulted the Accounting Standards Authority to develop extra-financial information disclosure frameworks to disclose information based on TCFD.
- Introduced a system to establish the Advisory Committee on Climate Change and Sustainable Finance composed of financial institutions, companies, and experts (July 2019)

China — **Scheduled revision of Environmental Reporting Guidelines**

- A pilot project was launched in collaboration with the British government. Exploring the incorporation of a TCFD framework into the Chinese Environmental Reporting Guidelines, and announcing its intention to make such mandatory for all listed companies by 2020 (January 2018). In addition, ESG has been incorporated into the Governance Disclosure Guidelines (September 2018).

United States — **Securities and Exchange Commission (SEC) recommends that the U.S. use its own ESG disclosure framework**

- The New York State Department of Financial Services (DFS) joined the Network for Greening the Financial System (NGFS). The NGFS will consider implementing responses to climate-related risks in areas of financial supervision, including publishing non-binding disclosure recommendations in its April 2019 integrated report such as those based on TCFD recommendations (September 2019)
- However, on October 4, 2019, the U.S. made a formal announcement to the United Nations of its intentions to withdraw from the Paris Agreement (October 2019)
- The SEC issued a report recommending that the U.S. use its own ESG disclosure framework. The report recognized the usefulness of TCFD recommendations, GRI, and U.S. Sustainability Accounting Standards Board (SASB) criteria in preparing the ESG disclosure framework (May 2020)

Japan — **Released guidance on TCFD disclosures**

- METI released TCFD Guidance*1 by adding explanation to TCFD final report in order to promote disclosure by companies based on TCFD (December 2018) "TCFD Guidance" was revised by the TCFD Consortium and published as "TCFD Guidance 2.0" (July 2020) and released at the TCFD Summit (October 2020)
- The Ministry of the Environment announced a practical guide describing examples and methodologies to be used as a reference when companies conduct scenario analysis (March 2019, March 2020)
- Led by five founders including Professor Kunio Ito of Hitotsubashi University, the TCFD Consortium was established (May 2019). The consortium formulated the Green Investment Guidance*2 which provides commentaries on perspectives needed by investors and other stakeholders when understanding the information disclosed based on the TCFD recommendations, and released it at the TCFD Summit (October 2019).

Trends toward institutionalization exist

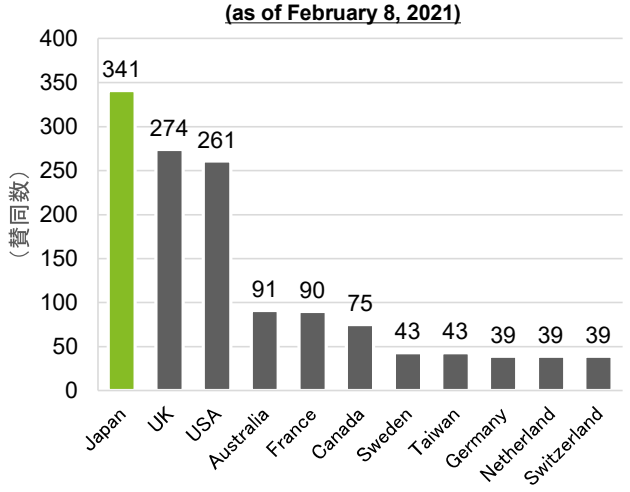
1-16 Source: TCFD, "2019 Status Report": Ministry of the Environment; European Union Commission website, etc.

*1 Guidance for Climate-related Financial Disclosures *2 Guidance for Utilizing Climate-related Information to Promote Green Investment

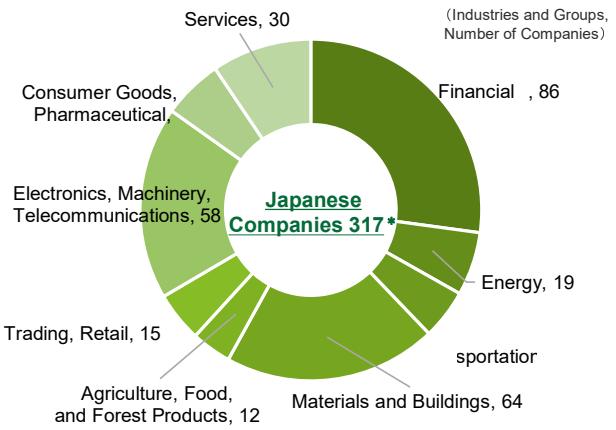
[Status of support for TCFD]
Japan ranks first in the world in terms of the number of organizations expressing support

- As of February 8, 2021, 71 countries, 1,769 companies, governments, multilateral institutions, private organizations, etc., expressed their support for TCFD. The Ministry of the Environment on July 27, 2018, the Ministry of Economy, Trade and Industries on December 25, 2018, and Financial Agencies Services Agency in December 2017 announced that it agreed to adopt the TCFD recommendations.
- Total assets of financial institutions that have expressed their support already exceed 150 trillion USD and have continued to increase thereafter (from the 2020 Status Report).

Number of Organizations Presenting Support (Top 11 countries & regions) (as of February 8, 2021)



Number of Japanese Companies Presenting Support (as of February 8, 2021)

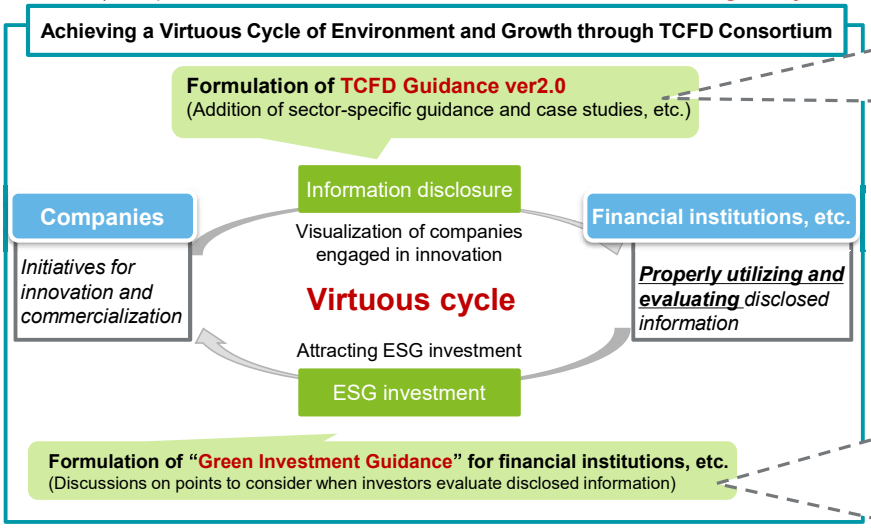


See below (the Ministry of the Environment website) for the latest number of companies presenting support and their names
http://www.env.go.jp/earth/datsutansokeiei.html

Source: TCFD HP
*The number of organizations presenting support in Japan is 341, and the number of companies presenting support in Japan (including general incorporated associations and law firms in addition to general companies) is 317. (as of February 8, 2021)

Outline of TCFD Consortium

- In view of the increased awareness on corporate disclosure and use of climate-related information highlighted by the Task Force on Climate-related Financial Disclosures (TCFD) in Japan, **the private-led TCFD Consortium was established on May 27, 2019** by five founders.
  * Founders of the consortium: Professor Kunio Ito of Hitotsubashi University; Chairman Hiroaki Nakanishi of Keidanren (Japan Business Federation); Chair Makoto Takashima of the Japan Bankers Association; President and Chief Executive Officer Takehiko Kakiuchi of Mitsubishi Corporation; and Chairman of the Board Shuzo Sumi of Tokyo Marine Holdings.
- the Consortium aims to further discussion on **effective corporate disclosure of climate-related information and their use by financial institutions for appropriate investment decision**.
- **"Green Investment Guidance"** was formulated to provide commentaries on **perspectives needed by investors and other stakeholders when understanding the information disclosed based on the TCFD recommendations and released globally at the "TCFD Summit"** held on October 8, 2019.
- In July 2020, the TCFD Consortium revised "TCFD Guidance" (developed by the Ministry of Economy, Trade and Industry in December 2018) and published it as **"TCFD Guidance 2.0".** It was then **released globally at the TCFD Summit 2020 held on October 9.**

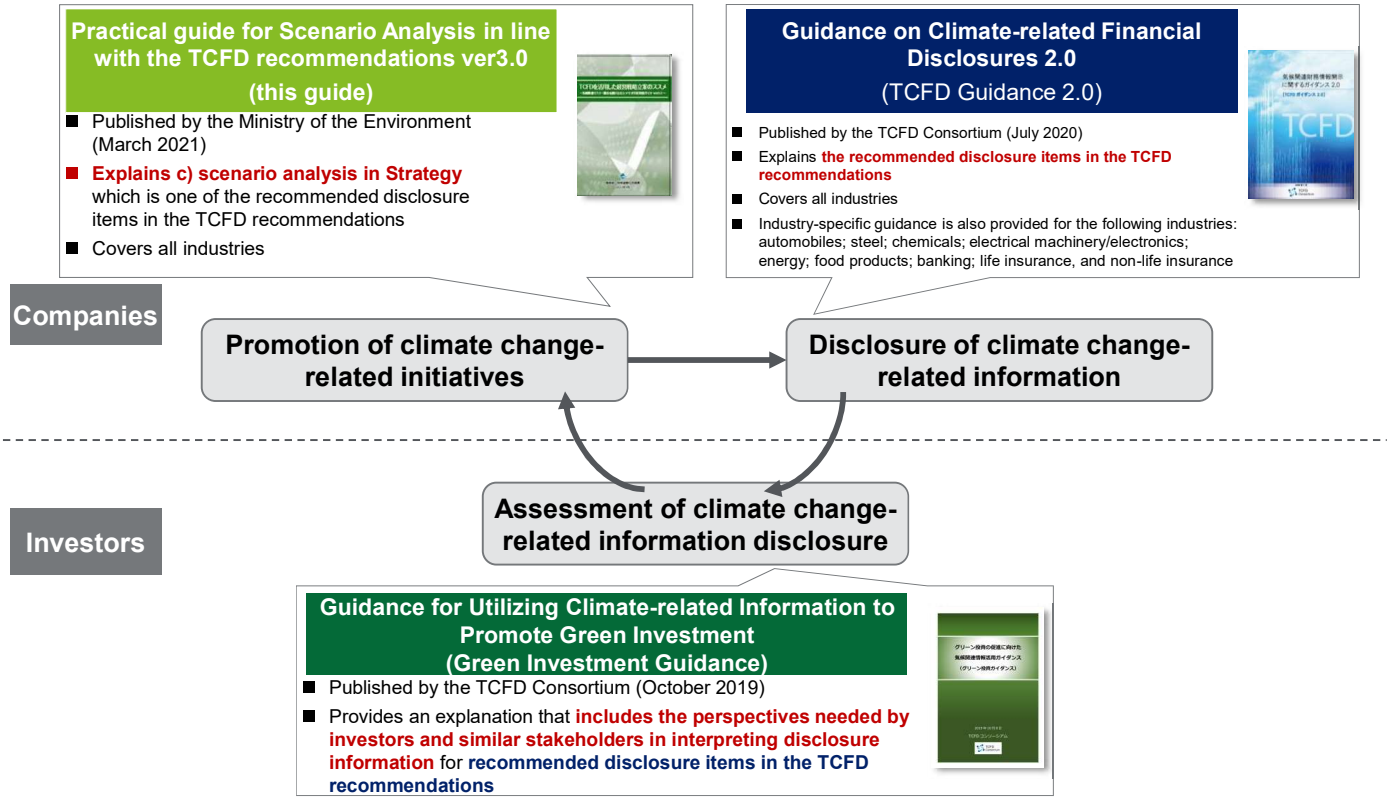


- An explanation of TCFD's Final Report to provide a first step toward TCFD disclosure, thereby encouraging disclosure by companies based on the TCFD recommendations.
  - See below for more information on TCFD guidance. https://www.meti.go.jp/press/2020/07/20200731002/20200731002.html

- Based on the increase in corporate information disclosure, it provides commentaries on perspectives needed by investors and other stakeholders when understanding the disclosed information.
- It is also expected that companies will deepen their understanding of the viewpoints of investors and other stakeholders, leading to further disclosure.
  - See below for more information on Green Investment Guidance. https://tcfd-consortium.jp/pdf/news/19100801/green_investment_guidance-j.pdf

Source: TCFD Consortium

[Guidance/guides related to the TCFD in Japan]
"Guidance on Climate-related Financial Disclosures (TCFD Guidance)", "Guidance for Utilizing Climate-related Information to Promote Green Investment (Green Investment Guidance)", and "Practical guide for Scenario Analysis in line with the TCFD recommendations" (this guide)



Sources: TCFD Consortium, Ministry of the Environment websites

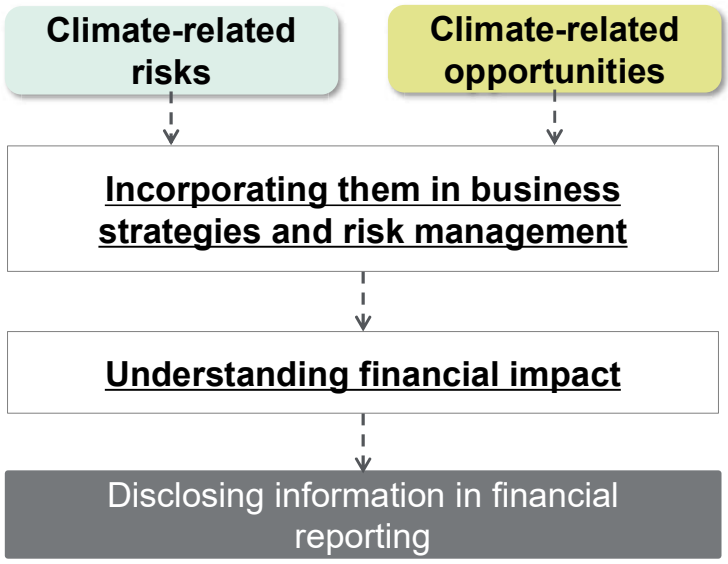
[The TCFD recommendations]
The TCFD recommendations are structured around four thematic areas: Governance, strategy, risk management, and metrics and targets

Recommended disclosures	Governance	Strategy	Risk Management	Metrics and Targets
Areas in detail	Disclose the organization's governance around climate-related risks and opportunities	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material	Disclose how the organization identifies, assesses, and manages climate-related risks	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material
Recommended Disclosures	a) Describe the board's oversight of climate-related risks and opportunities	a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term	a) Describe the organization's processes for identifying and assessing climate-related risks	a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process
	b) Describe management's role in assessing and managing climate-related risks and opportunities	b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning	b) Describe the organization's processes for managing climate-related risks	b) Disclose Scope 1, Scope 2, and if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks
		c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario	c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management	c) Describe the targets used by the organization to manage climate-related risks and opportunities, and performance against targets

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.14

【Requirement of the TCFD Recommendations】

The TCFD recommendations disclosure of information related to climate change that poses financial risks and opportunities

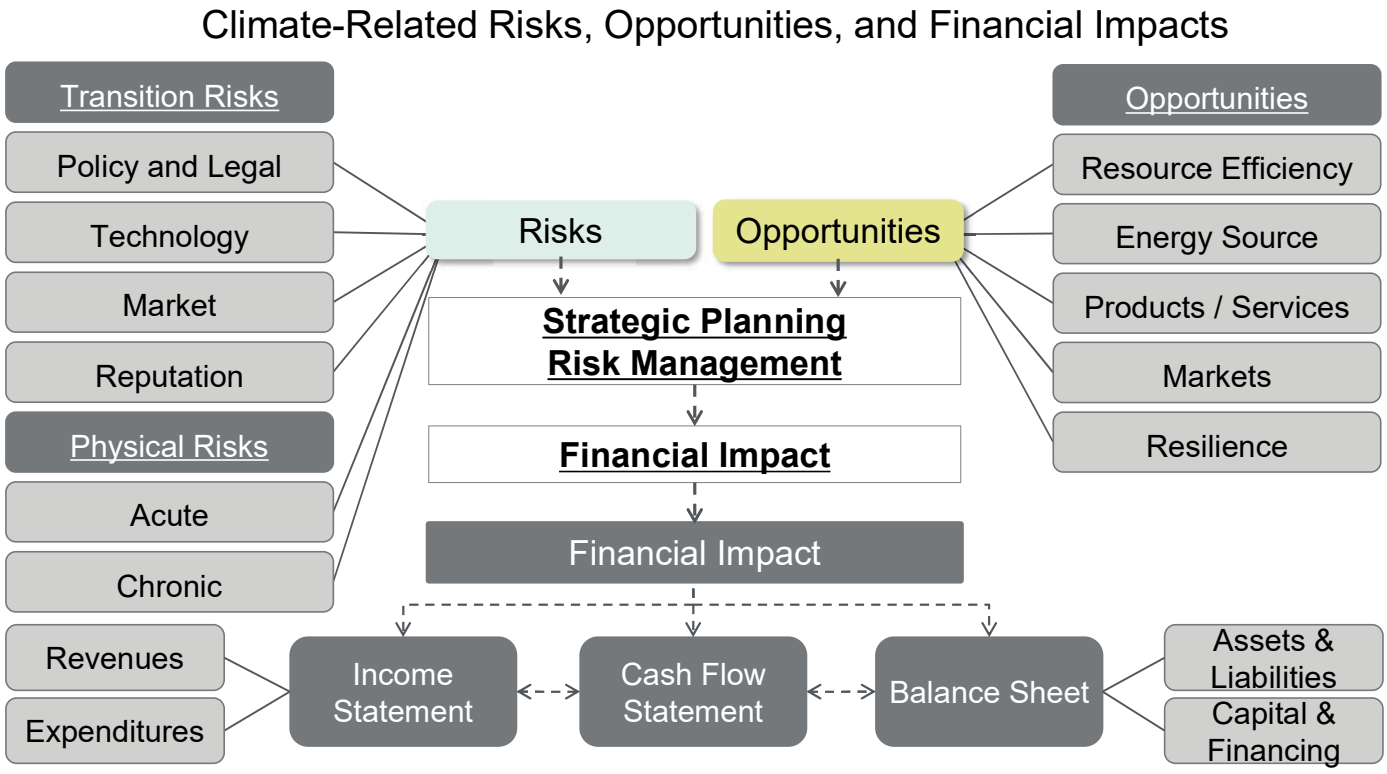


The TCFD recommendations request all companies to (i) use different climate-related scenarios, including a 2℃ or lower scenario to (ii) assess their climate-related risks and opportunities, (iii) incorporate such risks and opportunities in their business strategies and risk management, and (iv) understand and disclose their financial impacts.

Sources: prepared by the Ministry of the Environment based on the page 9 of Financial Services Agency's document, "On Reports of the Task Force on Climate related Financial Disclosures (TCFD)" for briefings on "Final Report

[Financial Impact]

The TCFD recommendations present the scope of climate-related risks and opportunities, and financial impacts to be disclosed



Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.8

[Climate-related Risks]

The TCFD Recommendations divided climate-related risks into two major categories: (1) risks related to the transition to a lower-carbon economy and (2) risks related to the physical impacts of climate change

Category	Definition	Type	Major aspects and policy actions
Transition Risks	Risks related to the transition to a lower-carbon economy	Policy and Legal	Enhancing regulations on GHG emissions, imposing greater obligations on information disclosure
		Technology	Replacing existing products with those based on low-carbon technologies, investing in new technologies that eventually turn out to be a failure
		Market	Changes in consumer behaviors, market signals with greater uncertainty, a rise in materials and costs
		Reputation	Changes in customer or community perceptions, criticism against certain industries, increased concern among stakeholders
Physical Risks	Risks related to the physical impacts of climate change	Acute	Event-driven risks, including severity of extreme events such as cyclones or floods
		Chronic	Longer-term shifts in climate patterns, including sustained higher temperatures, which may cause sea level rise or chronic heat waves

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.10

[Climate-related Opportunities]

The TCFD recommendations identified the following five areas of climate-related opportunities that organizations can produce in the course of their efforts to mitigate and adapt to climate change

	Area	Policy actions	Financial impact
Opportunities	**Resource Efficiency**	■ Use of more efficient models of transport ■ Use of more efficient production and distribution processes ■ Use of Recycling ■ Move to more efficient buildings ■ Reduced water usage and consumption	■ Reduced operating costs (e.g., through efficiency gains and cost reductions) ■ Increased production capacity, resulting in increased revenues ■ Increased value of fixed assets (e.g., highly rated energy-efficient buildings) ■ Benefits to workforce management and planning (e.g., improved health and safety, employee satisfaction) resulting in lower costs
	Energy Source	■ Use of lower-emission sources of energy ■ Use of supportive policy incentives ■ Use of new technologies ■ Participation in carbon market ■ Shift toward decentralized energy generation	■ Reduced operational costs (e.g., through use of lowest cost abatement) ■ Reduced exposure to future fossil fuel price increases ■ Reduced exposure to GHG emissions and therefore less sensitivity to changes in cost of carbon ■ Returns on investment in low-emissions technology ■ Increased capital availability (e.g., as more investors favor lower-emissions producers) ■ Reputational benefits resulting in increased demand for goods/services
	Products and Services	■ Development and/or expansion of low emission goods and services ■ Development of climate adaptation and insurance risk solutions ■ Development of new products or services through R&D and innovation ■ Ability to diversify business activities	■ Increased revenue through demand for lower emissions products and services ■ Increased revenue through new solutions to adaptation needs (e.g., insurance risk transfer products and services) ■ Better competitive position to reflect shifting consumer preferences, resulting in increased revenues
	Markets	■ Access to new markets ■ Use of public-sector incentives ■ Access to new assets and locations needing insurance coverage	■ Increased revenues through access to new and emerging markets (e.g., partnerships with governments, development banks) ■ Increased diversification of financial assets (e.g., green bonds and infrastructure)
	Resilience	■ Participation in renewable energy programs and adaptation of energy-efficiency measures ■ Resource substitutes/diversification	■ Increased market valuation through resilience planning ■ Increased reliability of supply chain and ability to operate under various conditions ■ Increased revenue through new products and services

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.11

[Guidance for Specific Sectors]

The TCFD supplemental guidance provides additional context and suggestions for implementing the recommended disclosures for four non-financial sectors (Energy; Materials and Buildings; Transportation; and Agriculture, Food, and Forest Products) potentially most affected by climate change

Sector	Industry	Recommended disclosure
Energy	■ Oil and Gas ■ Coal ■ Electric Utilities	Assessment and potential impacts of **legal compliance, operating costs, changes in risks and opportunities; changes in regulations and shift in consumer and investor preferences; and changes in investment strategy**
Transportation	■ Air Transport, Maritime Transportation ■ Land Transportation (Rail Transportation, Tracking Services) ■ Automobiles	Assessment and potential impacts of **financial risks of enhanced regulations and new technology on existing factories and equipment; R&D investment in new technologies; opportunities for use of new technologies to lower emissions standards and regulations on higher fuel efficiency**
Materials and Buildings	■ Metals and Mining ■ Chemicals ■ Construction Materials, Capital Goods ■ Real Estate Management and Development	Assessment and potential impacts of **enhanced regulations on GHG emissions and carbon pricing; risk assessment of increased severity of extreme weather events on construction materials and property; and opportunities for products to improve energy efficiency or reduce energy consumption**
Agriculture, Food, and Forest Products	■ Beverages, Foods ■ Agriculture ■ Paper and Forest Products	Assessment and potential impacts of **GHG emissions reductions; recycling and waste management; business of food and textile products with lower GHG emissions, and shifts in consumer preferences**

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.52-65

[Governance = Involvement of Management]

To incorporate climate-related risks and opportunities in business strategy, an organization should establish a system involving management. The TCFD recommendations require an organization to describe the board's oversight of climate-related risks and opportunities, and management's role in assessing and managing such risks and opportunities

The organization's governance around climate-related risks and opportunities

The board's oversight of climate-related risks and opportunities

- Processes and frequency by which the board and/or board committees are informed about climate-related issues
- Whether the board and/or board committees consider climate-related issues when reviewing and guiding strategy, major plans of action, risk management policies, annual budgets, and business plans as setting the organization's performance objectives, monitoring implementation and performance, and overseeing major capital expenditures, acquisitions, and divestitures
- How the board monitors and oversees progress against goals and targets for addressing climate-related issues

Management role in assessing and managing climate-related risks and opportunities

- Whether the organization has assigned climate-related responsibilities to management-level positions or committees; and, if so, whether such management positions or committees report to the board or a committee of the board and whether those responsibilities include assessing and/or managing climate-related issues
- A description of the associated organizational structure(s)
- How management (through specific positions and/or management committees) monitors climate-related issues

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.19

[Strategy]

The TCFD recommendations require an organization to describe the climate-related risks and opportunities over the short, medium, and long term; their impacts on the organization's businesses, strategy, and financial planning; and the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario

Impact on the organization's businesses, strategy, and financial planning (where relevant information is critical)

The climate-related risks and opportunities the organization has identified over the short, medium, and long term

- A description of what they consider to be the relevant short, medium, and long-term time horizons
- The specific climate-related issues for each time horizon that could have a material financial impact on the organization
- The process(es) used to determine which risks and opportunities could have a material financial impact on the organization

The impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning

- How identified climate-related issues have affected their businesses, strategy, and financial planning
- The impact on their businesses and strategy in the areas of products and services; supply chain and/or value chain; adaptation and mitigation activities; investment in research and development; and operations
- The impact of climate-related issues on operating costs and revenues; capital expenditures and capital allocation; acquisitions or divestments; and access to capital

The resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario

- How resilient their strategies are to climate-related risks and opportunities
- Where they believe their strategies may be affected by climate-related risks and opportunities; how their strategies might change to address such potential risks and opportunities; and the climate-related scenarios and associated time horizon(s)

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.20-21

[Risk Management]

The TCFD recommendations require an organization to describe the organization's processes for identifying, assessing, and managing climate-related risks, as well as how these processes are integrated into the organization's overall risk management

How the organization identifies, assesses, and manages climate-related risks

The Organization's processes for identifying and assessing climate-related risks

- Their risk management processes for identifying and assessing climate-related risks (An important aspect is how the organization determines the relative materiality of climate-related risks in relation to other risks)
- Whether they consider existing and emerging regulatory requirements related to climate change
- Their processes for assessing the potential size and scope of identified climate-related risks; and definitions of risk terminology used or references to existing risk classification frameworks used

The organization's processes for managing climate-related risks

- Their processes for managing climate-related risks, (including how they make decisions to mitigate, transfer, accept, or control those risks)
- Their processes for prioritizing climate-related risks, (including how materiality determinations are made)

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

- How their processes for identifying, assessing, and managing climate-related risks are integrated into their overall risk management

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.21-22

[Metrics and Targets]

The TCFD recommendations require an organization to describe the metrics used to assess climate-related risks and opportunities in line with its strategy and risk management process; GHG emissions; the targets to manage climate-related risks and opportunities, and performance against targets

The metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material

The metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process

- The key metrics used to measure and manage climate-related risks and opportunities (organizations should consider including metrics associated with water, energy, land use, and waste management)
- Whether and how related performance metrics are incorporated into remuneration policies (where climate-related issues are material)
- Their internal carbon prices as well as climate-related opportunity metrics such as revenue from products and services designed for a lower-carbon economy
- Metrics should be provided for historical periods to allow for trend analysis. The methodologies used to calculate or estimate metrics should also be included.

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

- GHG emissions calculated in line with the GHG Protocol methodology to allow for aggregation and comparability across organizations and jurisdictions
- Related, generally accepted industry-specific GHG efficiency ratios (as appropriate)
- GHG emissions and associated metrics should be provided for historical periods. The methodologies used to calculate or estimate the metrics should also be included.

The targets used by the organization to manage climate-related risks and opportunities and performance against targets

- Their key climate-related targets (such as those related to GHG emissions, water usage, energy usage)
- Other goals including efficiency or financial goals through the entire life cycle of products and services
- Whether the target is absolute or intensity; time frames over which the target applies; key performance indicators, etc.

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.22-23

[Disclosure contents required by the TCFD]

In the "Strategy" section of the TCFD recommendations, the implementation of climate change scenario analysis is recommended

TCFD's required items

Recommended disclosures	Governance	Strategy	Risk Management	Metrics and Targets
Areas in detail	Disclose the organization's governance around climate-related risks and opportunities	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material	Disclose how the organization identifies, assesses, and manages climate-related risks	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material
Recommended Disclosures	a) Describe the board's oversight of climate-related risks and opportunities	a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term	a) Describe the organization's processes for identifying and assessing climate-related risks	a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process
	b) Describe management's role in assessing and managing climate-related risks and opportunities	b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning	b) Describe the organization's processes for managing climate-related risks	b) Disclose Scope 1, Scope 2, and if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks
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(Differences with the existing information disclosure system (1))
Implementation of scenario analysis:
Recommends disclosure of information using **specific climate-related scenario analysis** as recommended by the TCFD

Source: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p.14

[Significance of Scenario Analysis(1)]

Information disclosure through scenario analysis is recommended for assessing the impact of climate-related risks and opportunities; a technical supplement document for scenario analysis has also been developed

Usefulness of scenario analysis

- Scenario analysis is a useful method for organizations to use to strategically address issues that are long-term and have a high level of uncertainty
- **Disclosures** should **also include premises for key scenarios in industries where climate change-related risks are a concern.** Scenario analysis requires ability/manpower, but it also holds benefits for organizations

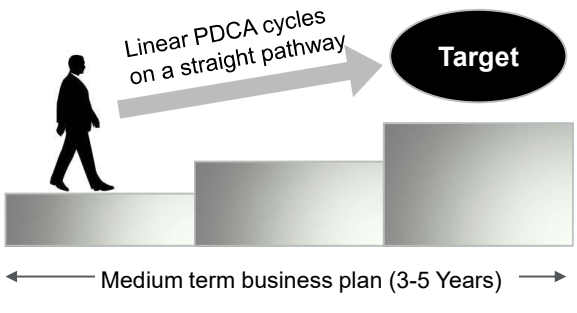
Target	Scenario groups that may be applied
Transition risks	■ IEA WEO NZE2050 / IEA WEO SDS / IEA ETP 2DS / IEA WEO STEPS / IEA WEO NPS / IEA WEO DRS (scenarios in which the target of 2° C is achieved, and scenarios in which it is not achieved) ■ Deep Decarbonization Pathways Project (the target of 2° C is achieved) ■ IRENA Remap (the renewable energy ratio is doubled by 2030) ■ Greenpeace Advanced Energy [R]evolution (the target of 2° C is achieved)
Physical risks	■ RCP (Representative Concentration Pathways) scenarios employed by the IPCC: RCP8.5、RCP6.0, RCP4.5, RCP2.6

Sources: prepared by the Ministry of the Environment based on the Task Force on Climate-related Financial Disclosures: "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2019, pages 25 - 20;
Task Force on Climate-related Financial Disclosures: "Supplementary Guidance - Using scenario analysis for disclosing climate-related risks and opportunities", 2017, p.21 & 25
The scenarios listed in the IEA WEO have been updated to reflect the most recently published report

[Significance of Scenario Analysis(2)]

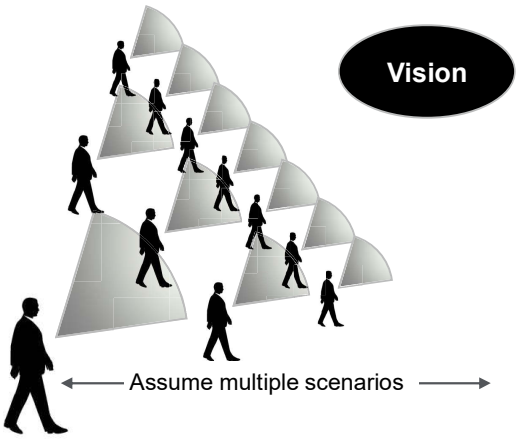
Scenario analysis enables strategic planning and internal/external dialogue in response to future uncertainties

In a reasonable foreseeable term…



- Business strategy cannot respond to changes in the future
- The discussion never reaches a consensus on future perspectives
- Suspected of lacking business resilience

In a longer term, where outcomes are highly uncertain, and possibly promising…



- Business management can flexibly respond to future change
- The discussion takes places without any subjective viewpoints on future
- Management can demonstrate business resilience

2. Scenario Analysis - Key Points of Practice

Chapter 2. Scenario Analysis - Key Points of Practice

This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

Scenario Analysis Guide - Key Points of Practice

2. Scenario Analysis - Key Points of Practice

The momentum for decarbonization among various countries and institutional investors is growing, and trends can be seen toward decarbonizing of business operations, the declaration of decarbonization targets, and disclosure of climate-related information. Climate change has now become a clear risk and opportunity for corporate management, and addressing the TCFD recommendations will lead to increased corporate value.[1]

In the TCFD recommendations' recommended disclosure items, the strategy section encourages the implementation of climate change scenario analysis in the following passage: "Describe the resilience of the organization's strategy based on a review of various climate-related scenarios, including scenarios for under 2°C"[2]. In response, we will use this section to explain the practical process for undertaking scenario analysis and to describe key points in its implementation based on use cases of companies under the support program of the Ministry of the Environment. Furthermore, in each initiative "STEP", we will describe a step-by-step direction for initiatives in line with the actual situation of the company as shown below.

・For companies that are conducting scenario analysis for the "first time," such as companies in their first year of scenario analysis (companies in their "first round" of scenario analysis): these companies should conduct scenario analysis in a sure and steady manner while keeping in mind the key points of practice in this guide. They should also work on implementing the "points for continuing companies" as much as possible.

・For companies that are conducting scenario analysis for the "first time", but which are already working on initiatives related to climate change to some degree, or companies that have already implemented scenario analysis (companies in their "second round" of scenario analysis): these companies should move on to the next step of "points for continuing companies" and use this to increase the sophistication of

[1] Refer to Section 1 for information on the materiality of responding to TCFD recommendations, such as decarbonization trends for various nations and institutional investors.

[2] Refer to Section 1, p.1-30.

climate change-related management. Additionally, they should use disclosures and dialogue with investors to enhance analysis and the presentation of evidence.

2-1. For beginning scenario analysis

When beginning scenario analysis, the first step in preparation is to involve internal stakeholders and establish a target scope for scenario analysis. Specifically, the following must be done: 1) Having management understand the materiality of responding to the TCFD recommendations (having management be aware of the recommendations and instruct that they be complied with); 2) Establishing an execution team; 3) Choosing a target scope for scenario analysis; and 4) Selecting a time frame of "X" years in the future to look at when conducting the scenario analysis. In this preparation stage, the key is in how to input climate change initiatives into management.

For companies undertaking scenario analysis for the first time, the following are important measures for beginning the analysis: establishing internal consensus for conducting scenario analysis (management has agreed); asking for cooperation from operation divisions; and deciding on the target scope/parties responsible (structure) for scenario analysis.

Meanwhile, companies that are continuing to conduct scenario analysis should aim for the following: having management/responsible departments understand the results of the previous scenario analysis, and having operation divisions take the lead in conducting the analysis; and expanding the target scope/responsible parties (structure) beyond what it was for the initial analysis.

1. Gain management's understanding

As the first step in preparation, it is necessary to obtain the understanding of the management team concerning the materiality of conducting scenario analysis. Conscientious communication with the management team facilitates internal involvement in scenario analysis through helping management recognize what the TCFD recommendations are and having them advance the initiatives necessary for

scenario analysis in a top-down approach.

First of all, it is crucial for management to understand that investors expect that the scenario analysis the company performs in the course of its operations (i.e., recognition of a broad range of risks and identification of potential responses should the risk actually occur) should also include climate change. For example, if the company only envisions a foreseeable future with a reasonable degree of probability, it will only formulate linear PDCA cycles toward goals. This may result in business strategies that cannot respond immediately to future changes and lack of consensus regarding the company's future, which may result in risks such as investors questioning the resilience of the business. On the other hand, formulating hypotheses based on an uncertain future (and therefore one that also holds possibilities) allows business management that responds flexibly to future changes, enables discussion to take place without subjective viewpoints regarding the future, and allows management to assert the resilience of the business.

When gaining the understanding of the management team, it is also effective to have study groups with experts provide input on the potential impact of climate change responses on corporate value. There are increasingly frequent requests from multi-stakeholders for responses to climate change, so there may also be cases when management hears about these trends directly. However, it is still common that those messages do not reach management. In these cases, it is important to compile the "status of requests from multi-stakeholders" and provide input to management through study groups with experts and other means on the possible impact of climate change responses on corporate value.

Even for companies in their second round of scenario analysis, continuing to provide input to management from the results of climate change-related scenario analysis will further deepen management's understanding of the specific opportunities and risks climate change holds for the company, and may lead to increased integration of climate change initiatives and business management within the company.

2. Create an execution team for scenario analysis

The second step for preparation is creating an execution team for scenario analysis. Internal involvement is essential for conducting scenario analysis. Because of this, a team should be formed where operation divisions are involved from the very beginning. Having the responsible parties in operation divisions understand the scenario analysis processes enables the divisions to think of climate change initiatives as something that involves them directly.

There are two separate patterns hypothesized for the structure of scenario analysis execution teams. The first is a pattern where relevant divisions and departments are involved as needed during the course of the scenario analysis. The second pattern is for the internal teams to be formed prior to beginning the analysis. The first pattern has the advantages of making the scenario analysis easy to begin, and of placing a minimal burden on each division/department. On the other hand, its disadvantages include the need for internal coordination in the scenario analysis process and the long reporting process from the environment/CSR division to management. For the second pattern, the advantages are that divisions are better able to cooperate due to internal coordination being completed in advance, and that reports reach management swiftly due to the analysis being conducted by a well-coordinated team. However, its disadvantages are that it takes time to start the analysis, and that there is a large burden on each division/department.

For use cases of involving operational divisions for companies that have implemented scenario analysis, the following examples have been cited as being effective: 1) using narratives suited to each division (e.g. how reductions in CO2 emissions over the entire company can be promoted through contributions by various areas such as products and procurement), and 2) leveraging management's commitment. Furthermore, regular communication of information related to the TCFD recommendations and scenario analysis can facilitate understanding and make it easier to receive cooperation when moving ahead with the scenario analysis.

3. Choose target for analysis

The third step for preparation is selecting a target scope for scenario analysis. When considering a target scope, the following should be determined: the region (e.g. only domestic sites, or including overseas sites), the scope of operations (only some businesses or all businesses), and the corporate scope (only for the scope of the consolidated financial statements or including subsidiaries).

By defining the scope of operations covered in the scenario analysis in terms of "sales composition", "relation to climate change", and "difficulty of data collection", companies can conduct scenario analysis in accordance with their business model. For example, companies might consider covering operations with particularly high sales in the scope defined as "sales composition", or they might cover operations with high CO2 emissions by using the scope "relation to climate change". Operations that are easy to collect data for may be covered in the scope defined as "difficulty of data collection", and so on.

In scenario analysis support, it is common to first select certain operations to cover in the analysis, and then gradually lead up to a scenario analysis for the company as a whole.

4. Choose time horizon to conduct scenario analysis

Select which year in the future to look at when conducting the scenario analysis. Since the worldviews showing the impacts of climate change vary depending on the year that the analysis is based on, companies should select a time horizon with the maximum benefit for the company after comparing advantages and disadvantages in light of factors such as project length, the amount of internal involvement, and effect from physical risks on the company.

For example, if the company selects 2030 as its time horizon, the advantages would be that there is abundant data available for reference, and that it is relatively easy to link with business plans. On the other hand, the disadvantages are that the effects from physical risk shown in this time horizon are small due to its narrow span, so there is a possibility that the impact shown on the company will be lower than what it would be in reality. The advantages of selecting 2050 are that physical risks from increased

temperatures will have become readily apparent, and therefore it should be easy to see the impact from this. Conversely, the disadvantage of this time horizon is that it is out of the scope of the business plan timeframe, which may make internal involvement and cooperation difficult.

2-2. STEP2. Assess materiality of climate-related risks

After finishing the preparations for scenario analysis, it is time to assess the risks and opportunities the company will face from the effects of climate change. The company should assess the materiality of these from the perspectives of whether or not the risks and opportunities hold the potential for significant impact in the future or if they are of concern to stakeholders.

Specifically, risk materiality should be determined through the following process: 1) list risks/opportunities for the targeted operation; 2) express the potential impact on operations from each listed risk/opportunity using qualitative terms; 3) determine the materiality of the risk based on how serious the impact on operations will be if the risk actually occurs. The key is to select risks from an industry/company perspective, and to consider the level of granularity to be used in assessing risk materiality.

For companies undertaking scenario analysis for the first time, the following are important when assessing the materiality of risks: climate-related risks material to the sector and company have been identified, and the specific impacts of these risks have been hypothesized.

Meanwhile, companies who are continuing to conduct scenario analysis should aim for greater fleshing out of climate-related risks that are material to the sector and company, and of the specific impact of risks. They should do this by involving operation divisions and outside experts, and while considering dialogue with investors on the results of prior scenario analysis.

1. List risk items

For Phase 1, the company should list out risk and opportunity items for the operation division it chose to target in the preparation stage. The company should make a list of risk and opportunity items based on the examples of risks and opportunities listed in the TCFD recommendations and in consideration of external reports such as industry-specific reports and other external information such as competitors' CDP responses. When doing this, it is important that the company consider and list a wide range of possible risks and opportunities to eliminate the unexpected, rather than attempting to keep the number of risk items listed to a minimum.

The listed risks and opportunities should be divided into two broad categories: transition risks, which are related to the transition to a low-carbon economy, and physical risks, which are related to physical changes caused by climate change. Examples of transition risks include risks from policies and regulations; market risks; technology risks; and reputational risks (changes in reputation with customers or investors). Meanwhile, physical risks include risks that occur on a chronic basis (e.g. increase in average temperature, changes in rainfall and weather patterns, rising sea level) and risks that occur on an acute basis (e.g. increasing severity of extreme weather conditions). When considering risk items, companies may wish to refer to examples of risk items used by support project companies.[3]

2. Identify potential impacts on business

The company will qualitatively identify the impact on business, and use qualitative terms to describe the potential impact on business from the risks and opportunities listed in Phase 1. When doing this, it is important that the company separates risks and opportunities and evaluates opportunities as well as risks.

The company should use the results of discussions with internal stakeholders as input when making qualitative descriptions, while also referring to external information such as external reports and CDP responses from competitors. For discussions with internal stakeholders, in particular: the important thing is that the company match its awareness with stakeholders and use a narrative (story-like) format to describe potential impacts based on the company's business model. These discussions on qualitatively describing impact can further deepen mutual understanding of scenario analysis within the company or its divisions/departments. Furthermore, discussions with each individual operation division often reveal unanticipated risks and opportunities. Companies continuing to conduct scenario analysis may also consider holding discussions that include external stakeholders.

[3] Refer to Section 3 for support project company examples.

3. Assess materiality of climate-related risks

In Phase 3, the company will determine the materiality of risks based on the scale of impact on business in the event that the risk/opportunity occurs. The company will go on to assess the impact on business for each of the risks/opportunities evaluated in Phase 1 and Phase 2 based on a scale of "Large", "Medium", "Small" and so on.

When assessing materiality, the company should compare each of the risks and opportunities from the perspective of the "scale of impact on the company's business". For example, the company may consider classifying risks/opportunities with a broad range of impact or that affect important products as "Large"; risks/opportunities with no impact on the company as "Small"; and using "Medium" for others. A specific example would be classifying the risk "increases or decreases in important products" as having a "Large" impact on the company's business, as it affects the cost toward raw materials, which occupy a large percentage of the company's sales costs.

It is also key to consider the level of granularity to use when assessing risk materiality. The same risk/opportunity can be evaluated by subcategorizing it by "differences in product (by sector)" or "affected supply chains (by supply chain)" to enable analysis that is adapted to the company's operations. For example, when performing assessment by supply chain, the impact from the same risk may be categorized as "Large" for the procurement stage, but "Small" for the sales stage.

2-3. STEP3. Identify and define range of scenarios

For identifying and defining the range of scenarios in STEP3, the company should define multiple scenarios that encompass the transitional and physical risks related to the organization. The company should examine scenario hypotheses and analysis methods along with perspectives on what scenarios (and narratives) are appropriate for the organization, and which scenarios out of existing scenario groups should be used as references.

The following process will be used to identify and define the range of scenarios: 1) choose scenarios; 2) obtain forecast information on relevant parameters; and 3) shape the worldview in consideration of stakeholders. The key is in selecting the type of scenario while considering the amount of available information and versatility, as well as use cases from competitors. Companies should also consider how they will align worldviews with their relevant divisions/departments.

Companies undertaking scenario analysis for the first time should use reliable external scenarios and select several scenarios (2°C (1.5°C)/4°C) that include a scenario for 2°C or lower. The company should aim toward building internal consensus after detailing the worldview listed in each scenario.

On the other hand, companies that are continuing scenario analysis should aim for the following: using reliable external scenarios and, based on dialogue with investors on the results of the previous scenario analysis, supplementing them with additional data for material risks; having selected multiple scenarios, including one for 1.5°C (1.5°C, 2°C, 4°C); and detailing the worldview in each scenario and holding discussions that include outside experts.

1. Choose scenarios

In Phase 1, the company will go on to choose scenarios from multiple temperature ranges, including the 2°C or lower scenario, in order to respond to an uncertain future. Types of scenarios include the IEA's WEO (World Energy Outlook)[4], which is the most

[4] Medium- to long-term energy market forecasts. Lists future information on energy (qualitative/quantitative).

versatile and data-rich, SSP (Shared Socioeconomic Pathways)[5], and the PRI's IPR (Inevitable Policy Response)[6].

The TCFD recommendations encourage companies to perform scenario analysis by selecting scenarios for multiple temperature ranges, including the 2°C or lower scenario. It is important that scenarios be chosen based on their characteristics and parameters, and that the scenario match the company's industry and situation, investor trends, and trends for domestic and international policies. Companies continuing with scenario analysis may also consider using a 1.5°C scenario.

The 2°C scenario is a scenario predicting that the temperature will rise 0.9°C to 2.3°C above pre-industrial levels, if strict measures against climate change are taken. Meanwhile, the 4°C (2.7°C or above) scenario is defined as a scenario that predicts that the temperature will rise 3.2°C to 5.4°C above pre-industrial levels unless measures more rigorous than current measures are taken. In the 2°C or above (2.7°C to 4°C) scenario, it is predicted that the temperature will rise 2.7°C to 4°C above pre-industrial levels. While the 2°C and 4°C scenarios show a nearly identical change in temperature up until 2030, the gap between the two scenarios widens after 2030.

For the 1.5°C scenario, the Paris Agreement indicates that the increase in average global temperature will be kept well below 2°C compared to pre-industrial levels, while efforts will be pursued to limit it to 1.5°C. A portion of information on parameters for the 1.5°C scenario has been published, including carbon taxes and changes in primary energy demand.

Selecting scenarios in this manner, with different temperature ranges and worldviews whenever possible, may help eliminate the unexpected. When selecting each scenario, it is important to draw an appropriate transition path focusing on decarbonization in 2050 based on the time horizon for scenario analysis that was chosen in the preparation stage.

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[5] Socioeconomic scenario based on recent policies and the socioeconomic environment. Lists the macroeconomic information scenarios that are based on for each scenario.

[6] Scenario for climate-related policies that are likely to be implemented in the short-term. Lists qualitative and quantitative forecasts for climate-related policies.

2. Obtain information on parameters (variables)

For Phase 2, the company will obtain objective forecast information on parameters related to risks/opportunities to enable it to address an uncertain future. The company will also identify the effects of these on the company in further detail. For example, if the popularization of EVs is listed as an opportunity item, the task would be to obtain information on the EV penetration rate for the relevant year of the analysis timeframe.

When obtaining information, the company may use external sources such as IEA, PRI and SSP reports to obtain objective forecast information on parameters for transition risks. For physical risks, it may use climate change impact assessment tools such as physical risk maps and hazard maps.[7]

The point to keep in mind here is that the company may not be able to find all forecast information for the target year set as the analysis time horizon, so it will need to consider using other methods such as estimates and collecting qualitative information. For example, if the analysis timeframe is 2050, but data are only available up to 2040, the company may use estimation to calculate forecast information for 2050. (The company will need to consider which estimation method to use, such as linear or cumulative, according to the type of data). In cases where quantitative information is not available, it may also be useful to use qualitative information to draw a picture of the future world. At this stage, the key is that the company gather a wide range of forecast information on risk/opportunity items without getting too caught up in trying to obtain quantitative information.

3. Shape the worldview in consideration of stakeholders

In Phase 3, the company should, if necessary, use forecast information to clarify the worldview surrounding the company, including the behavior of future stakeholders (including investors), and build consensus on the worldview within the company.

In the process of coordinating worldviews with the related divisions/departments, the key is to use dialogue to build a worldview that is convincing to these departments/divisions (including operation divisions). When staging dialogues, the

[7] Refer to Section 4 for examples of transition risk and physical risk parameters.

company may consider preparing materials that facilitate discussion to move discussions with operation divisions forward. It can do this by organizing the worldview by factors such as newcomers/sellers/buyers/substitute products/the industry centered on the company, which is a method that uses 5forces analysis (a framework for business environment analysis). The company may also use narrative descriptions or illustrations in these discussion materials to give visible form to the worldview.

It may be useful to aim to build internal consensus after establishing a comprehensive worldview that also incorporates perspectives from outside of the company.

2-4. STEP4. Evaluate business impacts

When evaluating business impacts, we will evaluate the potential effects from each of the scenarios defined in STEP3 on the organization's strategic and financial position, and then perform a sensitivity analysis.

Business impact evaluation is performed by using the following process: 1) identify potential financial indicators affected by risks and opportunities; 2) consider a calculation formula and estimate financial impact; and 3) be aware of the gap between financial indicators in the estimated impact and in the business as usual. The key points are in deciding what kind of internal data can be used for estimation, and how the company treats data that cannot be quantitatively estimated. The company should also take care not to focus excessively on pursuing numerical accuracy.

Companies undertaking scenario analysis for the first time should aim to quantitatively (or qualitatively, if this is difficult) calculate the estimated impact on business for "significant risks", and have a rough understanding of the gap between the estimated impact on business and business as usual. The company will also need to involve operation divisions to obtain their consensus regarding the method of calculating the impact on business and the resulting figures.

Continuing companies should aim for the following: performing trial estimates for quantitative calculation of the impact on business from significant risks, even for impact that was initially calculated qualitatively (though qualitative calculation may still be used where this is difficult); understanding the gap between the impact on business and business as usual; and promoting discussion to obtain consensus from managers and outside experts regarding the method of calculating the impact on business and the resulting figures.

1. Identify potential financial indicators affected by risks and opportunities

In Phase 1, the company should identify which financial indicators from its financial statements (P/L and B/S) are affected by impact on business brought on by climate change.

When identifying the affected financial indicators, the key is in first roughly sorting out whether the business impact falls under "sales" or "expenses" in the P/L. This is

because, while changes in expenses may be recorded as-is without any problems, changes in sales become changes in profit (as sales x profit ratio = profit), resulting in a much greater impact. For example, companies may consider organizing impact items in the following manner: having sales be affected by changes in operating revenues due to the effects of climate change, and having expenses be affected by changes in raw material procurement costs, carbon tax fluctuations, and damage from increased physical risk.

By using data that is commonly used by operation divisions (e.g. sales information by business/product, operational costs, cost structure, greenhouse gas emissions), it is possible to create estimates that are closer to actual company conditions. Since the company will need to gather information by making requests of/receiving cooperation from each operation division, it would be ideal to have each operation division develop an understanding of the TCFD recommendations scenario analysis through the preparation phase and the risk materiality assessment.

2. Consider calculation formula and estimate financial impact

In Phase 2, the company will consider a calculation formula for financial indicators, and then estimate the financial impact based on internal information. Since performing calculation for all financial indicators would be too difficult, the key is in starting with financial indicators that are possible to estimate.

The company should consider a calculation formula by combining the data collected when obtaining the forecast information for related parameters in STEP3 with the internal data obtained in Phase 1. A hypothetical example would be taking the financial parameter "carbon tax fluctuations" and using the formula: "the company's 2050 Scope 1 and 2 CO2 emissions amounts (estimated based on internal data) x carbon tax per t-CO2 for Scope 1 and 2 emissions amounts (obtained from forecast information)".

Interviews with outside experts and continuous monitoring may be effective methods for risk/opportunity items that cannot be quantitatively estimated due to the information being qualitative or having little scientific basis. The key is in classifying risks by review status (evaluated/not yet evaluated) and clarifying what the next action should be. For interviews with external sources, the company could conduct interviews toward outside experts such as research institutes and specialists regarding risks/opportunities that

cannot be calculated, and store the interview results as qualitative information. For continuous internal monitoring, the company could perform continuous monitoring in order to obtain up-to-date information on risks/opportunities.

3. Be aware of the gap between future outlook and financial indicators in the business as usual

In Phase 3, the company will develop awareness of the degree of impact on the future business outlook based on the estimate results it calculated in Phase 2. By giving visible form to the degree of impact climate change will have on business outlook as it currently stands (future business targets/plans), the company will be able to grasp which risks/opportunities have a significant impact on business, as well as how great of a threat climate change is to business outlook for future operations/targets.

When giving visible form to impact, the company should not simply make a list of financial figures from impact, but rather use waterfall graphs (for example) to illustrate this by adding/subtracting the estimated financial impact from the predicted operating income for the target year in the scenario analysis time horizon. This will show the final profit figures and make it easier for viewers to visualize the impact.

2-5. STEP5. Identify potential responses

In identifying potential responses for STEP5, the company should identify applicable, realistic choices for managing the identified risks and opportunities. The following responses are indicated here: "changes to the business model", "changes to the portfolio mix", and "investments in capabilities and technologies".

Specifically, the following process will be used: 1) understanding current in-house responses to risks/opportunities; 2) considering future actions for responding to risks and acquiring opportunities; 3) establishing an organizational structure and reviewing specific actions and procedures for the scenario analysis. The company will need to consider whether any modifications should be made to strategic/financial plans. The key is that the company be prepared for multiple scenarios and that it discloses information from the perspective of the reader.

On premise, when considering business strategies, the actions of each operation division are determined in the process of creating the corporate vision, formulating the medium-term business plan, and incorporating the business strategies into the operation division's activities plan. It is possible that, in the course of this process, there may be a difference in the direction taken by operation divisions versus responses based on corporate visions and medium-term business plans that do not take climate change into account. Consequently, it is important that, on principle, the company include climate change in medium-term business plans. If this is not possible, approaches should be made based on management's approval (top-down). The company should take care in such cases, however, as this may vary according to the corporate culture.

Meanwhile, the TCFD recommendations require specific responses, such as portfolio changes, business model changes, and low-carbon investment. However, these are not possible to implement all at once. Consequently, in this Practical Guide, we describe a process that starts with having the company consider responses according to the "limited personnel and time period" of the scenario analysis as an extension of the TCFD recommendations. Based on this, the company will then go on to implement responses for the company as a whole and in a manner that facilitates incorporation into the medium-term business plan and implementation by the related divisions/departments (applicable and realistic options, as stated in the TCFD recommendations).

Companies undertaking scenario analysis for the first time should proceed in the following direction: 1) identify significant risks requiring responses, and understand the company's current response status to significant risks; 2) establish a direction for future responses to significant risks; and 3) create a rough roadmap for implementing future responses/scenario analysis.

On the other hand, continuing companies should establish specific initiatives for future responses to significant risks based on dialogues with investors concerning the results of prior scenario analysis. It is also important that they work to further flesh out roadmaps for implementing these initiatives, as well as the framework for the organization structure needed to carry them out. In addition, one guideline these companies may wish to consider is incorporating the TCFD recommendations and climate change as a concept into the medium-term business plan.

1. Understand company's current status on risks management and seizing opportunities

The company should understand its response status concerning risks/opportunities with a large impact on its business and confirm the response status of rival companies if necessary. It is common to have a situation where the company already has responses in place (but relevant parties did not realize this due to barriers between divisions/departments). Because of this, it is key that the company first confirm its current responses while involving internal stakeholders. It will also be important for the company to check that there are no problems with its current initiatives by using other companies as benchmarks.

2. Consider countermeasures for climate-related risk management and seizing opportunities

In Phase 2, the company will consider specific responses for risks/opportunities with a large impact on its business. The important point is in planning responses that are resilient in any given situation. The company may also consider deciding on a rough direction for responses as a bare minimum before going on to consider responses in

the course of ongoing implementation. When considering responses, the members responsible for scenario analysis initiatives may work as a team to come up with examples to use to identify candidates for potential relevant divisions/departments.

Additionally, there may be cases where, when incorporating responses into the medium-term business plan, the members responsible for scenario analysis initiatives will need to negotiate a list of responses with the relevant departments/divisions if climate change has been included in the departments/divisions' activities plans. If a good relationship has already been established with the relevant department/division, it will be possible to immediately select responses that are related to existing business operations (for example, EV development for automobile companies). In cases where there is no relationship with existing business operations, then it will be key to establish responses based on the medium-term business plan described above.

3. Establish practical action plans and an organizational structure

In Phase 3, the company should establish the organizational structure required to proceed with responses and commence with practical actions with the cooperation of the relevant department/division. It should also consider how it will proceed with scenario analysis in the future. Once the responses have been incorporated into the medium-term business plan and management has given its approval, the next step is to establish an organizational structure (involving the relevant departments/divisions) and moving on to practical actions with the relevant departments/divisions. It is important that the company continue conducting scenario analysis itself as well as monitoring external information at least once per year, so the company will need to define the methodology for these processes.

The key points are the following: 1) incorporating climate change into business plans such as medium-term management plans; 2) establishing an organizational structure (or restructuring) based on management's understanding of the above (covered by the required governance items in the TCFD recommendations: "Describe the board's oversight of climate-related risks and opportunities"; and "Describe management's role in assessing and managing risks and opportunities"[8]). When establishing an

[8] Refer to Section 1, p.1-30.

organizational system, a cross-sectional organization on climate change and related issues could be created directly under the corporate planning department in order to make the scenario analysis results more effective.

Additionally, it is key that the company conduct scenario analysis/disclosure/business strategy as a cycle (not as a one-time effort, as the goal is to create corporate value), because this will give the process consistency and enable the necessary continuous monitoring.

2-6. STEP6 Document and disclose information

In STEP6, the company will perform information disclosure after appropriately documenting the contents of the steps up to STEP5. The key points are for the company to document the positioning of the scenario analysis in the TCFD's recommended disclosure items as well as the results obtained from each step to ensure proper disclosure and enhance corporate value. Specifically, this should be done according to the following process: 1) describe the relationship between the TCFD's recommended disclosure items and the scenario analysis; 2) describe the results from each step. It may also be helpful to reference the TCFD Guidance[9].

Companies undertaking scenario analysis for the first time should proceed in the following direction: 1) describe the relationship between the TCFD's recommended disclosure items and scenario analysis; 2) describe the results for each step of scenario analysis toward significant risks; and 3) describe the company's response policy to risks.

On the other hand, companies continuing with scenario analysis should aim for the following based on dialogues with investors concerning the results of prior scenario analysis: 1) describe the relationship between TCFD's recommended disclosure items and the scenario analysis; 2) describe the results of scenario analysis toward significant risks in as quantitative a manner as possible for each step; and 3) describe the company's response policy to risks and specific initiatives.

1. Describe the relationship between the TCFD's recommended disclosure items and the scenario analysis

When performing disclosure, the company should first describe the positioning of the scenario analysis in relation to the TCFD's recommended disclosure items (11 items total)[10]. Specifically, the relevant part of scenario analysis considered here is Strategy: C in the TCFD recommendations, which states: " Describe the resilience of the

[9] Refer to “TCFD Guidance 2.0” at the link below:
https://www.meti.go.jp/press/2020/07/20200731002/20200731002.html

[10] Refer to Section 1 p.1-30, and Section 2 p.2-52.

organization’s strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario ".

Scenario analysis is only part of the TCFD's recommended disclosure items, so it may be helpful to effectively use contrast charts and other methods to show an overall picture of the disclosure in line with the TCFD recommendations.

2. Describe the results obtained from each step

The next process is to list the scenario analysis results obtained up until now for each individual step. The key points are to clearly describe what kinds of risks/opportunities have been identified as a result of scenario analysis and show the organization's strategic resilience regarding climate change, such as what kinds of responses the company will implement. There is the view that it is not the disclosure itself that investors and experts are actually interested in; they are more concerned that the disclosure show the identified risks/opportunities and the impact on business strategy that can be seen in the scenario analysis results.

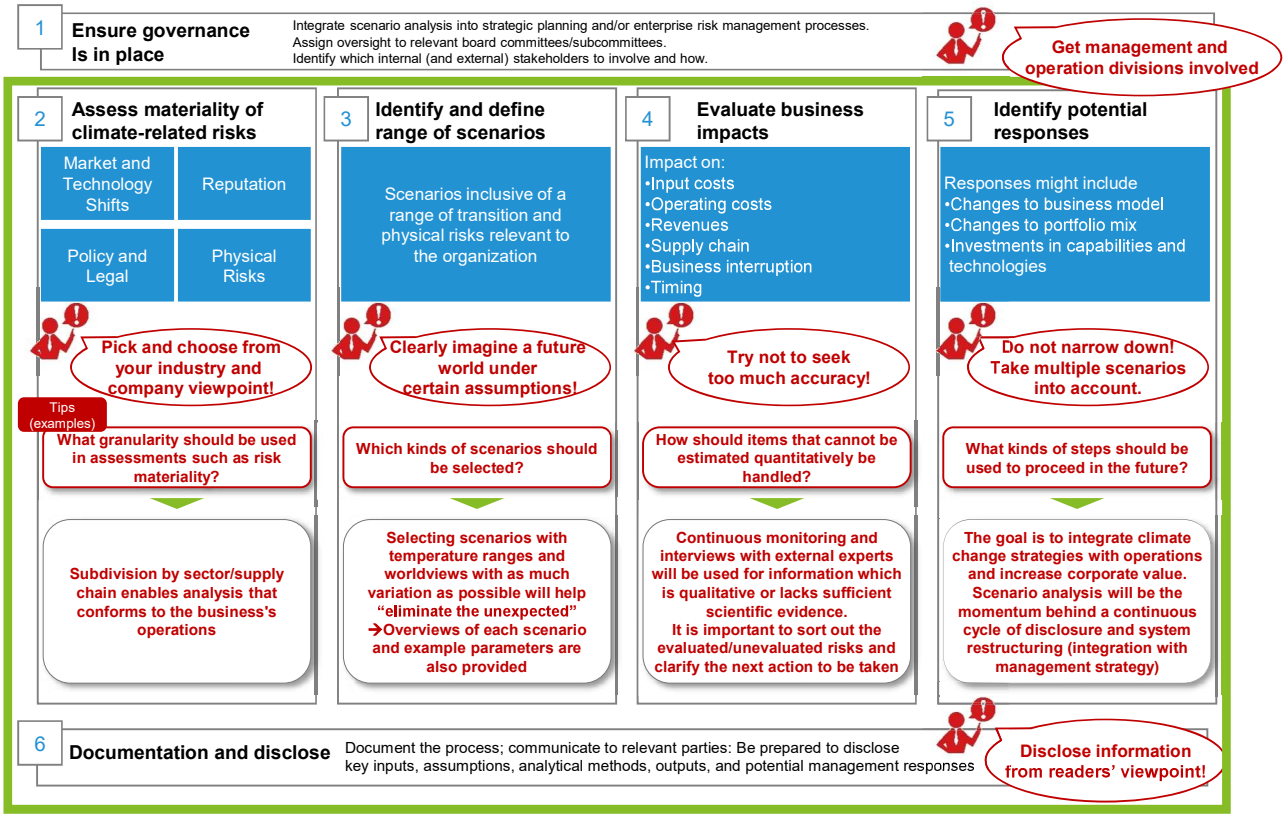
Specific items that should be included in order to show the organization's strategic resilience include the following: the status of climate change-related governance structure; information of data used as the basis for each scenario analysis; explanation of the appropriate transition of the company toward decarbonization by 2050; current/future initiatives toward risks/opportunities identified from the scenario analysis; narrative for climate change-related value creation based on scenario analysis results; and how the company will proceed with scenario analysis in the future and achieve the goals.

On the other hand, the question of what information to disclose, and to what extent (when disclosing quantitative information, for example) is an issue often faced by companies undertaking scenario analysis. However, some investors say that, at present, they do not necessarily want quantitative information on the results of scenario analysis. Companies may consider performing disclosures while bearing in mind that investors are focusing on the effect on business, such as management's involvement in scenario analysis and how scenario analysis results will be leveraged into the

company's business/management.

Furthermore, companies should not perform disclosure once and then leave it at that, but rather continuously increase the sophistication of the scenario analysis by having continued dialogue with investors based on the disclosure. Gradually enhancing the disclosure of the information used as evidence in the analysis based on dialogues with investors may lead to increased corporate value.

Points to consider when implementing scenario analysis in line with the TCFD recommendations were mapped out for 18 companies, forming the basis for the trial



Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

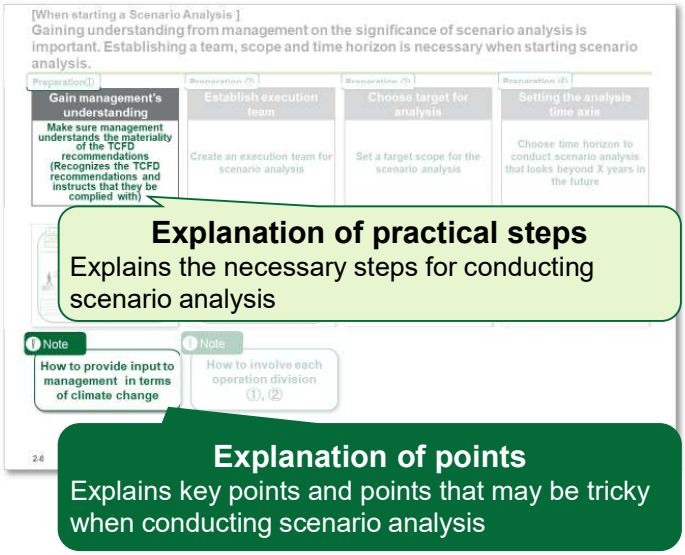
(Notes in red: Points to consider in each step were added after the support program)

2-1

[How to View the Key Points of Practice]

We describe scenario analysis procedures and the different levels for companies based on their prior experience with conducting scenario analysis

TCFD scenario analysis procedures



+ Description of the different levels for implementing gradual initiatives based on companies' prior experience

Level	Assumed targets	Direction for "gradual" initiatives
"First time" companies	✓ Companies conducting scenario analysis for the **"first time"** (for example, companies in their first year of scenario analysis)	✓ Sure and steady implementation with awareness of the key points of practice, in line with the direction for "First time" companies ✓ Try starting to implement the "points for continuing companies" as much as possible
Continuing companies	✓ Companies conducting scenario analysis for the **"first time"**, but which are **already working on initiatives related to climate change to some degree** ✓ Companies **that have already implemented scenario analysis** (for example, companies in their second year of scenario analysis)	✓ Move on to the next step of "direction for continuing companies" and use this to increase the sophistication of decarbonized management ✓ Use disclosures and dialogue with investors to enhance analysis and presentation of evidence

1-2

[Directions for Scenario Analysis (1/2)]

Scenario analysis should be conducted on an ongoing basis, and built upon gradually

	For beginning scenario analysis	STEP2 Assess materiality of climate-related risks	STEP3 Identify and define range of scenarios
Direction for "first time" companies	☐ **Internal consensus has been reached** for conducting scenario analysis (management consents) **2-7, 8** ☐ The **cooperation** of operation divisions has been **obtained** **2-9 to 11** ☐ The **scope/parties responsible (structure)** for scenario analysis have been **identified** **2-9 to 11**	☐ Main climate-related risks for the sector and the company **have been identified** **2-16 to 20** ☐ Additionally, the specific impacts from risks **have been hypothesized** **2-18,19**	☐ Reliable external scenarios **are being used** **2-24 to 27** ☐ Multiple scenarios, **including those for 2°C or lower**, have been selected (2°C (1.5°C)/4°C) **2-24 to 27** ☐ The worldview for each scenario has been described in detail, and **internal consensus has been reached** **2-29,30**
Direction for continuing companies	☐ The results of the previous scenario analysis are **understood by management / the heads of the responsible divisions** **2-7, 8** ☐ Operation divisions are **able to take the lead** in conducting scenario analysis **2-9 to 11** ☐ **The scope / parties responsible (structure)** for scenario analysis **has increased compared to the initial effort** **2-9 to 11**	**(Based on dialogue with investors)** ☐ Main climate-related risks for the sector and the company have **been further specified through increasing the involvement of operation divisions and outside experts** **2-16 to 20** ☐ The specific impacts from risks have also **been further specified through increasing the involvement of operation divisions and outside experts** **2-18, 19**	**(Based on dialogue with investors)** ☐ Reliable external scenarios are being used, and **additional scenario information for significant risks have also been supplemented** **2-24 to 27** ☐ Multiple scenarios, **including those for 1.5°C**, have been selected (1.5°C, 2°C, 4°C) **2-24 to 27** ☐ The worldview for each scenario has been described in detail, and **has also been discussed with outside experts** **2-29, 30**

Page number

[Directions for Scenario Analysis (2/2)]

	STEP4 Evaluate business impacts	STEP5 Identify potential responses	STEP6 Document and disclose information
Direction for "first time" companies	☐ The impact on business from significant risks has been calculated quantitatively **(or qualitatively if the former proves difficult)** even if this is only a trial estimate **2-36, 37** ☐ The gap between the impact on business and normal results is understood **2-38** ☐ **The operation division agrees** with the method of calculating the impact on business and the resulting figures **2-36 to 38**	☐ Risks requiring responses have been identified **2-43** ☐ The company's current status in addressing significant risks is understood **2-43** ☐ **Policies for future responses toward** significant risks **have been established** **2-44** ☐ **A rough roadmap** for future response measures / how to proceed after scenario analysis **has been prepared** **2-45**	☐ The relationship between TCFD disclosure items and the scenario analysis has been described **2-52** ☐ The results of scenario analysis toward significant risks has been described for each step **2-53 to 59** ☐ The company's response policy to risks has been described **2-53 to 59**
Direction for continuing companies	**(Based on dialogue with investors)** ☐ Trial estimates for quantitative calculation of the impact on business from significant risks has been performed even for **impact that was initially calculated qualitatively** (though qualitative calculation may still be used where this is difficult) **2-36, 37** ☐ The gap between the impact on business and normal results is understood **2-38** ☐ **Management and outside experts agree** with the method of calculating the impact on business and the resulting figures **2-36 to 38**	**(Based on dialogue with investors)** ☐ Risks requiring responses have been identified **2-43** ☐ The company's current status in addressing significant risks is understood **2-43** ☐ **Specific initiatives for future responses toward** significant risks **have been established** **2-44** ☐ **A roadmap and organizational structure** for future response measures / **scenario analysis has been established** **2-45, 48**	**(Based on dialogue with investors)** ☐ The relationship between TCFD disclosure items and scenario analysis has been described **2-52** ☐ The results of scenario analysis toward significant risks has been described **in as quantitative a manner as possible** for each step **2-53 to 59** ☐ The company's response policy to risks and **specific initiatives** have been described **2-53 to 59**

Page number

2. Scenario Analysis - Key Points of Practice

2-1. For beginning scenario analysis

2-2. STEP2. Assess materiality of climate-related risks

2-3. STEP3. Identify and define range of scenarios

2-4. STEP4. Evaluate business impacts

2-5. STEP5. Identify potential responses

2-6. STEP6. Document and disclose information

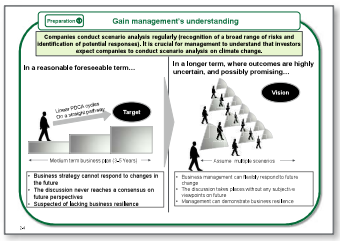
Chapter 2 Scenario Analysis - Key Points of Practice

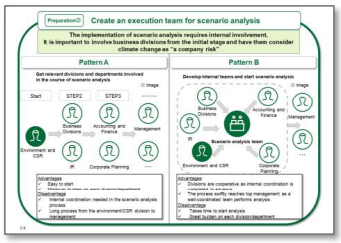
This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

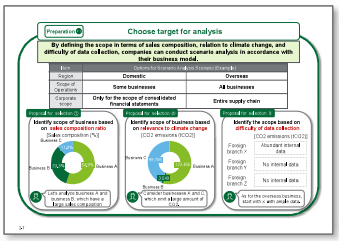
[When starting a Scenario Analysis]

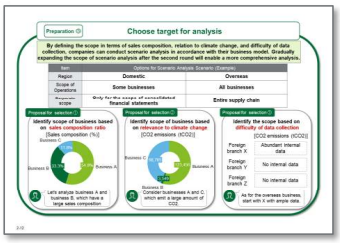
Gaining understanding from management on the significance of scenario analysis is important. Establishing a team, scope and time horizon is necessary when starting scenario analysis.

Preparation①	Preparation ②	Preparation ③	Preparation ④
Gain management's understanding	**Establish execution team**	**Choose target for analysis**	**Setting the analysis time axis**
Make sure management understands the materiality of the TCFD recommendations (Recognizes the TCFD recommendations and instructs that they be complied with)	Create an execution team for scenario analysis	Set a target scope for the scenario analysis	Choose time horizon to conduct scenario analysis that looks beyond X years in the future









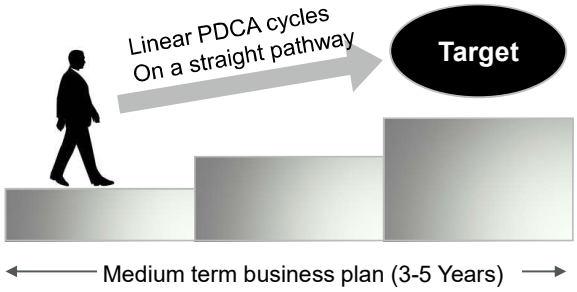
Note	Note
How to provide input to management in terms of climate change	How to involve each operation division ①, ②

Preparation ①

Gain management's understanding

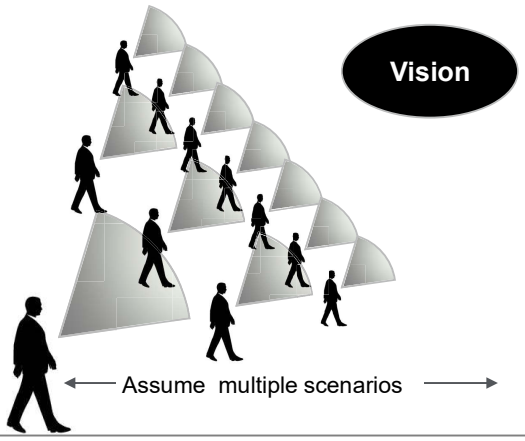
Companies conduct scenario analysis regularly (recognition of a broad range of risks and identification of potential responses). It is crucial for management to understand that investors expect companies to conduct scenario analysis on climate change.

In a reasonable foreseeable term…



- Business strategy cannot respond to changes in the future
- The discussion never reaches a consensus on future perspectives
- Suspected of lacking business resilience

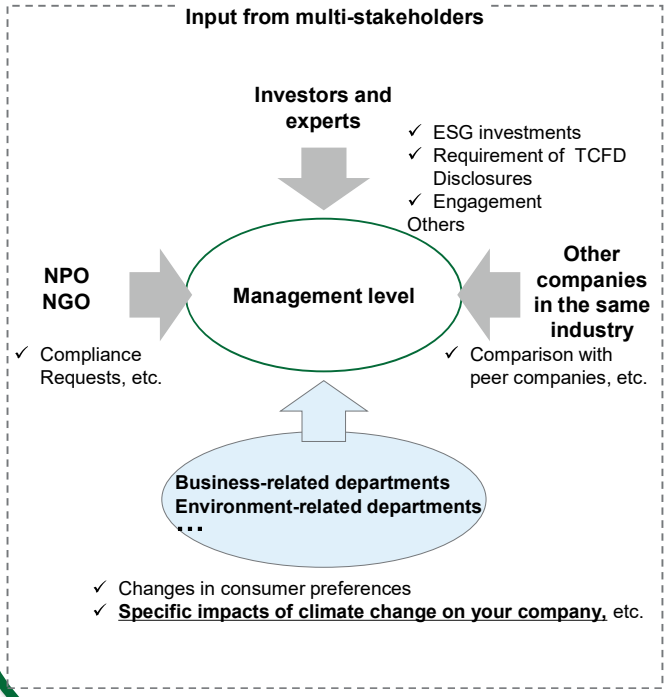
In a longer term, where outcomes are highly uncertain, and possibly promising…



- Business management can flexibly respond to future change
- The discussion takes places without any subjective viewpoints on future
- Management can demonstrate business resilience

How to provide input to management in terms of climate change

It is effective to convey the effect that climate change solutions have on the value of businesses through workshops with experts.



- There are increasingly frequent requests from multi-stakeholders for responses to climate change. While there are cases where management hears about these trends directly, there are also cases where those messages don't reach management.
- In such a case, it is important to compile **the status of requests from multi-stakeholders**, and input to management **through study groups with experts and other means that responding to climate change can affect corporate value**.
- Continuing to input the results of climate change-related scenario analysis from the second round and after onward will further deepen management's understanding of the specific opportunities/risks related to climate change for the company.

Preparation②

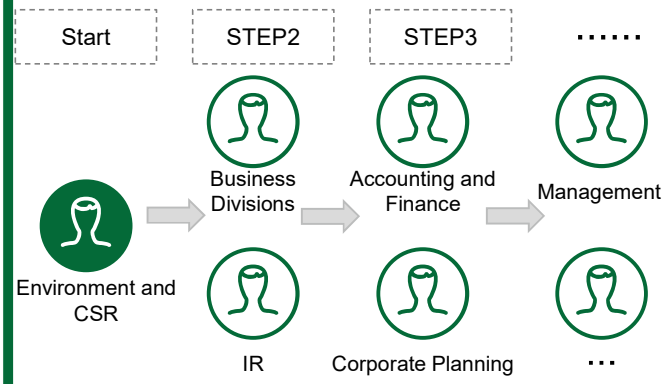
Create an execution team for scenario analysis

**The implementation of scenario analysis requires internal involvement.
It is important to involve business divisions from the initial stage and have them consider climate change as "a company risk"**

Pattern A

Get relevant divisions and departments involved in the course of scenario analysis

※ Image



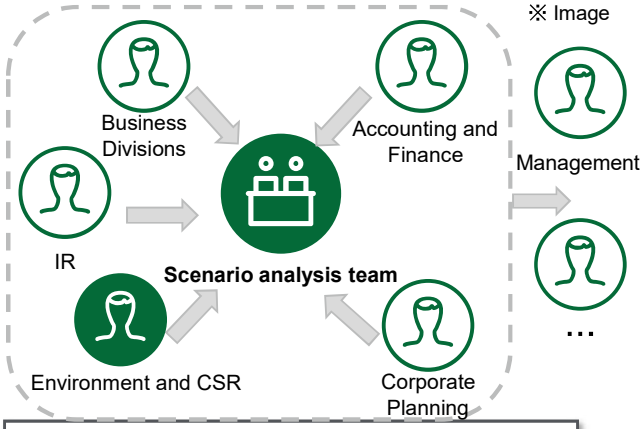
Advantages
- ✓ Easy to start
- ✓ Minimum burden on each division/department

Disadvantage
- ✓ Internal coordination needed in the scenario analysis process
- ✓ Long process from the environment/CSR division to management

Pattern B

Develop internal teams and start scenario analysis

※ Image



Advantages
- ✓ Divisions are cooperative as internal coordination is completed in advance
- ✓ The process swiftly reaches top management as a well-coordinated team performs analysis

Disadvantage
- ✓ Takes time to start analysis
- ✓ Great burden on each division/department

How to involve each operation division ①

**The following use cases exist as examples for involving operation divisions for companies that have implemented scenario analysis.
Effectively leveraging management's commitment and using narratives suited to each division/department are useful strategies, and daily communication of information within the company will also help promote understanding.**

Narratives for each operation division

- It may be good to put the focus on **how the company as a whole can reduce its CO2 emissions through the contributions of various areas such as products and procurement,** rather than concentrating only on reducing emissions from processes. Framing it in such a way could promote greater participation from each operation division.
- Since each operation division is connected, **we can motivate them by having each operation division consider strategies they can implement and come up with a storyline** for what to do. The important thing is **showing what they can do as a business**, and not being limited to environmental measures.

Effectively leveraging management's commitment

- We communicate with operation divisions in the following manner: "we are planning to discuss the results we reviewed based on external data at the management committee, **so if there is anything that you as a division think should be corrected, please let us know**".
- The backing of **management's commitment** allows us to use the momentum to involve operation divisions

- There are many other issues besides climate change, and some might argue that those issues should be addressed first. However, we emphasize that **there is a need for us to focus on measures against climate change, as this is something that is required of us as a company**.
- Having **management position climate change measures as a priority issue** enables us to gain operation divisions' understanding that this is an important issue for the company.

Strengthening communication of information within the company

- We started **communicating information within the company** about the TCFD recommendations from the beginning stage of their implementation, so there was no sense of resistance internally as our staff was already aware of them.
- **When it became time to proceed with the scenario analysis, each division responded quickly by assigning members to the scenario analysis team.**

How to involve each operation division ②

Operation divisions should also take the lead and be involved in the scenario analysis process.
In the initial stages, it is assumed that operation divisions will provide interviews/data regarding the analysis results from ESG/sustainability-related departments.

	Structure for conducting scenario analysis	How operation divisions are involved	Positions in the operation division that are involved
Companies undertaking scenario analysis for the first time	✓ Departments or other units responsible for ESG/sustainability will take the lead in conducting scenario analysis and interviews with operation divisions	✓ Provide data to those conducting scenario analysis ✓ Provide feedback on analysis results (for analysis conducted by other divisions)	✓ Not specified ✓ However, the responsible parties within the operation division should understand the significance and overview of scenario analysis
Companies continuing to conduct scenario analysis	✓ ESG/sustainability-related departments perform a secretarial role ✓ Operation divisions conduct scenario analysis/intra-divisional interviews	✓ Provide data to those conducting scenario analysis ✓ Conduct scenario analysis for related target areas ✓ Intra-divisional interviews	✓ Positions closest to decision making processes should be involved, as it will be necessary to involve operation division members in tasks such as data collection and promoting countermeasures

Preparation ③

Choose target for analysis

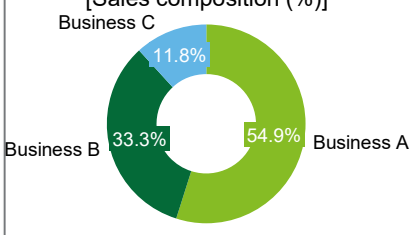
By defining the scope in terms of sales composition, relation to climate change, and difficulty of data collection, companies can conduct scenario analysis in accordance with their business model. Gradually expanding the scope of scenario analysis after the second round will enable a more comprehensive analysis.

Item	Options for Scenario Analysis Scenario (Example)	
Region	**Domestic**	**Overseas**
Scope of Operations	**Some businesses**	**All businesses**
Corporate scope	**Only for the scope of consolidated financial statements**	**Entire supply chain**

Proposal for selection ①

Identify scope of business based on sales composition ratio

[Sales composition (%)]

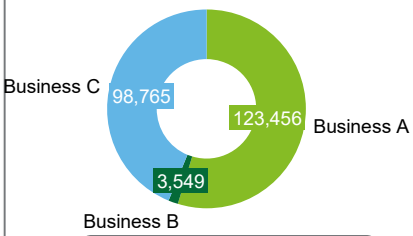


Let's analyze business A and business B, which have a large sales composition

Proposal for selection ②

Identify scope of business based on relevance to climate change

[CO2 emissions (tCO2)]



Consider businesses A and C, which emit a large amount of CO2.

Proposal for selection ③

Identify the scope based on difficulty of data collection

[CO2 emissions (tCO2)]

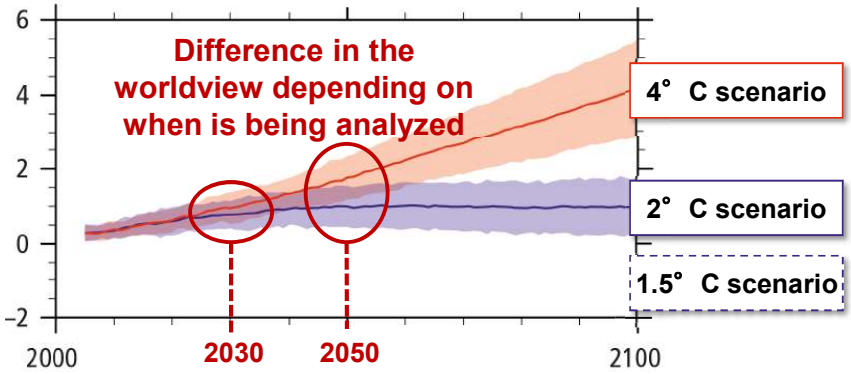
Foreign branch X	Abundant internal data
Foreign branch Y	No internal data
Foreign branch Z	No internal data

As for the overseas business, start with X with ample data.

Preparation ④ Choose time horizon to conduct scenario analysis

It is important to choose a time horizon with maximum benefit to the company by comparing the merits and demerits of factors from a perspective of project length, amount of internal involvement, and effect of physical risks

[Forecast of global average surface temperature] (Difference from the 1986-2005 average)



[Discussions on time horizon decisions raised in support projects (examples)]

	Benefits	Disadvantage
2030	• Abundant data available for reference • Relatively easy to link with business plans	• Possibility that the impact of physical risk is small and that the impact on the company will be low
2050	• Physical risks are emerging.	• Cooperation may be difficult (cannot involve the company) because there is distance from the time horizon of the business plan

Source: AR5 SYR Chart SPM.6, IEA, "ETP2017," UNEP, "The Emission Gap Report 2015

2. Scenario Analysis - Key Points of Practice

Chapter 2 Scenario Analysis - Key Points of Practice

This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

Assess materiality of climate-related risks:
What are the current and anticipated organizational exposures to climate-related risks and opportunities?

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES (Notes in red: Points to consider in each step were added after the support program.)

1 Ensure governance Is in place
Integrate scenario analysis into strategic planning and/or enterprise risk management processes.
Assign oversight to relevant board committees/subcommittees.
Identify which internal (and external) stakeholders to involve and how.
Get management and operation divisions involved!

2 Assess materiality of climate-related risks
- Market and Technology Shifts
- Reputation
- Policy and Legal
- Physical Risks

What are the current and anticipated organizational exposures to climate-related risks and opportunities?
Do these have the potential to be material in the future? Are stakeholders concerned?
Pick and choose from your industry and company viewpoint!

3 Identify and define range of scenarios
Scenarios inclusive of a range of transition and physical risks relevant to the organization
What scenarios (and narratives) are appropriate, given the exposures?
Consider input parameters, assumptions, and analytical choices. What reference scenario(s) should be used?
Clearly imagine a future world under certain assumptions!

4 Evaluate business impacts
Impact on:
- Input costs
- Operating costs
- Revenues
- Supply chain
- Business interruption
- Timing

Evaluate the potential effects on the organization's strategic and financial position under each of the defined scenarios.
Identify key sensitivities.
Try not to seek too much accuracy!

5 Identify potential responses
Responses might include
- Changes to business model
- Changes to portfolio mix
- Investments in capabilities and technologies

Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities.
What adjustments to strategic/financial plans would be needed?
Do not narrow down! Take multiple scenarios into account.

6 Documentation and disclose
Document the process; communicate to relevant parties: Be prepared to disclose key inputs, assumptions, analytical methods, outputs, and potential management responses
Disclose information from readers' viewpoint!

Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

[Overview]
List risk items, identify the potential impacts on business, and assess materiality of climate-related risks

Stage1 List risk items
List the risks and opportunities related to targeted business areas

Stage2 Identify potential impacts on business
From the list of risk and opportunities, qualitatively describe the potential impact on business

Stage3 Assess the materiality of climate-related risks
Conduct risk assessment based on scale of impact (large to small) and determine how important it is

Image

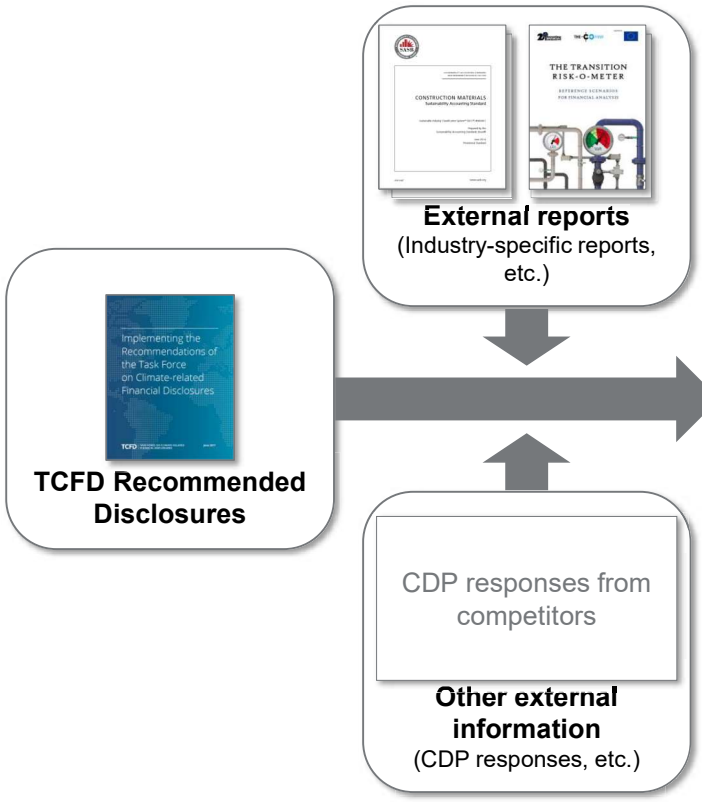
Risks and Opportunities		Business impact			Assessment
Major classification	Small classification	Index	Discussion: Risks	Discussion: Opportunities	
Transition Risk	Carbon price	Revenue	➢ The introduction of carbon prices is expected to reduce the demand for fossil fuels (to reduce the demand for petroleum plants), which will have a medium-scale impact on PL.	➢ Developments in carbon tax markets could create new opportunities in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	Large
	Carbon emission targets/policies of each country (including subsidies)	Revenue	➢ Regulatory tightening affects orders for fossil-fuel-derived plants, affecting PL	➢ The market for green energy, hydrogen, etc. is expected to expand with the advancement of policy support, and the demand for plant and energy transportation, etc. is expected to increase, creating business opportunities.	
	In the energy mix Change	Revenue	➢ Large impact on PL due to changes in fossil fuel-derived power generation rate, which affects plant orders	➢ Alternatives to coal such as LNG and natural gas may increase demand for plant production, which can be an opportunity as well as a risk ➢ Increased demand for green energy creates new business opportunities	
	Energy Demand	Revenue	➢ Significant impact on PL due to decrease in demand for gasoline and decrease in orders for petroleum refineries ➢ Smaller plant size and diversification of customers and regions reduced business opportunities.	➢ Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia) ➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
	Spread of low-carbon technologies	Revenue	➢ Influence on PL due to the spread of electric vehicles, reduced demand for gasoline, etc., affecting the volume of orders received for petroleum plants.	➢ Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia) ➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
	Developing next-generation technologies	Revenue Spend-ing	➢ Popularization of decarbonizing materials (bio-plastics, etc.) reduces the market size of petroleum products and has a large impact on orders for petroleum refineries	➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
Other	Changes in customer reputation, changes in investor reputation, rising mean temperatures, rising sea levels, and extreme weather conditions	Revenue Spend-ing	➢ Die investment accelerated for oil and LNG, and plant orders declined or were suspended. In addition, the postponement and cancellation of projects have an impact on PL. ➢ Construction delays caused by extreme weather conditions have an impact on PL due to increased construction costs, etc.	➢ Investors' evaluation improves due to orders received for projects aimed at realizing a low-carbon society such as renewable energy. ➢ Expected increase in demand for plant resilient to natural disasters, etc.	Small to medium

Note
To what extent should the risk assessment be conducted?

Source: This Practical Guide (example of Chiyoda Corporation: 3-43)

[Stage1: List risk items]

List risk and opportunity categories for targeted business areas

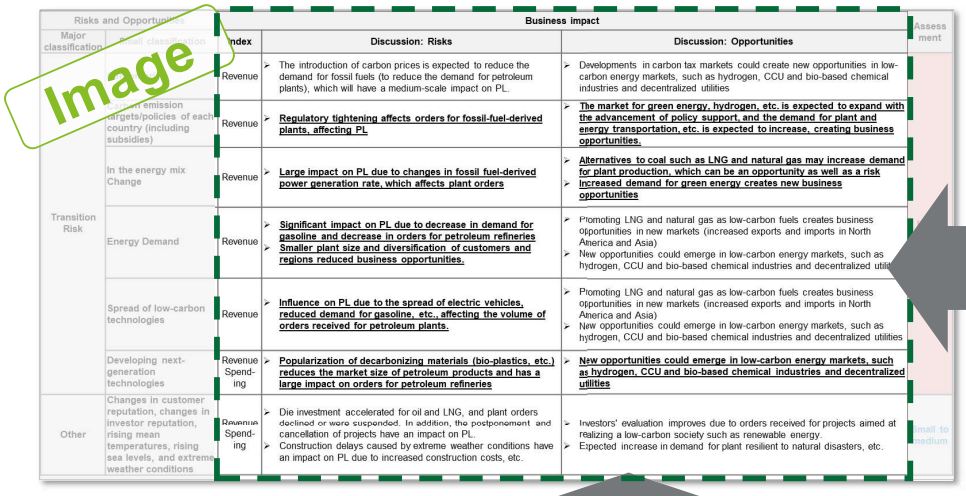


Classification		Risks and Opportunities Related to Climate Change (Examples)
Transition Risk	Policy Regulation	Carbon price
		Carbon emissions targets/policies in each country
		Energy-saving policy
		Fossil fuel subsidies
		Subsidies for renewable energy, etc.
	Market	Changes in the energy mix
		Changes in energy demand
		Changes in important products/prices
	Technologies	Diffusion of renewable energy and energy-saving technologies
	Reputation	Changes in customer reputation
		Changes in investor's reputation
Physical Risk	Chronic	Increase in average temperature
		Changes in rainfall and weather patterns
		Rising sea level
	Acute	Increasing severity of extreme weather conditions

Image

[Stage 2: Identify potential impacts on business]

From the list of risk and opportunity items, qualitatively describe the potential impact on business



Source: This Practical Guide (example of Chiyoda Corporation: 3-43)

[Stage3: Materiality assessment of climate-related risks]

Conduct risk assessment based on scale of impact (large to small)

Business impact

Risks and opportunities tied to business impact

Image

Large

- Carbon price
- Changes in important products/prices
- Policies and regulations of each country
- Changes in rainfall and weather conditions

Mediun

- Changes in the energy mix
- Changes in the reputation of customers and investors

Small

- Energy-saving policy
- Fossil fuel subsidies
- Subsidies for renewable energy, etc.
- Energy demand
- Improving efficiency
- Diffusion of renewable/energy-saving technologies
- Rising sea levels
- Increasing in severity of extreme weather conditions

Comparison of each risk and opportunity item from the perspective of **the size of the business impact** for the company

Example: **Describe risks and opportunities that impact in a wide range, and those that relate to important goods as "Large." Describe those that have no impact on one's business as "Small" and "Medium" for others**.

Examples of Analysis (Changes in Important Products)

Since raw materials account for a large proportion of the cost of sales, the business impact may be "large."

To what extent should the risk assessment be conducted?

Assessing materiality of risks after categorizing them by differences in products (by sector) and affected supply chains (by supply chain) enables an analysis that is convincing to management

Example ①

Materiality assessment of risks by sector

Image

Risk Item	Materiality assessment of risks by sector		
	X	Y	Z
Risk A	Large	Medium	Small
Risk B	Small	Small	Large
Opportunity C	Large	Medium	Medium
Opportunity D	Medium	Large	Large

Example ②

Materiality assessment of risks by supply chain

Image

Risk Item	Materiality assessment of risks by supply Chain			
	Procurement	Transportation	Sales	・・・
Risk A	Large	Large	Small	Medium
Risk B	Small	Small	Large	Large
Opportunity C	Large	Medium	Medium	Small
Opportunity D	Medium	Large	Large	Large

2. Scenario Analysis - Key Points of Practice

Chapter 2 Scenario Analysis - Key Points of Practice

This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

Identify and define range of scenarios: What scenarios (and narratives) are appropriate, given the exposures?

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

(Notes in red: Points to consider in each step were added after the support program.)

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Get management and operation divisions involved!

2 **Assess materiality of climate-related risks**

Market and Technology Shifts | Reputation | Policy and Legal | Physical Risks

What are the current and anticipated organizational exposures to climate-related risks and opportunities?
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Scenarios inclusive of a range of transition and physical risks relevant to the organization

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4 **Evaluate business impacts**

Impact on:
•Input costs
•Operating costs
•Revenues
•Supply chain
•Business interruption
•Timing

Evaluate the potential effects on the organization's strategic and financial position under each of the defined scenarios.
Identify key sensitivities.

Try not to seek too much accuracy!

5 **Identify potential responses**

Responses might include
•Changes to business model
•Changes to portfolio mix
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Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities.
What adjustments to strategic/financial plans would be needed?

Do not narrow down! Take multiple scenarios into account.

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Disclose information from readers' viewpoint!

Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

[Overview]

Choose scenarios, obtain forecast information on parameters, and shape the worldview

Stage 1

Choose scenarios

Choose a number of scenarios with different temperature targets, including "lower than 2°C".

Stage 2

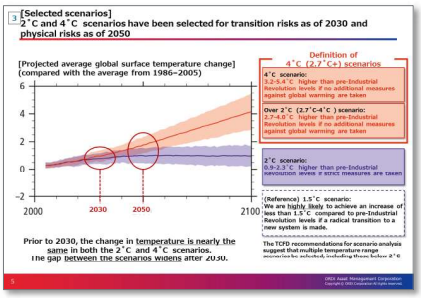
Obtain forecast information on relevant parameters (variables)

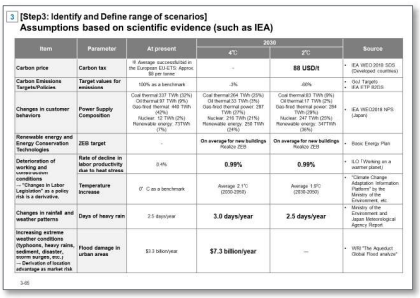
Obtain objective forecast information of relevant parameters on each risk and opportunity items, and identify the effects to the company in further detail.

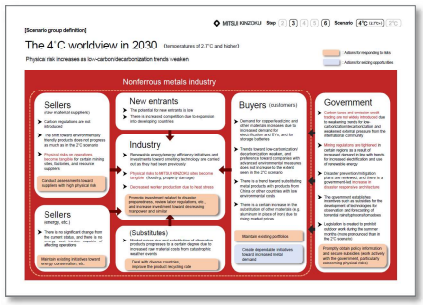
Stage 3

Shape the worldview in consideration of stakeholders

Based on forecast information, shape the company's worldview such as future stakeholders' performance, and work towards achieving internal and external consensus by incorporating the perspectives from outside of company (If needed).







Note

What kind of scenarios should be chosen?

Note

What kind of scenario is the 1.5°C scenario? ①②

Note

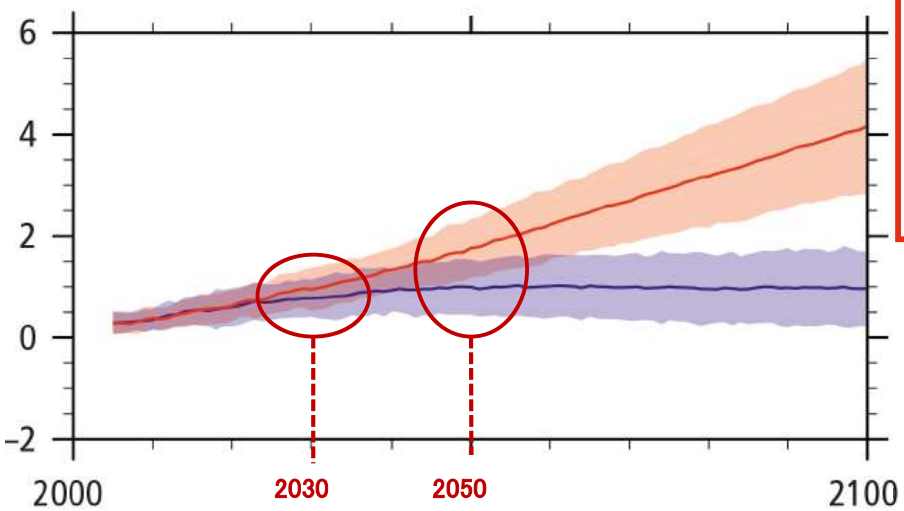
How to coordinate the worldview with each business division?

Sources: This Practical Guide (example of ORIX Asset Management Corporation 3-38, example of KAJIMA Corporation 3-65, example of Mitsui Mining & Smelting Co., Ltd. 3-127)

[Stage1: Choose scenarios]

We will select scenarios from multiple temperature ranges, including the below 2°C scenario, in order to respond to an uncertain future

[Forecast of global averages surface temperature]
(Difference from the 1986-2005 average)



- ✓ Almost the same temperature changes would occur in the 2°C and 4 °C scenarios by 2030
- ✓ It is important to draw an appropriate transition path focusing on decarbonization by 2050 for each timeframe selected in the scenario analysis

Definition of the 4°C (2.7°C or above) scenario

4°C scenario:
The temperature will rise 3.2-5.4°C above pre-industrial levels, unless more rigorous measures are taken.

2°C or above (2.7°C -4°C) scenario:
The temperature will rise 2.7-4.0°C above pre-industrial levels, unless more rigorous measures are taken.

2°C scenario:
The temperature will rise 0.9-2.3°C above pre-industrial levels, if strict measures are taken.

(Reference) 1.5 °C scenario:
The temperature will rise less than 1.5°C above pre-industrial levels with high probability, if fundamental system migration is achieved

Scenario analysis in the TCFD recommendations indicates applying multiple temperature scenarios including the 2°C or lower scenario

Sources: AR5 SYR Chart SPM.6, "ETP2017," UNEP, "The Emission Gap Report 2015, Global Warming of 1.5°C (IPCC).

What kind of scenarios should be chosen?

Selecting scenarios with temperature ranges and worldviews with as much variation as possible will help "eliminate the unexpected". It is important to consider the characteristics and parameters of each scenario and choose a scenario that matches the company's industry and situation, investor trends, and trends for domestic and international policies. Companies that continue to conduct scenario analysis may want to consider using a 1.5˚C scenario.

Scenario /temperature range	IEA WEO (World Energy Outlook)	SSP (Shared Socioeconomic Pathways)					PRI IPR (Inevitable Policy Response)
	• Lists medium- to long-term energy market forecasts ✓ Lists future information (quantitative/qualitative) related to energy	• Socioeconomic scenario based on recent policies and the socioeconomic environment ✓Lists the macroeconomic information scenarios are based on for each scenario					• Scenario for climate-related policies that are likely to be implemented in the short term ✓Lists qualitative and quantitative forecasts for climate-related policies
		SSP1	SSP2	SSP3	SSP4	SSP5	
RCP 8.5 (4˚C)	CPS (Current Policies, removed in 2020)	—	—	—	—	✓	—
RCP 6.0 (below 4˚C)	STEPS (Stated Policies) DRS (Delayed Recovery, added in 2020)	✓	✓	✓	✓	✓	FPS (Forecast Policy Scenario)
RCP 4.5	—	✓	✓	✓	✓	✓	—
RCP 3.4	—	✓	✓	✓	✓	✓	—
RCP 2.6 (2˚C)	SDS (Sustainable Development)	✓	✓	✓	—	(✓) Incomplete	—
RCP 1.9 (1.5˚C)	NZE 2050 (Net Zero Emissions by 2050, added in 2020)	✓	—	—	—	—	—

*RCP stands for Representative Concentration Pathways. The subsequent values are the radiative forcing values (for example, RCP 2.6 indicates a radiative forcing increase of 2.6W/m2 by the end of the 21st century compared to pre-industrial levels)

✓: Climate models corresponding to RCPs exist
(✓) Some portions lacking models

→See the Appendix for the overview and parameters of each scenario

Sources: IEA website, Riahi et al. (2017) https://doi.org/10.1016/j.gloenvcha.2016.05.009 , PRI website

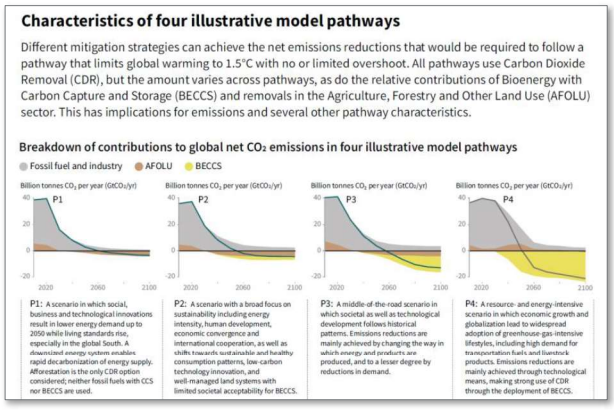
What kind of scenario is the 1.5˚C scenario? ①

The Paris Agreement indicated that efforts will be pursued to keep the global average temperature increase well below 2˚C and to keep it at 1.5˚C compared to pre-industrial levels.
In October 2018, the Intergovernmental Panel on Climate Change (IPCC) prepared a special report on the effects of a 1.5˚C global warming and the pathways through which it can emit greenhouse gases.

Impact difference between 2˚C and 1.5˚C scenario (Examples)

	1.5° C scenario	2° C scenario
Sea level rise by 2100	Rise of 26~77cm	Rise of 30~93cm
Biological species loss	Insects：6% decrease Plants：8% decrease Vertebrates：4% decrease	Insects:18% decrease Plants:16% decrease Vertebrates:8% decrease
Disappearance frequency of sea ice in the Arctic Ocean during summer	Once in 100 years	Once in 10 years
Decrease ratio of catches	1.5 million tons	3.0 million tons
Impacts on coral reef	Approximately 70%~90% dies	Mostly annihilated

Greenhouse gas emissions pathways to 1.5 ˚C

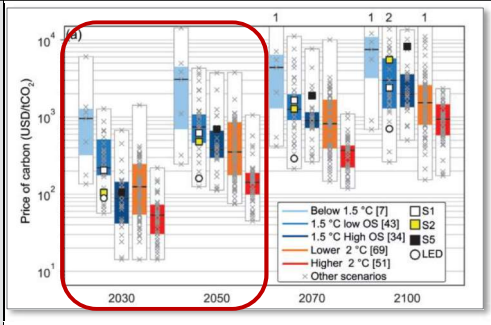
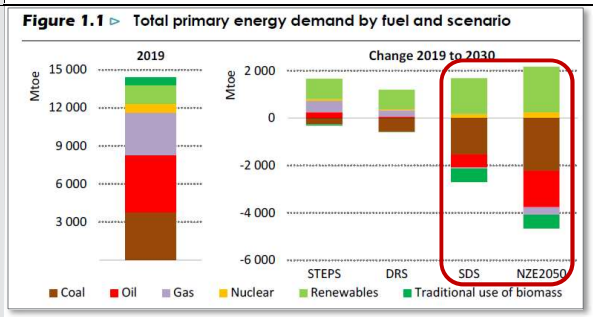


- Examples of 4 representative pathways (P1 to P4) are listed.
  - **P1: Low energy demand. No use of CCS**
  - **P2: Wide focus on sustainability**
  - **P3: Middle of the road scenario (business as usual)**
  - **P4: Expected use of CCS**

Source: Global Warming of 1.5° C (IPCC)

What kind of scenario is the 1.5˚C scenario? ②

Information has been released on a portion of parameters for the 1.5˚C scenario.
Parameter information such as the following can be obtained for the 1.5˚C scenario and the 2˚C scenario.

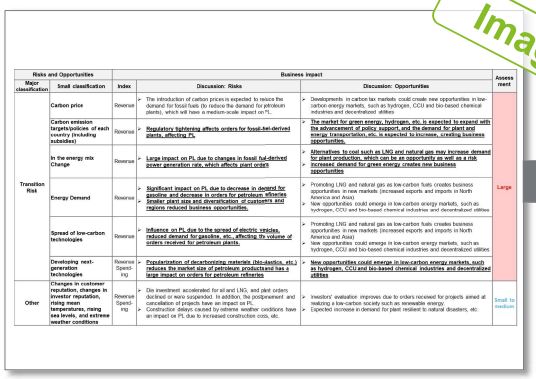
Parameter (example)	Parameter information allowing comparison of the 1.5˚C scenario and 2˚C scenario
Carbon tax (2030/2050)	 The following carbon prices are predicted: In the below 1.5˚C scenario: • 2030: **135** USD/tCO2 + • 2050: **245** USD/tCO2 + In the 2˚C and above scenario: • 2030: **15** USD/tCO2 + • 2050: **45** USD/tCO2 +
Change in primary energy demand (2019 – 2030)	 In the 1.5˚C scenario, the following changes are predicted compared to 2019: • **Renewable energy/nuclear power demand increases** by **approximately 2,200Mtoe** • **Fossil fuel (coal, oil, gas) and biomass demand decreases** by **approximately 4,700Mtoe** In the 2˚C scenario, the following changes are predicted compared to 2019: • **Renewable energy/nuclear power demand increases** by **approximately 1,700Mtoe** • **Fossil fuel (coal, oil, gas) and biomass demand decreases** by **approximately 2,700Mtoe**

Sources: IPCC “Global Warming of 1.5˚C” (Carbon tax); IEA “World Energy Outlook 2020” (Change in primary energy demand)

[Step 2: Obtain forecast information on parameters (variables)]

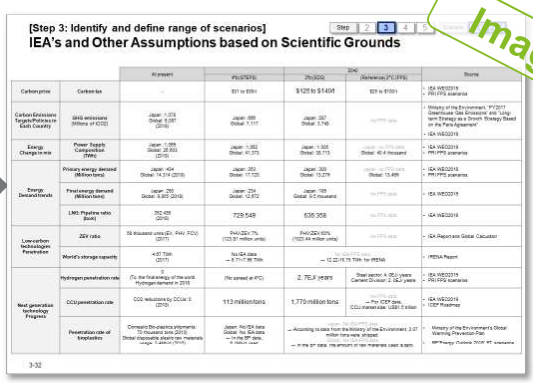
Obtain forecast information on parameters and identify the effects to the company in further detail

List of Risks and Opportunities



Image

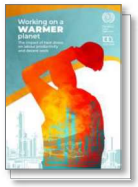
Parameters list



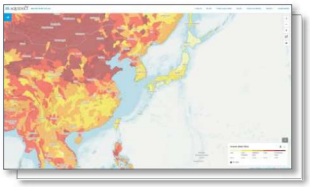
Image

It is important to obtain objective forecast information on parameters from external sources

Scenario Report
(IEA WEO, IEA ETP (Energy Technology Perspectives) etc.)



External reports
(Industry-specific reports, academic papers, etc.)



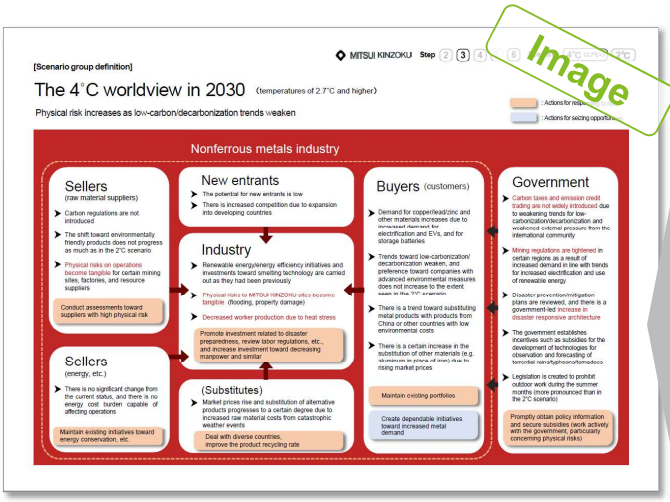
Climate Change Impact Assessment Tools
(Physical Risk Map, Hazard Map, etc.)

⇒See Appendix for examples of parameters.

Source：This Practical Guide (example of CHIYODA Corporation: 3-43, 44)

[Stage 3: Shape the worldview in consideration of stakeholders]

Based on forecast information, shape the company's worldview such as future stakeholders' performance and work towards achieving internal and external consensus by incorporating the perspectives from outside of company (if needed)



It would be useful to aim for building internal consensus after incorporating the perspectives from outside of company in order to understand comprehensive worldview.

Components of the worldview surrounding the company (e.g.)

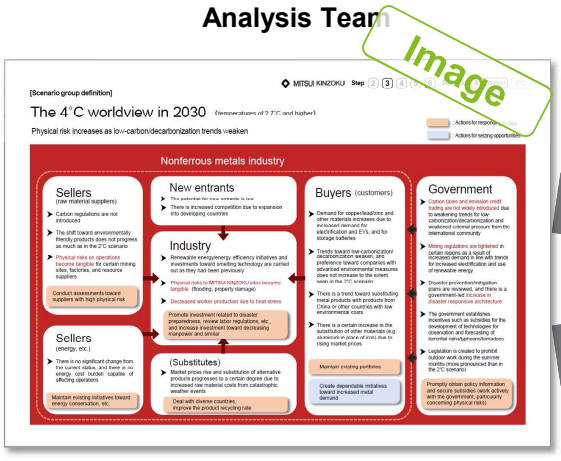
Government	✓ Legal systems and regulations related to risks ✓ Policies to promote opportunities
Industry	✓ Trends, technologies and tendencies related to climate change that are mainstream in the industry
Buyer (Customers)	✓ Customer trends and tendencies affecting products, businesses, and services we provide
Seller (Suppliers)	✓ Trends affecting raw materials and costs required for business
New comer	✓ Businesses themselves and new entrants who can change supply chains
Substitute product	✓ Substitutes, etc., that could affect the market for the products, businesses, and services provided

Source: This Practical Guide (example of Mitsui Mining & Smelting Co., Ltd.: 3-127）

How to coordinate worldview with each business division?

It is important to create a worldview that can convince relevant departments including business division through dialogue. In order to encourage relevant department members to think of climate change as their own problem, and to share the scenario's meaning and perspective, it is important to have a written narrative or some type of visualization to facilitate discussion.

Worldview (draft) developed by the Scenario Analysis Team



Points in the discussion with each department to coordinate the worldview (Example)

Business Divisions

- ✓ Are there any discrepancies in the worldview, technology, products, etc., related to each business?
- ✓ Is it a worldview that is likely to occur in the future relative to the behavior of the sellers and buyers who interact with us in our day-to-day operations?

Corporate Planning

- ✓ Are there any discrepancies compared with the company's management strategy?
- ✓ Are there any prospects for the future compared to the industry outlook mentioned in our daily operations?

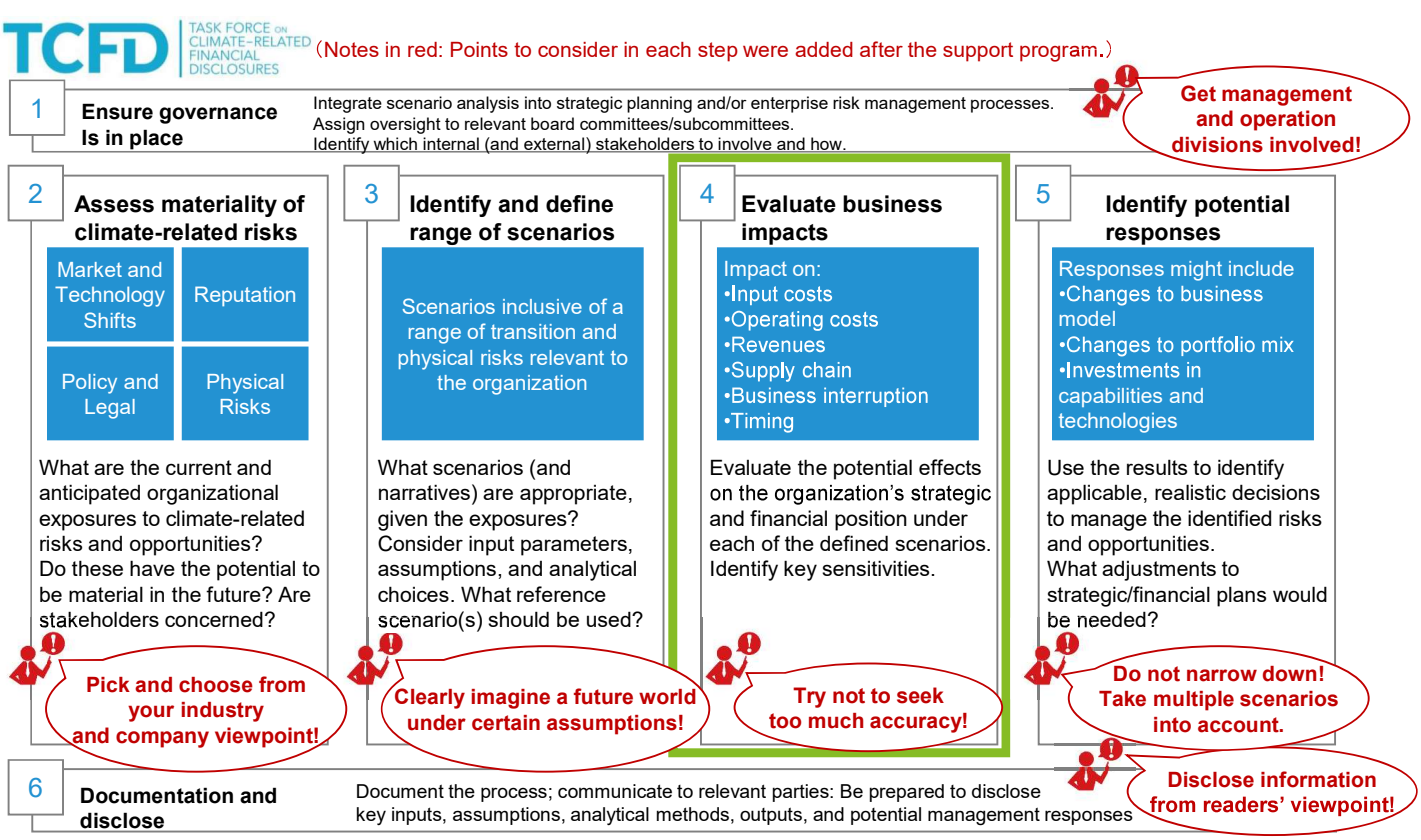
Source: This Practical Guide (example of Mitsui Mining & Smelting Co., Ltd.: 3-127）

2. Scenario Analysis - Key Points of Practice

Chapter 2 Scenario Analysis - Key Points of Practice

This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

Evaluate business impacts:
Evaluate the potential effects on the organization's strategic and financial position under each of the defined scenarios.



Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

[Overview]

Estimate the financial impact on P/L and B/S, then compare the gap between future perspectives and financial items in the business as usual

Stage 1

Identify potential financial items affected by risks and opportunities

Identify which financial indicators are possibly affected by business impact of climate change

Stage 2

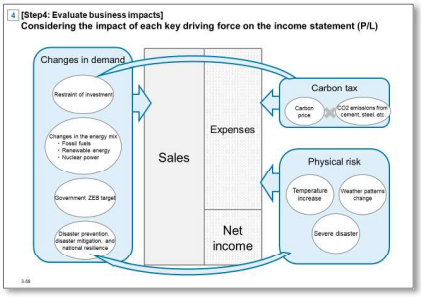
Consider calculation formula and estimate financial impact

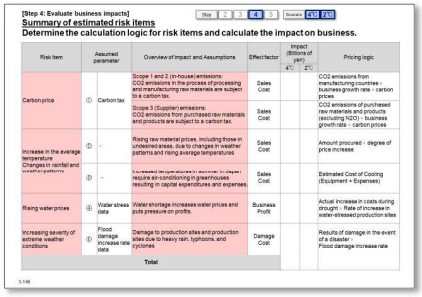
Consider calculation formula for risks that can be estimated, then estimate the financial impact based on internal information

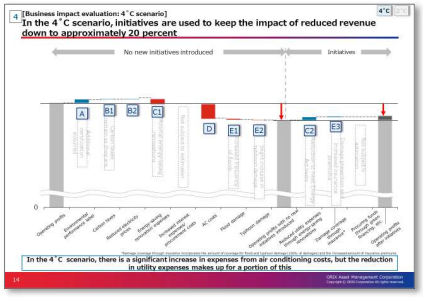
Stage 3

Be aware of the gap between future outlook and financial indicators in the business as usual

Based on the estimated results, be aware of the scale of impact on the future outlook







Note

What kind of internal data can be used for estimation?

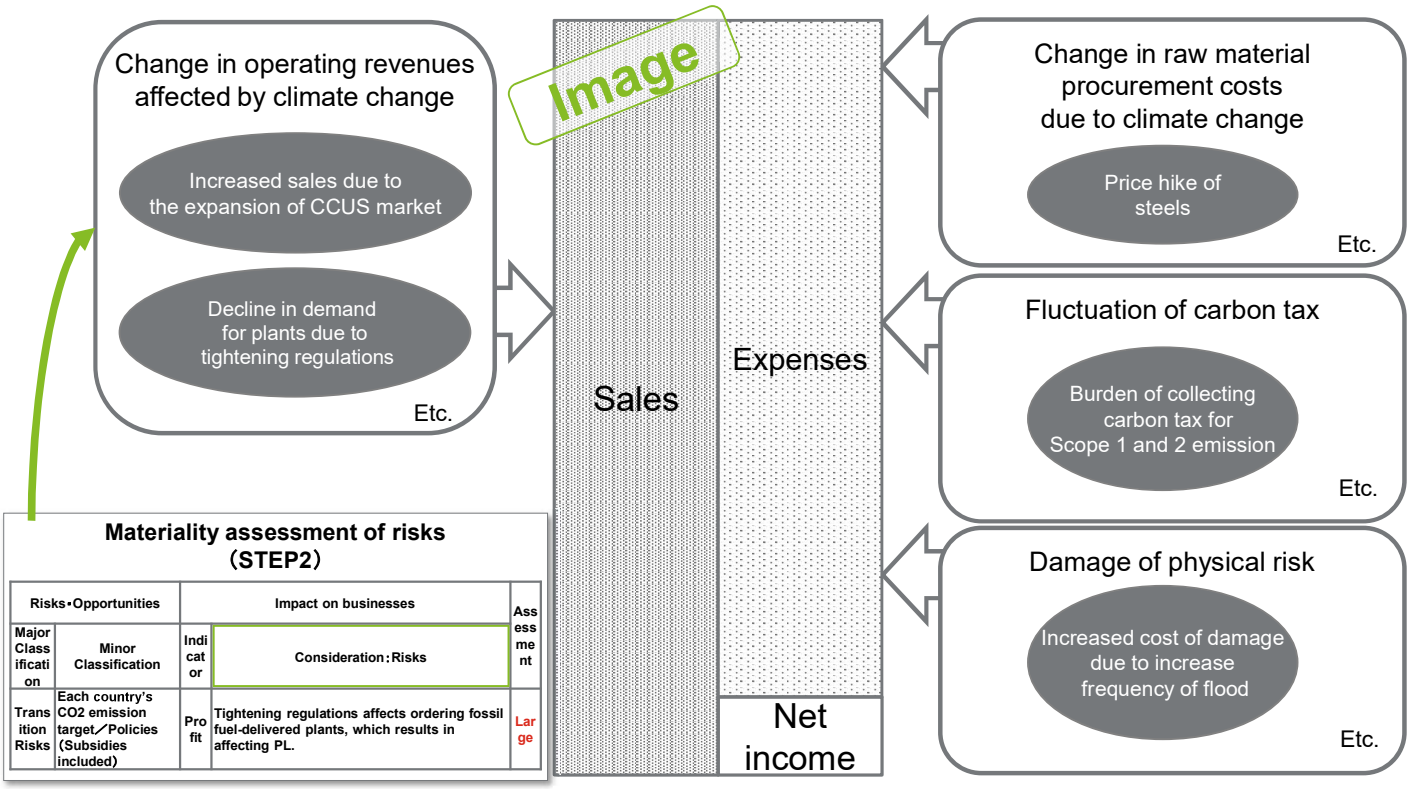
Note

How do we treat data that cannot be quantitatively estimated?

Source: This Practical Guide (example of KAJIMA CORPORATION: 3-68, example of KAGOME Co., Ltd.: 3-146, example of ORIX Asset Management Corporation: 3-37)

[Stage1: Identify potential financial items affected by risks and opportunities]

Identify which financial items of P/L and B/S are affected by risks and opportunities



Materiality assessment of risks (STEP2)

Risks・Opportunities		Impact on businesses		Assessment
Major Classification	Minor Classification	Indicator	Consideration：Risks	
Transition Risks	Each country's CO2 emission target／Policies (Subsidies included)	Profit	Tightening regulations affects ordering fossil fuel-delivered plants, which results in affecting PL.	Large

It is crucial to differentiate "Profit" and "Cost" at first (as Fluctuation of profit × Profit ratio = Fluctuation of profit, which also indicates that the impact can be largely different.)

▭ ･･･ Business impact

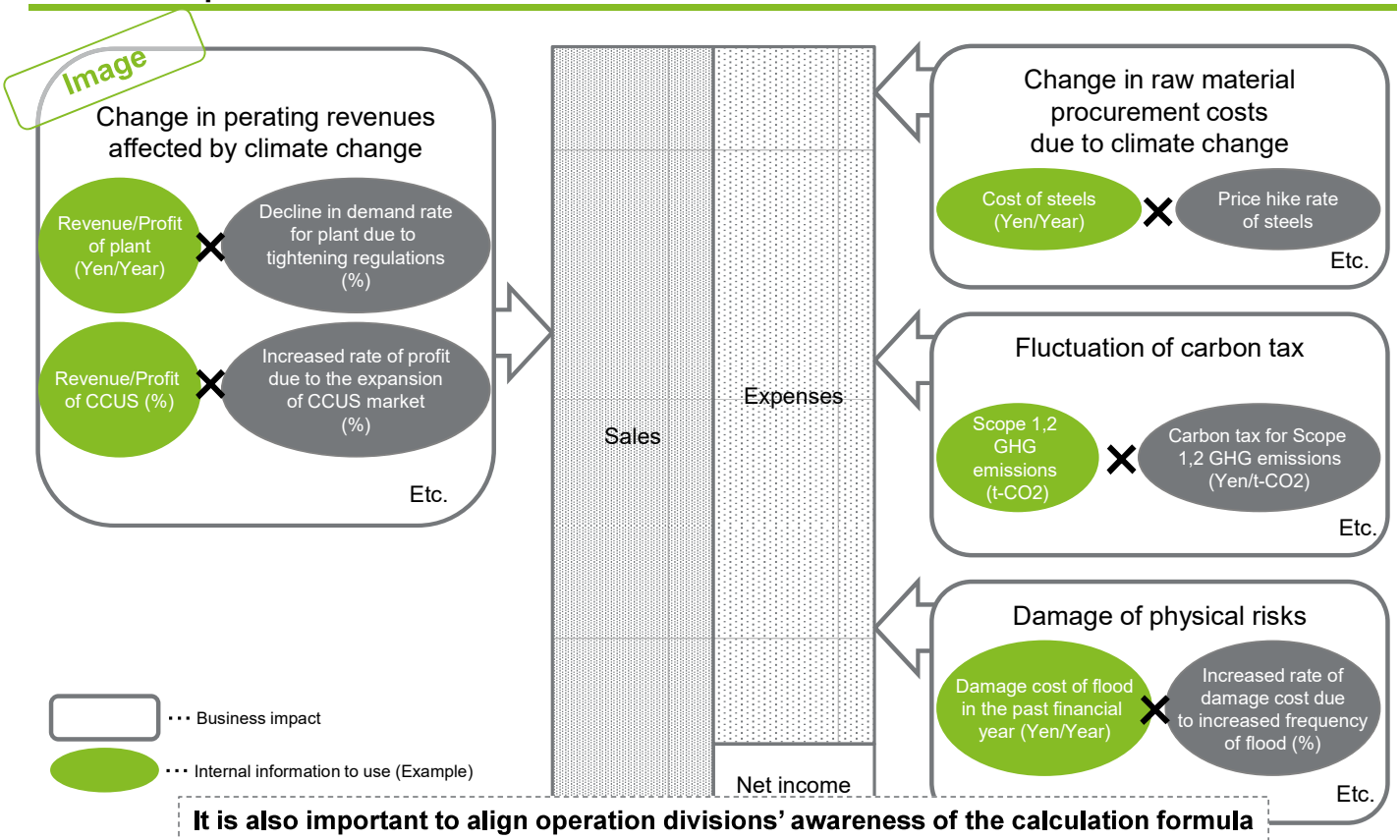
What kind of internal data can be used for estimation?

By using data that is commonly used by business divisions (e.g. sales information by business/products, operational costs, cost structure, greenhouse gas emissions), it is possible to create estimations close to actual company conditions

	Information available for consideration	Methods for collecting information
Sales Structure	**Current and future sales and operating income by business segment** (Targets for net sales and operating income)	✓ Refer to the company's **long-term management targets,** etc. ✓ In the absence of relevant information, it is possible to calculate the current value using CAGR (annual growth rate), etc.
Sales Structure	**Sales forecasts and targets for related products in the future** (By product)	✓ **Hearings from business divisions, corporate planning, etc.** ✓ If owned, also collect **information on future market conditions normally used by relevant departments**.
Cost Structure	**Current operating costs** (Electricity and fuel prices, electricity and fuel consumption, etc.)	✓ **Hearings from business divisions, corporate planning, etc.**
Cost Structure	**Information on the cost structure of raw materials** (Amount of raw materials used, procurement cost, etc.)	✓ **Hearings from business divisions, corporate planning, etc.** ✓ If owned, also collect **information on future market conditions normally used by relevant departments**.
Cost Structure	**Current and future GHG emissions** (Scope 1 and 2, Scope3 if needed)	✓ Refer to the company's **environment-related targets, etc.**

[Stage2: Consider calculation formula and estimate financial impact]

Consider calculation formula for financial indicator that can be estimated, then estimate the financial impact based on internal information



It is also important to align operation divisions' awareness of the calculation formula (as well as management, etc., for the second round and after)

How do we treat data that cannot be quantitatively estimated?

Regarding qualitative information or information with little scientific basis, measures such as continuous monitoring and interviews with external experts could be methods for evaluation. It is important to identify evaluated/unevaluated risks and clarify the next action

Image

Risk Item	Validity of quantitative estimation of business impact	Review status
Risk A	**Possible**	**Considered**
Risk B	**Possible**	**Considered**
Risk C	**Not possible** (Qualitative Information Only)	Considered (Qualitative)
Risk D	**Not possible** (no scientific data)	Not considered
Risk E	**Possible**	**Considered**

[Examples of actions for risks that cannot be quantified]

Interviews with outside experts

- ✓ Hearings with external experts such as research institutes and experts regarding risks that could not be calculated
- ✓ The results of the hearings are stored as qualitative information.

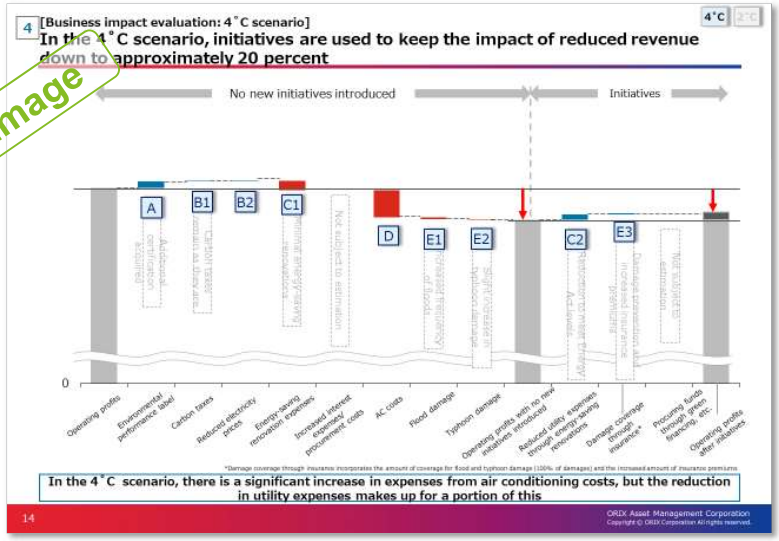
Continuous internal monitoring

- ✓ Continuously monitor to obtain up-to-date information on risks.

[Stage 3: Be aware of the gap between future outlook and financial indicators in the business as usual]

Based on the estimated results, be aware of the scale of impact on the future outlook

Image



Understand the impact of climate change on business prospects (future management targets and plans)

- ✓ What risks and opportunities have a greater impact?
- ✓ It is possible to understand the extent to which climate change threatens the business prospects for future management and targets. In some sectors and industries, the impact may be smaller than anticipated.

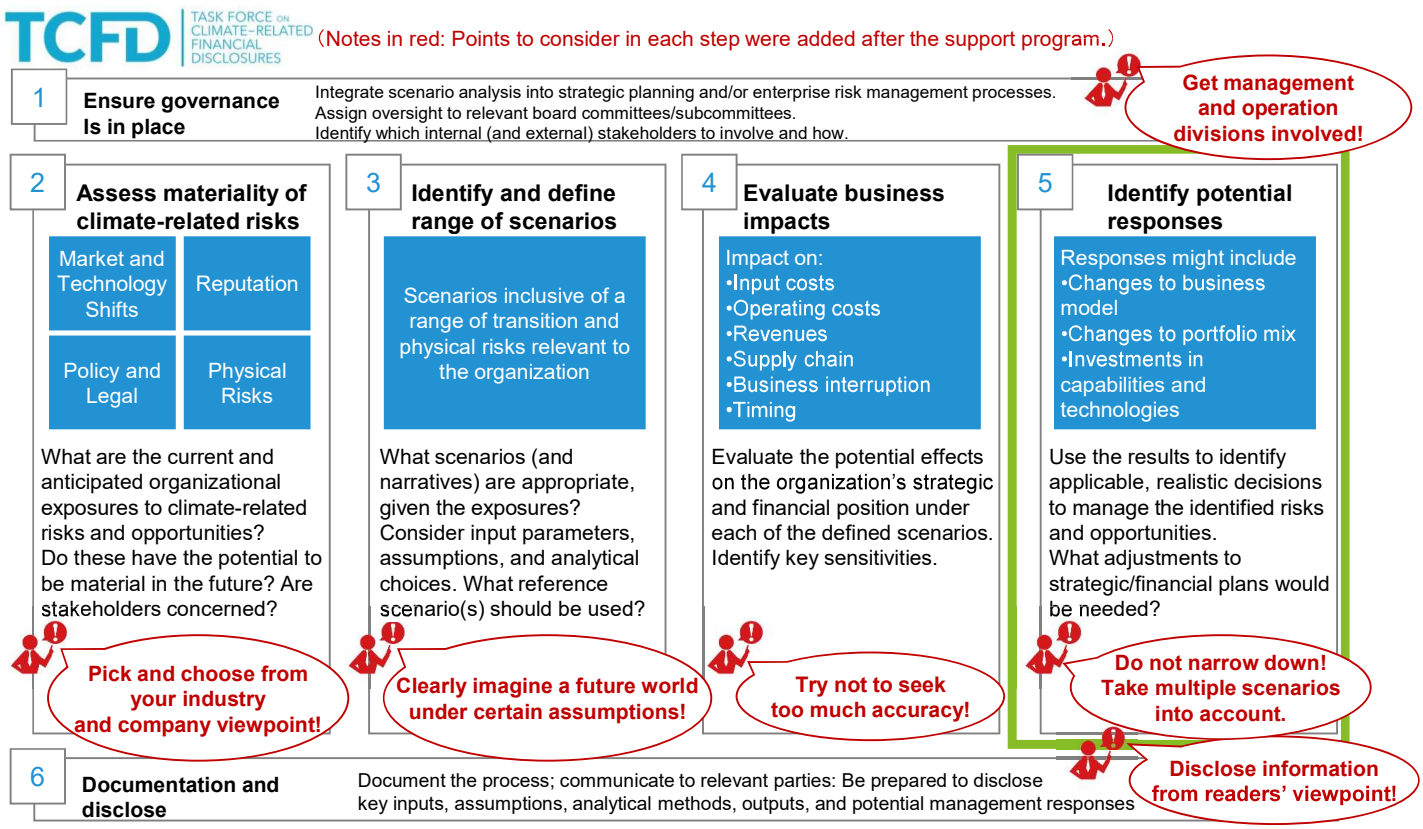
Source: This Practical Guide (example of ORIX Asset Management Corporation: 3-37)

2. Scenario Analysis - Key Points of Practice

Chapter 2 Scenario Analysis - Key Points of Practice

This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

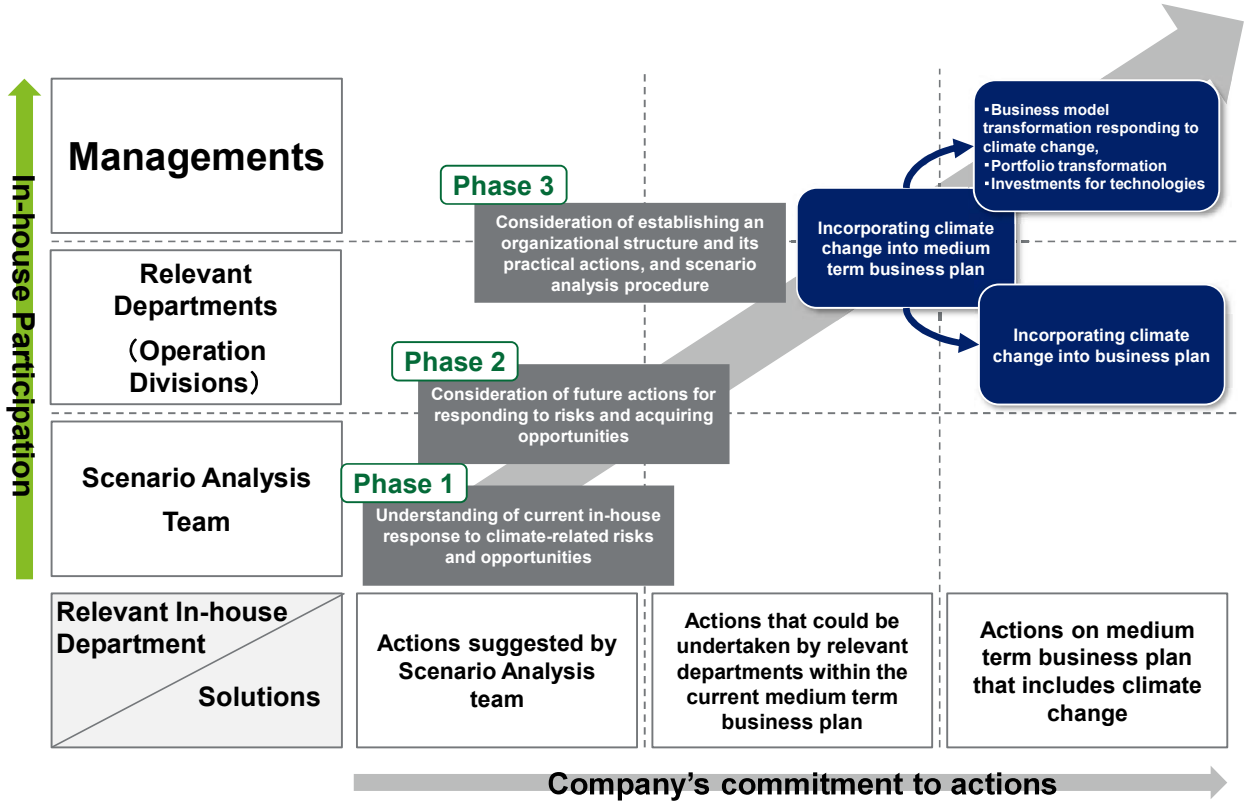
Identify potential responses:
Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities.



Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

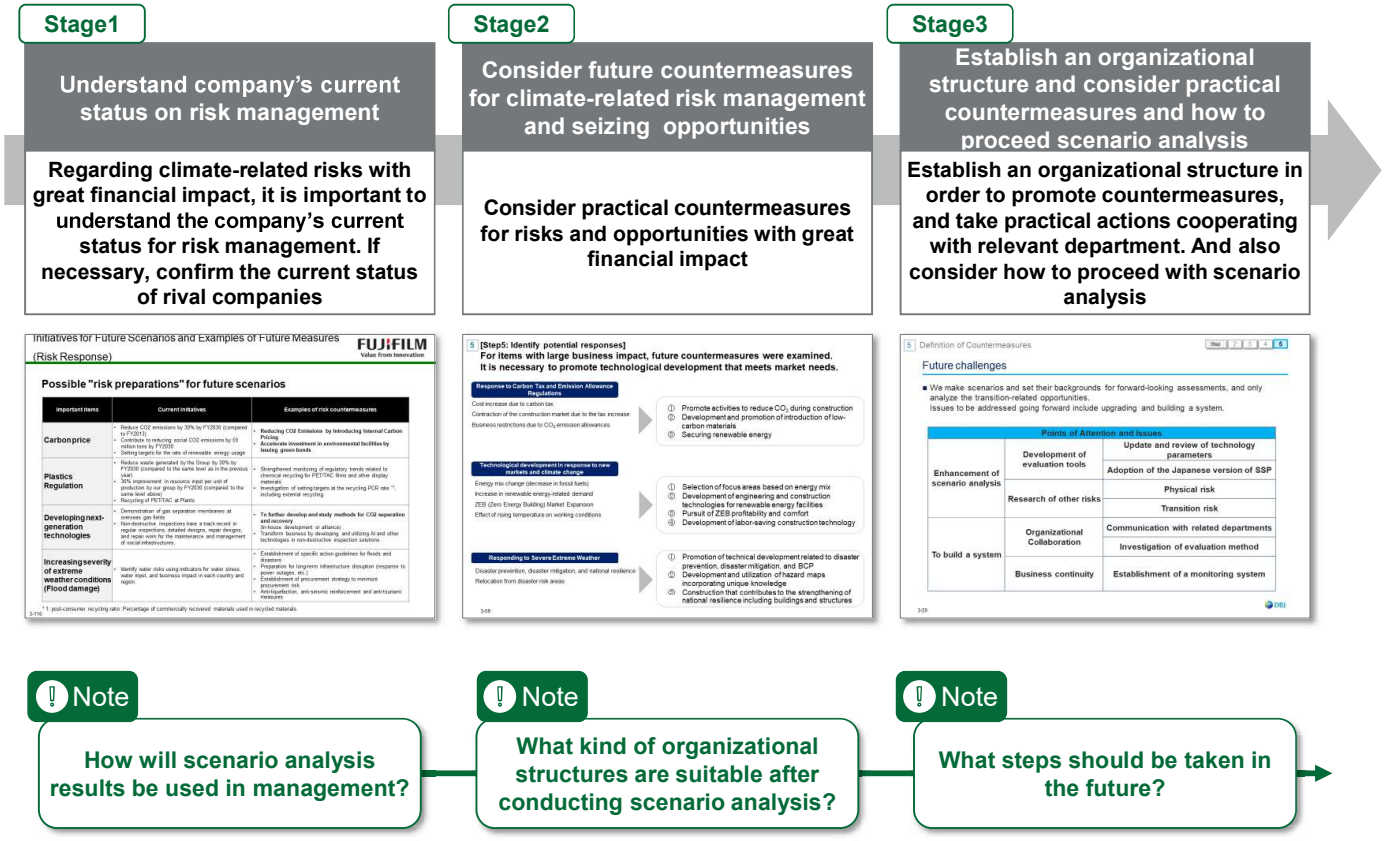
【STEP5 Definitions of Actions/ Target of Practical Guide】

Practical Guide demonstrates flows for “integration of climate change into business management (inclusion of climate change into medium term business plan)” as it is crucial for countermeasures involving business model transformation.



【Overview】

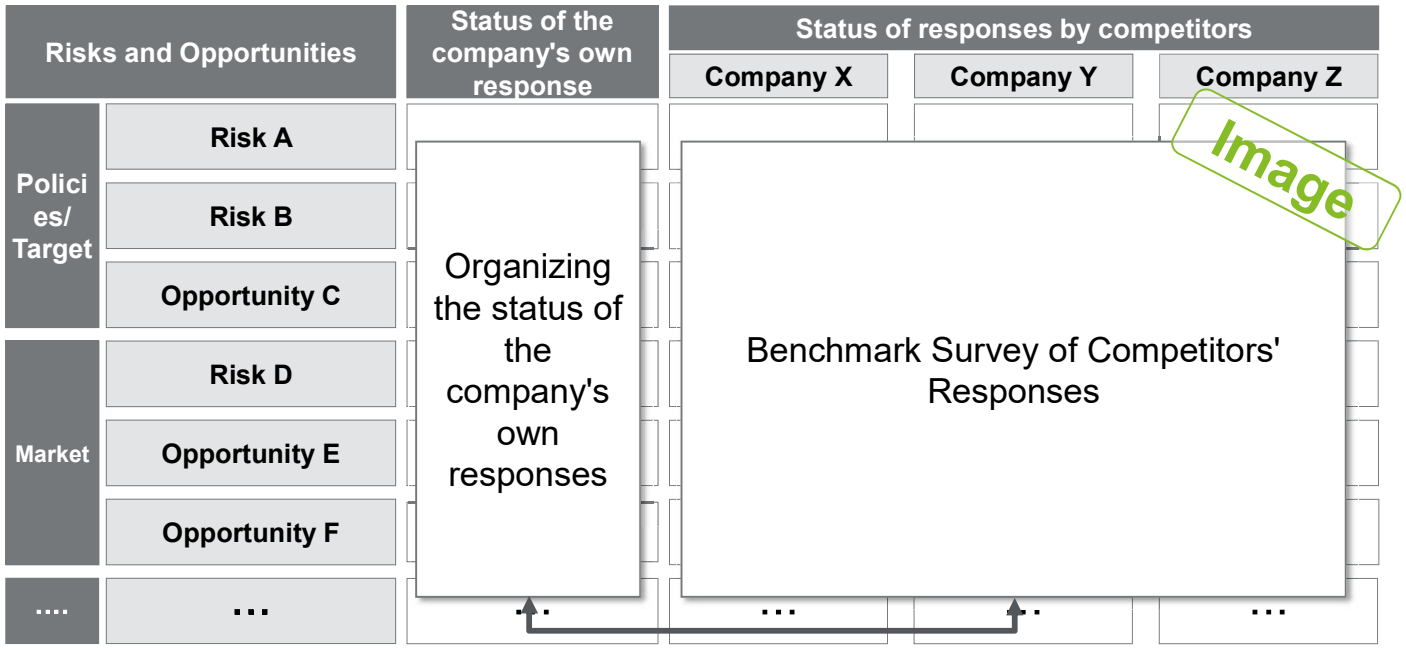
Understand company’s current status on risk management, consider countermeasures, and establish practical action plans and an organizational structure



Source: This Practical Guide (examples of FUJIFILM Holdings Corporation: 3-108, Kajima Corporation: 3-70, Development Bank of Japan Inc.: 3-23)

[Stage1: Understand company's current status on risks management and seizing opportunities]

Regarding climate-related risks and opportunities with great financial impact, it is important to understand the company's current status for risk management.
If necessary, confirm the current status of rival companies



It is a suggestion to conduct comparative analysis on the company and competitors regarding risk management

[Stage 2: Consider countermeasures for climate-related risk management and seizing opportunities]

Consider practical countermeasures for risks and opportunities with great financial impact

Scenario	Future business impact	Countermeasures (Example)
2° C scenario	Operating income **-JPY X trillion**	• Change in business model ✓ Consideration of procuring alternative materials ✓ Investments in low carbon technology
4° C scenario	Operating income **-JPY Y trillion**	• Strengthen supply chain performance considering climate change ✓ Promote response to BCP ✓ Invest to improve quality of raw materials

It will become important to plan resilient countermeasures that can be used in any situation. Companies may also try deciding on a rough direction for countermeasures as a bare minimum before going on to consider specific countermeasures in the course of ongoing implementation.

[Stage 3: Establish practical action plans and an organizational structure]

Establish an organizational structure in order to implement countermeasures and take practical actions cooperating with relevant department. And also consider how to proceed with scenario analysis

Image

Response implementation period (Example)	Future Actions (Example)		
	Establish an organizational structure	Taking practical actions cooperating with relevant department	How to proceed with scenario analysis
Currently or for a few months	✓ **Dissemination of the results of scenario analysis within the company** (including managements) ✓ **Gaining an agreement from managements on the needs for establishing an organizational structure** in order to promote countermeasures	-	✓ **Interviews with experts on important risks and opportunities** for which there is little information
～1 year	✓ **Establishing an organizational structure in order to promote countermeasures through explaining to relevant department**	✓ Cooperating with relevant department **and take practical actions aligned with existing business plans that is relatively easy to implement** ✓ Beginning practical consideration with relevant department for new actions	✓ **Establishment of a monitoring system for scenario analysis** ✓ Monitoring
As needed (timings may differ for each company)	✓ **Incorporating climate change into medium term business plan** ✓ Encourage dialogue with stakeholders on climate change to create markets ✓ Introduction of internal carbon pricing as a mechanism to promote low-carbon investment		

Consider scenario analysis procedure, establishing an organizational structure , and getting relevant department involved in the course of scenario analysis, alongside with proceeding the incorporation of climate change into medium term business plan

(Column) What is Internal Carbon Pricing?

Internal Carbon Pricing is carbon prices set by companies and used within them.
It is one potential countermeasure, and is a "mechanism" that promotes decarbonization.

- **Internal Carbon Pricing is the price of carbon estimated internally by the company, and is a mechanism for promoting low-carbon investment by companies**
- It is a method used in corporate planning, and is leveraged in incentives for promoting energy efficiency, the identification of revenue opportunities and risks, and in guiding investment decisions

→See "Utilization Guidelines for Internal Carbon Pricing" published by the Ministry of the Environment for information on ICP

Source: TCFD, "Recommendations of the Task Force on Climate-related Financial Disclosures" (2017.6)

How will scenario analysis results be used in management?

It is important that climate change be included in the process of business strategy planning. One tip is to include climate change into the nearest midterm management plan

Report the results of scenario analysis to managements → **Establish an organizational structure and take practical actions cooperating with relevant department** → **Incorporate climate change into medium term business plan**

Climate Change

Management Policy

Responding to Risks and Opportunities

- Report the results of scenario analysis to managements

※Under the Ministry's support program, it is required to conduct "A debrief session on climate change impacts on one's company" (the results of the scenario analysis) for managements

- Company-wide deployment of scenario analysis
- Materialization of countermeasures for risk management and seizing opportunities
- Establishment of a system to promote the above

Alignment of target level and practical measures for achieving the targets in the medium term business plan

- Creation of the medium term business plan

Input of external environment

- Monitoring of risks and opportunities
- Establishment of a system to promote the above

Promoting Scenario Analysis

[Results of the FY2018 Ministry of the Environment Scenario Analysis Support Project]

Company A: Established a new department specializing in the integration of IR/Sustainability as the understanding of management progressed. **Periodic discussions with executives on TCFD held at the Sustainability Committee**

Company B: Improved understanding of management and launched a team for climate change management. **Executive Vice President assumes chairmanship**

- **Consider indicators and targets linked to medium term business plan**
- Continuation of monitoring

What kind of organizational structures are suitable after conducting scenario analysis?

It may be suggested to create a cross-sectional organization directly under the corporate planning department that deals with climate change to give effectiveness to the result of scenario analysis

As a cross-sectional organization with climate change as a company-wide theme

Philosophy

Vision

Management Strategy

Input scenario analysis results

Climate Change Measures Division

Business Divisions — Collaborate under common goals

XX Division — Collaborate under common goals

CSR Division

Remain as limited initiatives by some divisions

Philosophy

Vision

Management Strategy

Climate Change Measures

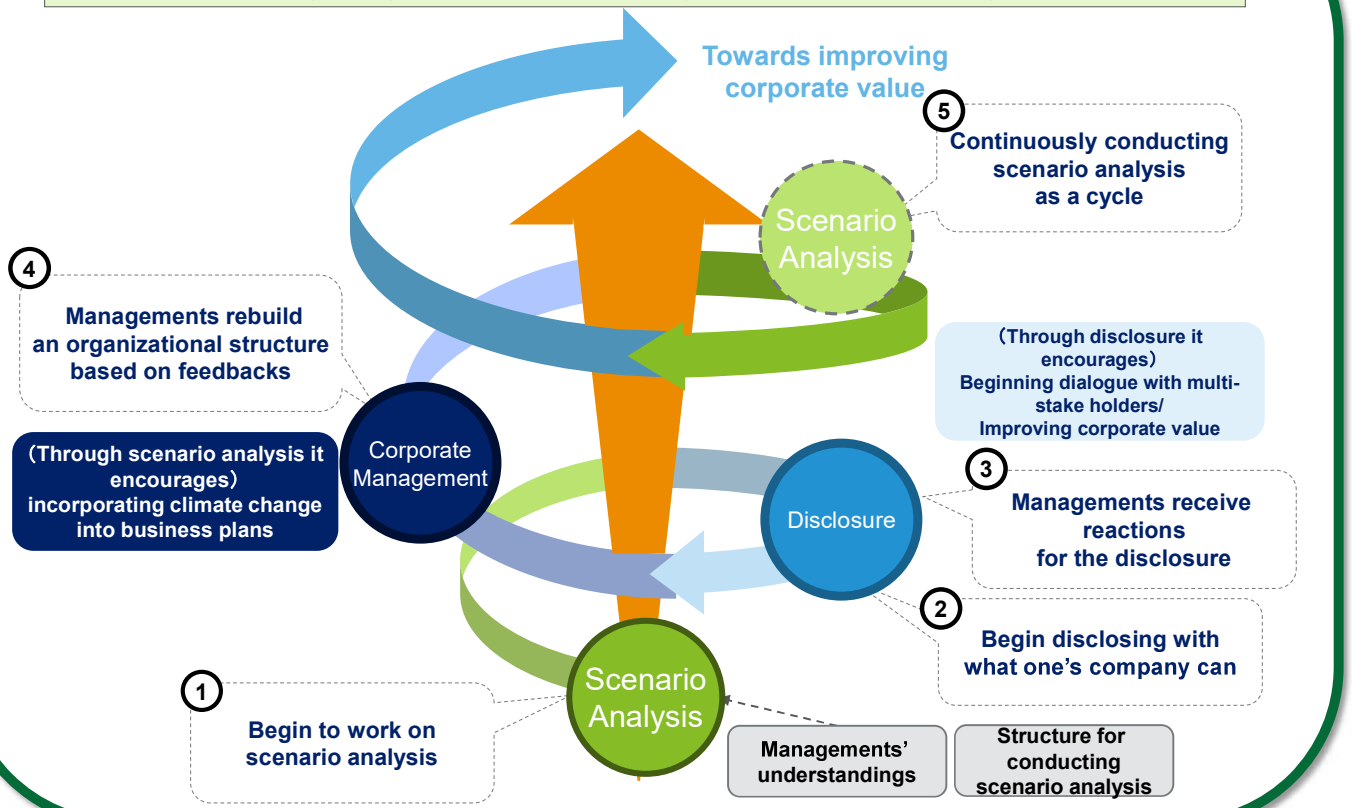
Business Divisions — Cooperation on climate change is limited

XX Division — Cooperation on climate change is limited

CSR Division

Actions to be taken for the next step?

The goal of scenario analysis is to integrate climate change with business management, and to enhance corporate value. With scenario analysis, it aims to continue the cycle of disclosing information and rebuilding an organizational structure (integration with business management).



2. Scenario Analysis - Key Points of Practice

Chapter 2 Scenario Analysis - Key Points of Practice

This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of the Environment.

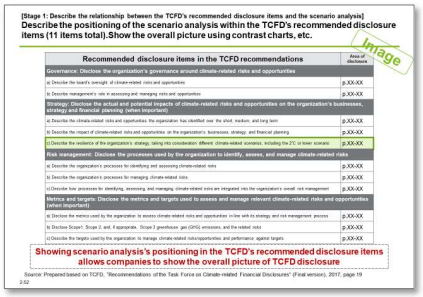
[Overview]

Describe the positioning of scenario analysis in the TCFD's recommended disclosure items and the results obtained from each step; use appropriate disclosure to achieve increased corporate value

Stage 1

Describe the relationship between the TCFD's recommended disclosure items and the scenario analysis

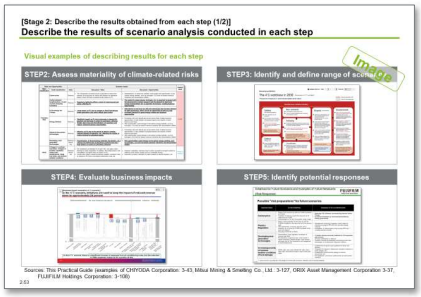
Describe the positioning of the scenario analysis within the TCFD's recommended disclosure items (11 items total). Show the overall picture using contrast charts, etc.



Stage 2

Describe the results obtained from each step

Described the results obtained from scenario analysis for each step



***It may also be helpful to reference TCFD Guidance 2.0**

Point

"What" and "how much" should be disclosed?

[Stage 1: Describe the relationship between the TCFD's recommended disclosure items and the scenario analysis]

Describe the positioning of the scenario analysis within the TCFD's recommended disclosure items (11 items total).Show the overall picture using contrast charts, etc.

Image

Recommended disclosure items in the TCFD recommendations	Area of disclosure
Governance: Disclose the organization's governance around climate-related risks and opportunities	
a) Describe the board's oversight of climate-related risks and opportunities	p.XX-XX
b) Describe management's role in assessing and managing risks and opportunities	p.XX-XX
Strategy: Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy and financial planning (when important)	
a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term	p.XX-XX
b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning	p.XX-XX
c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including the 2°C or lower scenario	p.XX-XX
Risk management: Disclose the processes used by the organization to identify, assess, and manage climate-related risks	
a) Describe the organization's processes for identifying and assessing climate-related risks	p.XX-XX
b) Describe the organization's processes for managing climate-related risks	p.XX-XX
c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management	p.XX-XX
Metrics and targets: Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities (when important)	
a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process	p.XX-XX
b) Disclose Scope1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks	p.XX-XX
c) Describe the targets used by the organization to manage climate-related risks/opportunities and performance against targets	p.XX-XX

Showing scenario analysis's positioning in the TCFD's recommended disclosure items allows companies to show the overall picture of TCFD disclosure

Source: Prepared based on TCFD, "Recommendations of the Task Force on Climate-related Financial Disclosures" (Final version), 2017, page 19

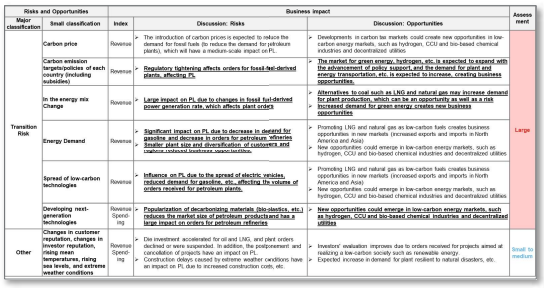
[Stage 2: Describe the results obtained from each step (1/2)]

Describe the results of scenario analysis conducted in each step

Visual examples of describing results for each step

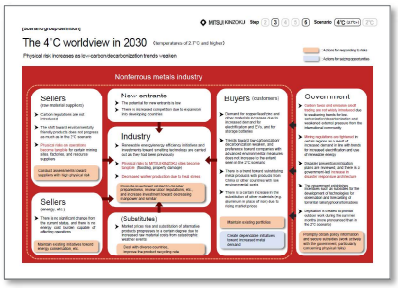
Image

STEP2: Assess materiality of climate-related risks

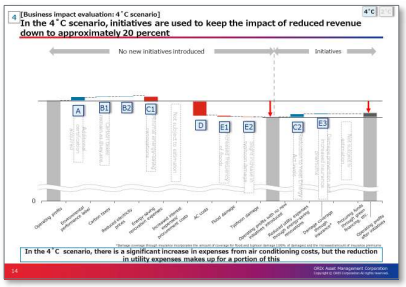


Risks and Opportunities		Business impact			
Major classification	Small classification	Index	Discussion: Risks	Discussion: Opportunities	Assessment
Transition Risk	Carbon price	Revenue	➢ The introduction of carbon prices is expected to reduce the demand for fossil fuels (to reduce the demand for petroleum plants), which will have a medium-scale impact on PL.	➢ Developments in carbon tax markets could create new opportunities in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
	Carbon emission targets/policies of each country (including subsidies)	Revenue	➢ Regulatory tightening affects orders for fossil-fuel-derived plants, affecting PL	➢ The market for green energy, hydrogen, etc. is expected to expand with the advancement of policy support, and the demand for plant and energy transportation, etc. is expected to increase, creating business opportunities.	
	In the energy mix Change	Revenue	➢ Large impact on PL due to changes in fossil fuel-derived power generation rate, which affects plant orders	➢ Alternatives to coal such as LNG and natural gas may increase demand for plant production, which can be an opportunity as well as a risk ➢ Increased demand for green energy creates new business opportunities	
	Energy Demand	Revenue	➢ Significant impact on PL due to decrease in demand for gasoline, and decrease in orders for petroleum refineries ➢ Smaller plant size and diversification of customers and customer-induced business opportunities	➢ Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia) ➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	Large
	Spread of low-carbon technologies	Revenue	➢ Influence on PL due to the spread of electric vehicles, reduced demand for gasoline, etc., affecting the volume of orders received for petroleum plants.	➢ Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia) ➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
	Developing next-generation technologies	Revenue / Spending	➢ Popularization of decarbonizing materials (bio-plastics, etc.) reduces the market size of petroleum products and has a large impact on orders for petroleum refineries	➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
Other	Changes in customer reputation, changes in investor reputation, rising mean temperatures, rising sea levels, and extreme weather conditions	Revenue / Spending	➢ Die investment accelerated for oil and LNG, and plant orders declined or were suspended. In addition, the postponement and cancellation of projects have an impact on PL. ➢ Construction delays caused by extreme weather conditions have an impact on PL due to increased construction costs, etc.	➢ Investors' evaluation improves due to orders received for projects aimed at realizing a low-carbon society such as renewable energy ➢ Expected increase in demand for plant resilient to natural disasters, etc.	Small to medium

STEP3: Identify and define range of scenarios



STEP4: Evaluate business impacts



STEP5: Identify potential responses

Sources: This Practical Guide (examples of CHIYODA Corporation: 3-43, Mitsui Mining & Smelting Co., Ltd.: 3-127, ORIX Asset Management Corporation 3-37, FUJIFILM Holdings Corporation: 3-108)

[Stage 2: Describe the results obtained from each step (2/2)]

It is important to describe climate change-related governance, as well as what was understood from the scenario analysis results and how the company plans to respond

Results of interviews with investors/experts

It is not the disclosure itself that will be evaluated; showing the results of risk/opportunity identification and the effect scenario analysis results have on management strategy is the important thing

- ✓ **Increasing corporate value is the top priority,** and disclosure is needed in cases where climate change is a significant factor for this. Consequently, **if climate change does not have materiality for the company, then there is no need to conduct a detailed analysis.**
- ✓ It is not the disclosure itself that will be evaluated; **what is important is using qualitative terms to communicate the company's current initiatives/future initiatives.** Disclosures should be made on the assumption that dialogue will take place and **describe the scenario analysis in an easy-to-understand manner as a starting point for discussion.**
- ✓ For scenario analysis disclosures, **investors want to know how the results of the scenario analysis will affect management strategy**. I am concerned that there will be companies that make scenario analysis an end in itself.

Disclosing the following will make it easier to describe the resilience of the organization's climate change-related strategies

- ✓ **Status of climate change-related governance structure** — STEP1 (2-9-11)
- ✓ **Information of data used as the basis for each scenario analysis** — STEP3 (2-25 – 28)
- ✓ **Explanation of the company's appropriate transition toward decarbonization by 2050**
  - ✓ **Current/future initiatives toward risks/opportunities identified from the scenario analysis** — STEP5 (2-43, 44) Example disclosure (2-56, 57)
  - ✓ **Narrative for climate change-related value creation based on scenario analysis results** — STEP5 (2-49), Example disclosure (2-58,59)
- ✓ **How the company will proceed with scenario analysis and achieve the goals** — STEP5 (2-45)

Source: Prepared based on interviews conducted by the Ministry of the Environment in FY2020 toward 30 investors and experts

: Reference page

“What” and “how much” should be disclosed?

Investors are not necessarily looking for "quantitative" information on the results of scenario analysis. They are focused on the impact on operations, such as management's involvement and how scenario analysis results are leveraged in the company's business and management.

Results of interviews with investors/experts

For beginning scenario analysis	**What is important is whether the company has a structure that allows it to proceed with scenario analysis, as well as management's understanding** ✓ Scenario analysis is an area which is not yet covered by mainstream discussions in company management. Because of this, many companies have outsourced the first round of scenario analysis to external consultants in their corporate planning and so on, and it is questionable whether the company has established a structure that enables it to tackle scenario analysis on its own ✓ While involving external experts is a good tactic, investors are more concerned about how the company's senior management understands sustainability risks and discusses them at board meetings
Assess materiality of climate-related risks	**This area is the core of scenario analysis, and risks/opportunities affecting businesses should be explained in detail** ✓ This area is the core of scenario analysis, and should be explained in detail
Identify and define range of scenarios	**The reasons for scenario selection should be explained. If unique viewpoints have been added, these must be explained in detail** ✓ The reasons for scenarios being selected are important, as opinions on scenarios may vary according to the industry ✓ If the company has added its own variables to the parameters, specific explanation is needed, as side-by-side comparisons with other companies cannot be made in such cases ✓ The bare minimum of analysis required in the future, as well as data and assumptions, should be made clear
Evaluate business impacts	**Opinions concerning quantitative information varied, with some investors saying that they had no problem with the current qualitative information** ✓ There is no international consensus on the methodology for impact evaluation, and at present, investors may be satisfied with qualitative information. It is expected that demand for quantitative information will be determined by the future actions of financial supervisory authorities and the influence those actions have on financial institutions and general business companies afterward ✓ Rather than providing figures, it may be better to disclose the process for internal discussions and have direct dialogue concerning impacts that cannot be publicly disclosed ✓ Investors want to know how climate change will affect business, so the company should put a theoretical image of this into figures, even if it is only a rough one ✓ For the 1.5°C scenario, companies may want to consider first assessing the impact from carbon tax, as there is data currently available for this
Identify potential responses	**Investors are focused on how the results of scenario analysis will be leveraged in the company's business and management** ✓ Investors are focused on how the results of scenario analysis will be leveraged in the company's business and management ✓ It is also important to express how climate change risks / sustainability issues will be addressed in strategies and which kinds of actions are insufficient

Source: Prepared based on interviews conducted by the Ministry of the Environment in FY2020 toward 30 investors and experts

**[Examples of how to show the organization's strategic resilience ①:
Panasonic (electrical appliances/machinery/communications)]**

Panasonic shows the organization's strategic resilience through stating that the impact from the possible risks in each scenario is minor, or that the company has implemented countermeasures against them

The analysis shows the organization's strategic resilience by stating that the impacts in the scenario analysis results are minor / are already being addressed

Scenario Analysis

World Energy Outlook 2017 (WEO2017) issued by the International Energy Agency (IEA) presents the New Policies Scenario (NPS=4 degree scenario), a set of policies to realize the targets set by various countries in the Paris Agreement, and the Sustainable Development Scenario (SDS=2 degree scenario) that could “hold the increase in the global average temperature to well below 2°C above pre-industrial levels” if executed.

Towards realization of Environment Vision 2050, we analyzed the impact of climate change on our business based on the said scenarios, discussed the countermeasures, and verified the resilience of our strategy.

Respective SDS and NPS were created on the assumption that the average temperature would rise 2°C or 4°C by 2100. Assuming that we continue the current business activities, we analyzed the impact of climate change on our business as of 2030.
SDS, the 2°C rise scenario, forecasts rapid changes in society to restrain greenhouse gas emissions by 2030. For example, the scenario estimates that an emission restriction measure possibly charging more than 100 dollars per one ton of CO_2 emissions, may be adopted. Using this 2°C rise scenario as a reference, we analyzed the impact from regulation changes on our business by 2030, assuming that there will be no major impact to the business from physical risks from climate change, such as water shortages and more frequent abnormal weather conditions.

At the same time, using NPS, the 4°C rise scenario, we analyzed the impact from physical changes due to climate change to our business by 2030, assuming that such impact from physical changes would be greater than that from regulation changes.

Results of the analyses based on the 2°C increase scenario suggest that the burden of CO_2 emissions would increase as carbon pricing is adopted by the major countries. However, effects of the burden are minor, as we have worked on reducing CO_2 emissions with our products through increase in their energy-efficiency and creating and selling energy-creating products, as well as reduction of CO_2 emission in manufacturing through roll-out of zero CO_2 model factories, to realize the Panasonic Environmental Vision 2050.

When we identify issues that need to be addressed, we gather latest information on relevant environmental regulations, using the data base on environmental regulations, and shared the information to relevant departments. In the case that taking some measures is necessary, we share the information and situation with Companies and Business Divisions, and relevant parties necessary take actions in due time. This ensures that those issues have minor effects on our businesses.

When referring to the 4°C rise scenario, we need to take account of the impact from the predicted increase in abnormal weather conditions, such as flooding and tropical storms, on the supply chain, and reduced economic activity in society. For example, we experienced large scale flooding in Thailand in 2011 and we suffered massive losses. Although we established a range of countermeasures in case of a recurrence, if some disaster hinders our business operations—or those of any party in the supply chain—sales will be affected and we would still need to direct significant funds to recover damaged facilities. To prepare for such situations, we create Business Continuity Plans (BCP) based on past experience of damage from abnormal weather conditions. At the beginning of 2012, we established the Business Continuity Management (BCM) Guidelines that focus on minimizing various risks related to factories and operations in accordance with the BCM System. As a means to reinforce disaster and accident countermeasures, we have established the Disaster/Accident Countermeasure Committee under the Global and Group Risk Management Committee, which is chaired by the Chief

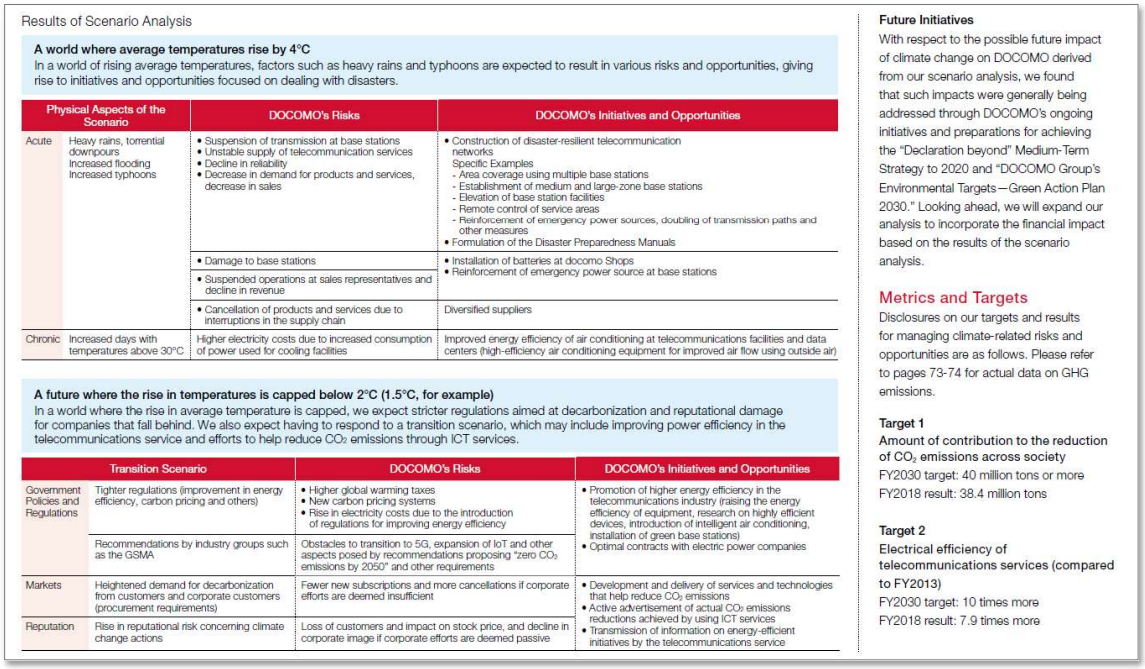
	Possible risks	Risk impacts, countermeasures
2˚C	Carbon pricing	• **Impact is minor** due to the company already making efforts toward CO2 reduction
2˚C	Changes in environmental laws and regulations	• Will have a significant impact on home electronics businesses dealing with energy-saving products ➢ **Share information on environmental laws and regulations and adopt countermeasures by working with global sites**
4˚C	Extreme weather	• Impact on the supply chain and potential reduction of economic activity ➢ **Work on developing a business continuity plan**

Source: Panasonic Corporation, "Sustainability Data Book 2020"

[Examples of how to show the organization's strategic resilience ②: NTT DOCOMO (service)]

NTT DOCOMO lists the risks for each scenario and states that the company is already working on countermeasures linked to medium- to long-term strategy

The analysis shows the organization's strategic resilience through stating that the risks are already being addressed



Results of Scenario Analysis

A world where average temperatures rise by 4°C

In a world of rising average temperatures, factors such as heavy rains and typhoons are expected to result in various risks and opportunities, giving rise to initiatives and opportunities focused on dealing with disasters.

Physical Aspects of the Scenario		DOCOMO's Risks	DOCOMO's Initiatives and Opportunities
Acute	Heavy rains, torrential downpours Increased flooding Increased typhoons	• Suspension of transmission at base stations • Unstable supply of telecommunication services • Decline in reliability • Decrease in demand for products and services, decrease in sales	• Construction of disaster-resilient telecommunication networks Specific Examples - Area coverage using multiple base stations - Establishment of medium and large-zone base stations - Elevation of base station facilities - Remote control of service areas - Reinforcement of emergency power sources, doubling of transmission paths and other measures • Formulation of the Disaster Preparedness Manuals
		• Damage to base stations	• Installation of batteries at docomo Shops • Reinforcement of emergency power source at base stations
		• Suspended operations at sales representatives and decline in revenue	
		• Cancellation of products and services due to interruptions in the supply chain	Diversified suppliers
Chronic	Increased days with temperatures above 30°C	Higher electricity costs due to increased consumption of power used for cooling facilities	Improved energy efficiency of air conditioning at telecommunications facilities and data centers (high-efficiency air conditioning equipment for improved air flow using outside air)

A future where the rise in temperatures is capped below 2°C (1.5°C, for example)

In a world where the rise in average temperature is capped, we expect stricter regulations aimed at decarbonization and reputational damage for companies that fall behind. We also expect having to respond to a transition scenario, which may include improving power efficiency in the telecommunications service and efforts to help reduce CO_2 emissions through ICT services.

Transition Scenario		DOCOMO's Risks	DOCOMO's Initiatives and Opportunities
Government Policies and Regulations	Tighter regulations (improvement in energy efficiency, carbon pricing and others)	• Higher global warming taxes • New carbon pricing systems • Rise in electricity costs due to the introduction of regulations for improving energy efficiency	• Promotion of higher energy efficiency in the telecommunications industry (raising the energy efficiency of equipment, research on highly efficient devices, introduction of intelligent air conditioning, installation of green base stations) • Optimal contracts with electric power companies
	Recommendations by industry groups such as the GSMA	Obstacles to transition to 5G, expansion of IoT and other aspects posed by recommendations proposing "zero CO_2 emissions by 2050" and other requirements	
Markets	Heightened demand for decarbonization from customers and corporate customers (procurement requirements)	Fewer new subscriptions and more cancellations if corporate efforts are deemed insufficient	• Development and delivery of services and technologies that help reduce CO_2 emissions • Active advertisement of actual CO_2 emissions reductions achieved by using ICT services • Transmission of information on energy-efficient initiatives by the telecommunications service
Reputation	Rise in reputational risk concerning climate change actions	Loss of customers and impact on stock price, and decline in corporate image if corporate efforts are deemed passive	

Future Initiatives

With respect to the possible future impact of climate change on DOCOMO derived from our scenario analysis, we found that such impacts were generally being addressed through DOCOMO's ongoing initiatives and preparations for achieving the "Declaration beyond" Medium-Term Strategy to 2020 and "DOCOMO Group's Environmental Targets—Green Action Plan 2030." Looking ahead, we will expand our analysis to incorporate the financial impact based on the results of the scenario analysis.

Metrics and Targets

Disclosures on our targets and results for managing climate-related risks and opportunities are as follows. Please refer to pages 73-74 for actual data on GHG emissions.

Target 1

Amount of contribution to the reduction of CO_2 emissions across society

FY2030 target: 40 million tons or more

FY2018 result: 38.4 million tons

Target 2

Electrical efficiency of telecommunications services (compared to FY2013)

FY2030 target: 10 times more

FY2018 result: 7.9 times more

The company lists physical and transition risks, and describes various initiatives for achieving medium- to long-term strategies against risks

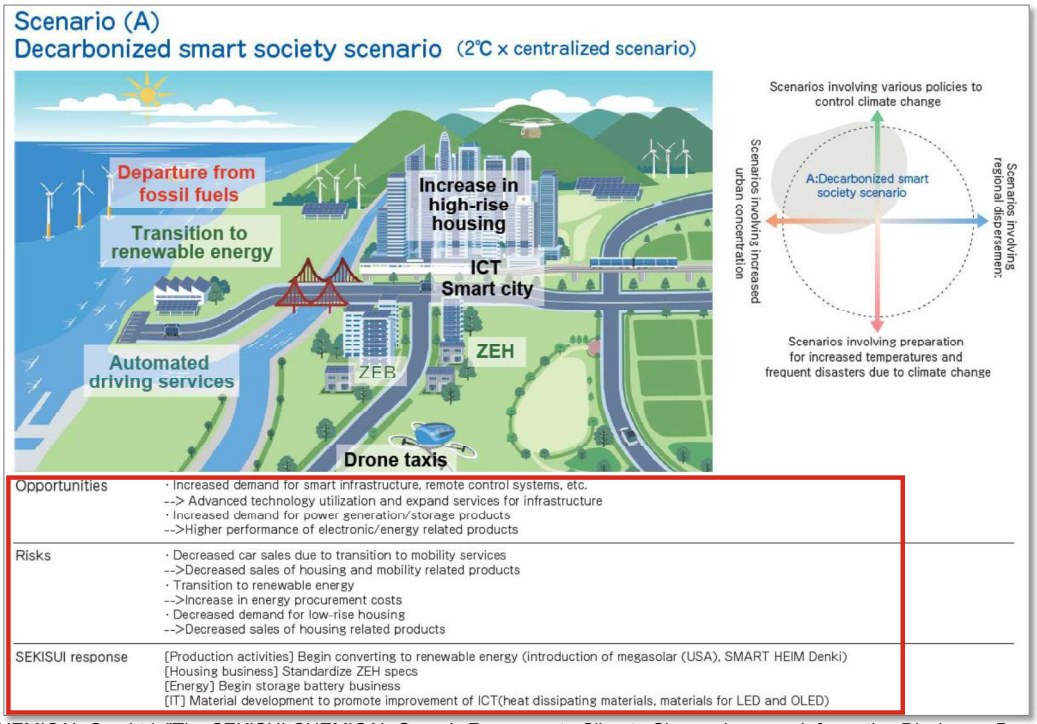
Source: NTT DOCOMO, Inc. "NTT DOCOMO GROUP SUSTAINABILITY REPORT 2019"

2-57

[Examples of how to show the organization's strategic resilience ③: SEKISUI CHEMICAL (materials/buildings)]

SEKISUI CHEMICAL describes the scenario worldview and states that the company's technology is compatible with the scenario

The analysis shows the organization's strategic resilience through stating that there are opportunities to expand business by leveraging the company's technology



Opportunities	· Increased demand for smart infrastructure, remote control systems, etc. --> Advanced technology utilization and expand services for infrastructure · Increased demand for power generation/storage products -->Higher performance of electronic/energy related products
Risks	· Decreased car sales due to transition to mobility services -->Decreased sales of housing and mobility related products · Transition to renewable energy -->Increase in energy procurement costs · Decreased demand for low-rise housing -->Decreased sales of housing related products
SEKISUI response	[Production activities] Begin converting to renewable energy (introduction of megasolar (USA), SMART HEIM Denki) [Housing business] Standardize ZEH specs [Energy] Begin storage battery business [IT] Material development to promote improvement of ICT(heat dissipating materials, materials for LED and OLED)

Source: SEKISUI CHEMICAL Co., Ltd, "The SEKISUI CHEMICAL Group's Reponses to Climate Change Issues – Information Disclosure Based on TCFD Recommendations –"

2-58

[Examples of how to show the organization's strategic resilience ④: Mitsubishi Chemical Holdings (materials)]

Mitsubishi Chemical Holdings analyzes business risks and opportunities and uses quantitative terms to state that there are opportunities for expanding the company's business

Strategy and risk management

Category	Report on FY2019	Related pages
Business opportunities and risks from perceived social issues	Under *APTSIS 20*, response to climate change has been identified as a material issue through materiality assessment, and the risks and opportunities that are recognized as well as core measures have been reported. Moreover, in formulating our medium- to long-term management basic strategy KAITEKI Vision 30 (KV30) for 2030, we identified opportunities and risks related to the social issues that the MCHC Group will face over the period to 2030. Business opportunities, including the following opportunities related to climate change, have been identified as growth businesses for the MCHC Group that contribute to solutions to social issues. The Group will expand its scale and strengthen its profitability through the implementation of the next medium-term management plan. ✔ Use energy more efficiently: Lighter mobility, electrification solutions, and chemical processes with low environmental impacts ✔ Expand renewable energy: Decentralized energy management ✔ Capture and use GHGs: CO_2 capture and utilization ✔ Use natural resources: Bio-based polymers ✔ Recycle resources: Chemical and materials recycling We quantitatively assess the risk of leaving social issues unmanaged. We recognize the increased carbon tax burden and reduced profitability due to lower demand for our products as risks that have a particularly large impact in relation to climate change. We aim to achieve a safe and secure society by minimizing damage and ensuring business continuity in the event of a large-scale natural disaster while providing solutions that contribute to disaster prevention and mitigation.	▶ *APTSIS 20*: The Group's material issues (page 29) ▶ KV30: • Growth businesses as the pillars of the portfolio (page 15) • Risks of leaving social issues unmanaged (page 14) ▶ Corporate governance: Risk management (pages 63–65) • Measures against major risks
Impact on business scale and risks from perceived social issues	• We aim to increase the percentage of revenue and profit from growth businesses, including the GHG reduction area, to over 70% and approximately ¥4 trillion or more by 2030. • We estimate that the risks associated with social issues and structural changes, including climate change, could be as large as ¥1 trillion in 2030.	▶ KV30: • Sales revenue targets for 2030 (page 16) • Risks of leaving social issues unmanaged (page 14)
Risk management	• We will strive to avoid the occurrence of major risks and minimize losses when they occur under our risk management system (see page 63). • We view climate change as a risk that is expected to grow further over the medium- to long-term, and we plan to incorporate it into KV30 and the next medium-term management plan, and consider how to manage this risk.	▶ Corporate governance: Risk management (pages 63–65) • Risk management system • Measures against major risks • Measures against future risks

Source: Mitsubishi Chemical Holdings Corporation, "KAITEKI REPORT 2020 Integrated Report"

3. Scenario Analysis - Practice Cases

Chapter 3. Scenario Analysis - Practice Cases

This chapter explains how scenario analysis is carried out based on the support cases of the Ministry of the Environment (18 companies).

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【Cases of scenario analysis by sector】
For beginning scenario analysis

Sector		Company	For beginning scenario analysis			
			Preparation① Gaining understandings from managements	Preparation② Establishing an organizational structure for scenario analysis	Preparation③ Setting target analysis	Preparation④ Setting timeline for analysis
Financial	Banks	Development Bank of Japan Inc.	—	—	3-10, 3-11	3-10
	Asset Management	ORIX Asset Management Corporation	—	—	3-25, 3-26	3-28
Non-Financial	Energy	Chiyoda Corporation	—	—	3-42	3-42
	Transportation	Kyushu Railway Company	—	—	3-50	3-54
	Buildings	Kajima CORPORTAION	—	—	3-62	3-64
	Construction Materials	LIXIL Group Corporation	—	—	3-73, 3-74	3-74
	Materials	Shin-Etsu Chemical Co., Ltd.	—	3-88	3-87, 3-92, 3-93	3-90
		FUJIFILM Holdings Corporation	—	—	3-98	3-100
		Furukawa Electric Co., Ltd.	—	—	3-110, 3-111	3-114
		Mitsui Mining & Smelting Co., Ltd.,	—	—	3-122, 3-123, 3-124	3-126
	Food	Kagome CO.,LTD.	—	—	3-139	3-141
		Calbee, Inc.	—	—	3-156	3-158
		Meiji Holdings Co., Ltd.	—	—	3-165	3-165
	Electronic Equipment	KYOCERA Corporation	—	—	3-182	3-183
		YASKAWA Electric Corporation	—	—	3-195	3-198
	Retailing	ASKUL Corporation	—	—	3-207, 3-208	3-209
		Seven & i Holdings Co., Ltd.	—	—	3-222	3-225
	Consumer Product	Lion Corporation	—	3-235	3-235	3-235

【Cases of scenario analysis by sector】
STEP2. Assess materiality of climate-related risks

Sector		Company	STEP2. Assess materiality of climate-related risks		
			Stage 1 Listing risk items	Stage 2 Identifying potential impact on business	Stage 3 Assessing materiality of risks
Financial	Banks	Development Bank of Japan Inc.	3-13	3-13	3-13
	Asset Management	ORIX Asset Management Corporation	3-27	3-27	3-27
Non-Financial	Energy	Chiyoda Corporation	3-43	3-43	3-43
	Transportation	Kyushu Railway Company	3-52, 3-53	3-52, 3-53	3-52, 3-53
	Buildings	Kajima CORPORTAION	3-63	3-63	3-63
	Construction Materials	LIXIL Group Corporation	3-75	3-75	3-75
	Materials	Shin-Etsu Chemical Co., Ltd.	3-94 ~ 3-96	3-94 ~ 3-96	3-94 ~ 3-96
		FUJIFILM Holdings Corporation	3-99	3-99	3-99
		Furukawa Electric Co., Ltd.	3-113	3-113	3-113
		Mitsui Mining & Smelting Co., Ltd.,	3-125	3-125	3-125
	Food	Kagome CO.,LTD.	3-140	3-140	3-140
		Calbee, Inc.	3-157	3-157	3-157
		Meiji Holdings Co., Ltd.	3-166, 3-167	3-166, 3-167	3-166, 3-167
	Electronic Equipment	KYOCERA Corporation	3-182	3-182	3-182
		YASKAWA Electric Corporation	3-196, 3-197	3-196, 3-197	3-196, 3-197
	Retailing	ASKUL Corporation	3-207, 3-208	3-207, 3-208	3-207, 3-208
		Seven & i Holdings Co., Ltd.	3-223, 3-224	—	3-223, 3-224
	Consumer Product	Lion Corporation	3-236, 3-237	3-236, 3-237	3-236, 3-237

【Cases of scenario analysis by sector】
STEP3. Identify and define range of scenarios

Sector		Company	STEP3. Identify and define range of scenarios		
			Stage 1 Choosing scenarios	Stage 2 Obtaining forecast information on relevant parameters (viable)	Stage 3 Shaping worldview in consideration of stakeholders
Financial	Banks	Development Bank of Japan Inc.	3-14, 3-15	3-13 ~ 3-15	3-16 ~ 3-19
	Asset Management	ORIX Asset Management Corporation	3-28	3-29	3-30 ~ 3-34
Non-Financial	Energy	Chiyoda Corporation	3-42	3-44	3-45, 3-46
	Transportation	Kyushu Railway Company	3-54	3-57	3-55, 3-56
	Buildings	Kajima CORPORTAION	3-64	3-65	3-66, 3-67
	Construction Materials	LIXIL Group Corporation	3-74	3-80	3-76 ~ 3-79
	Materials	Shin-Etsu Chemical Co., Ltd.	3-90	—	—
		FUJIFILM Holdings Corporation	—	3-100	3-101 ~ 3-104
		Furukawa Electric Co., Ltd.	—	—	3-115 ~ 3-117
		Mitsui Mining & Smelting Co., Ltd.,	3-126	—	3-127 ~ 3-130
	Food	Kagome CO.,LTD.	3-141	3-142	3-143 ~ 3-145
		Calbee, Inc.	3-158	3-159	3-160, 3-161
		Meiji Holdings Co., Ltd.	3-165	3-168	3-169, 3-170
	Electronic Equipment	KYOCERA Corporation	3-183	3-184	3-185 ~ 3-188
		YASKAWA Electric Corporation	3-198	3-199	3-200 ~ 3-203
	Retailing	ASKUL Corporation	3-209	3-210	3-211, 3-212
		Seven & i Holdings Co., Ltd.	3-225	3-226	3-227, 3-228
	Consumer Product	Lion Corporation	3-238	3-239	3-240 ~ 3-243

【Cases of scenario analysis by sector】
STEP4. Evaluate business impacts

Sector		Company	STEP4. Evaluate business impacts		
			Stage 1 Identifying potential financial indicators affected by risks and opportunities	Stage 2 Considering calculation formula and estimating financial impact	Stage 3 Being aware of the gap between future outlook and financial indicators in the business as usual
Financial	Banks	Development Bank of Japan Inc.	—	3-16 ~ 3-20	—
	Asset Management	ORIX Asset Management Corporation	3-35	3-35	3-36 ~ 3-39
Non-Financial	Energy	Chiyoda Corporation	3-47	3-47	3-48
	Transportation	Kyushu Railway Company	3-58	—	3-58
	Buildings	Kajima CORPORTAION	3-68	—	3-69
	Construction Materials	LIXIL Group Corporation	3-81	—	3-82, 3-83
	Materials	Shin-Etsu Chemical Co., Ltd.	—	3-91	—
		FUJIFILM Holdings Corporation	3-105	3-105	3-106, 3-107
		Furukawa Electric Co., Ltd.	—	—	3-118, 3-119
		Mitsui Mining & Smelting Co., Ltd.,	3-131, 3-132	—	3-131, 3-132
	Food	Kagome CO.,LTD.	3-146	3-146	3-147 ~ 3-148
		Calbee, Inc.	—	3-162	3-162
		Meiji Holdings Co., Ltd.	3-171, 3-178	3-171, 3-178	3-172, 3-179
	Electronic Equipment	KYOCERA Corporation	—	—	3-189
		YASKAWA Electric Corporation	3-204	3-204	—
	Retailing	ASKUL Corporation	3-213, 3-214	—	3-213, 3-214
		Seven & i Holdings Co., Ltd.	3-229, 3-230	—	3-229, 3-230
	Consumer Product	Lion Corporation	3-244	3-244	3-245, 3-246

【Cases of scenario analysis by sector】
STEP5. Identify potential responses

Sector		Company	STEP5. Identify potential responses			STEP6. Document and disclose information	
			Stage 1 Understand company's current status on risk management	Stage 2 Consider future countermeasures for climate-related risk management and seizing opportunities	Stage 3 Establish an organizational structure and consider practical countermeasures and how to proceed scenario analysis	Stage 1 Describe the relationship between the TCFD's recommended disclosure items and the scenario analysis	Stage 2 Describe the results obtained from each step
Financial	Banks	Development Bank of Japan Inc.	—	3-22	3-23	—	—
	Asset Management	ORIX Asset Management Corporation	—	3-39	—	—	3-40
Non-Financial	Energy	Chiyoda Corporation	—	3-48	—	—	—
	Transportation	Kyushu Railway Company	—	3-59	—	3-60	3-60
	Buildings	Kajima CORPORTAION	—	3-70, 3-71	—	—	—
	Construction Materials	LIXIL Group Corporation	—	—	3-84	—	—
	Materials	Shin-Etsu Chemical Co., Ltd.	—	3-95, 3-96	3-89	—	3-95, 3-96
		FUJIFILM Holdings Corporation	3-108	3-108	—	—	—
		Furukawa Electric Co., Ltd.	—	3-118 ~ 3-120	—	—	—
		Mitsui Mining & Smelting Co., Ltd.,	—	3-133	3-134 ~ 3-136	—	3-122, 3-123, 3-125 ~ 3-133, 3-136
	Food	Kagome CO.,LTD.	—	3-149 ~ 3-152	—	—	—
		Calbee, Inc.	3-163	3-163	—	—	—
		Meiji Holdings Co., Ltd.	3-173, 3-180	3-173, 3-180	—	—	—
	Electronic Equipment	KYOCERA Corporation	3-190 ~ 3-192	3-190 ~ 3-192	—	—	—
		YASKAWA Electric Corporation	—	3-205	3-205	—	3-205
	Retailing	ASKUL Corporation	—	3-215, 3-216	3-217 ~ 3-220	—	3-217 ~ 3-220
		Seven & i Holdings Co., Ltd.	—	3-233	—	—	—
	Consumer Product	Lion Corporation	3-247	3-247	—	—	—

【Cases of scenario analysis by sector（in the practical guide ver2.0）】
For beginning scenario analysis,STEP2. Assess materiality of climate-related risks

Sector		Company	For beginning scenario analysis			
			Preparation① Gaining understandings from managements	Preparation② Establishing an organizational structure for scenario analysis	Preparation③ Setting target analysis	Preparation④ Setting timeline for analysis
Non-Financial	Energy	ITOCHU Corporation	—	—	the practical guide ver2.0 3-22	the practical guide ver2.0 3-24
	Transportation	Mitsui O.S.K. Lines, Ltd.	—	—	—	the practical guide ver2.0 3-39
		Japan Airlines Co., Ltd.	—	—	—	the practical guide ver2.0 3-50
		Mitsubishi Motors Corporation	—	—	—	the practical guide ver2.0 3-55, 3-58
	Buildings/Forest Products	Sumitomo Forestry Co., Ltd.	—	—	—	the practical guide ver2.0 3-74
		Tokyu Fudosan Holdings Corporation	—	—	the practical guide ver2.0 3-86	the practical guide ver2.0 3-86

Sector		Company	STEP2. Assess materiality of climate-related risks		
			Stage 1 Listing risk items	Stage 2 Identifying potential impact on business	Stage 3 Assessing materiality of risks
Non-Financial	Energy	ITOCHU Corporation	the practical guide ver2.0 3-23	the practical guide ver2.0 3-23	the practical guide ver2.0 3-23
	Transportation	Mitsui O.S.K. Lines, Ltd.	the practical guide ver2.0 3-38	the practical guide ver2.0 3-38	the practical guide ver2.0 3-38
		Japan Airlines Co., Ltd.	the practical guide ver2.0 3-49	the practical guide ver2.0 3-49	the practical guide ver2.0 3-49
		Mitsubishi Motors Corporation	the practical guide ver2.0 3-56, 3-59	the practical guide ver2.0 3-56, 3-59	—
	Buildings/Forest Products	Sumitomo Forestry Co., Ltd.	the practical guide ver2.0 3-72, 3-73	the practical guide ver2.0 3-72, 3-73	the practical guide ver2.0 3-72, 3-73
		Tokyu Fudosan Holdings Corporation	the practical guide ver2.0 3-87	the practical guide ver2.0 3-87	the practical guide ver2.0 3-87

Source：Ministry of the Environment, " Practical guide for Scenario Analysis in line with the TCFD recommendations 2nd edition"

【Cases of scenario analysis by sector（in the practical guide ver2.0）】
STEP3. Identify and define range of scenarios, STEP4. Evaluate business impacts

Sector		Company	STEP3. Identify and define range of scenarios		
			Stage 1 Choosing scenarios	Stage 2 Obtaining forecast information on relevant parameters (viable)	Stage 3 Shaping worldview in consideration of stakeholders
Non-Financial	Energy	ITOCHU Corporation	the practical guide ver2.0 3-24	the practical guide ver2.0 3-25	the practical guide ver2.0 3-26, 3-27
	Transportation	Mitsui O.S.K. Lines, Ltd.	the practical guide ver2.0 3-39	the practical guide ver2.0 3-40, 3-41	the practical guide ver2.0 3-42 ~ 3-45
		Japan Airlines Co., Ltd.	the practical guide ver2.0 0 3-50	—	the practical guide ver2.0 3-51, 3-52
		Mitsubishi Motors Corporation	—	the practical guide ver2.0 3-56, 3-59	the practical guide ver2.0 3-55, 3-58
	Buildings/Forest Products	Sumitomo Forestry Co., Ltd.	the practical guide ver2.0 3-74	the practical guide ver2.0 3-81	the practical guide ver2.0 3-75 ~ 3-80
		Tokyu Fudosan Holdings Corporation	—	—	the practical guide ver2.0 3-88, 3-90

Sector		Company	STEP4. Evaluate business impacts		
			Stage 1 Identifying potential financial indicators affected by risks and opportunities	Stage 2 Considering calculation formula and estimating financial impact	Stage 3 Being aware of the gap between future outlook and financial indicators in the business as usual
Non-Financial	Energy	ITOCHU Corporation	—	—	the practical guide ver2.0 3-28
	Transportation	Mitsui O.S.K. Lines, Ltd.	the practical guide ver2.0 3-46, 3-47	—	the practical guide ver2.0 3-46,47
		Japan Airlines Co., Ltd.	the practical guide ver2.0 3-53	—	—
		Mitsubishi Motors Corporation	—	—	the practical guide ver2.0 3-56, 3-59
	Buildings/Forest Products	Sumitomo Forestry Co., Ltd.	—	—	the practical guide ver2.0 3-83, 3-84
		Tokyu Fudosan Holdings Corporation	—	—	the practical guide ver2.0 3-89, 3-91

Source：Ministry of the Environment, " Practical guide for Scenario Analysis in line with the TCFD recommendations 2nd edition"

【Cases of scenario analysis by sector（in the practical guide ver2.0）】
STEP5. Identify potential responses

Sector		Company	STEP5. Identify potential responses		
			Stage 1 Understand company's current status on risk management	Stage 2 Consider future countermeasures for climate-related risk management and seizing opportunities	Stage 3 Establish an organizational structure and consider practical countermeasures and how to proceed scenario analysis
Non-Financial	Energy	ITOCHU Corporation	—	—	—
	Transportation	Mitsui O.S.K. Lines, Ltd.	—	—	—
		Japan Airlines Co., Ltd.	—	—	—
		Mitsubishi Motors Corporation	—	—	—
	Buildings/Forest Products	Sumitomo Forestry Co., Ltd.	—	—	—
		Tokyu Fudosan Holdings Corporation	—	—	—
	Construction Materials	ITOCHU Corporation	—	the practical guide ver2.0 3-104	—

Source：Ministry of the Environment, " Practical guide for Scenario Analysis in line with the TCFD recommendations 2nd edition"

Financial Sector (Banks)

✓ Practice Case ①：Development Bank of Japan Inc.

Overview of our scenario analysis

- Scenario analysis of transition risks and analysis of expected impact on loans and investments by 2050 (Principle)

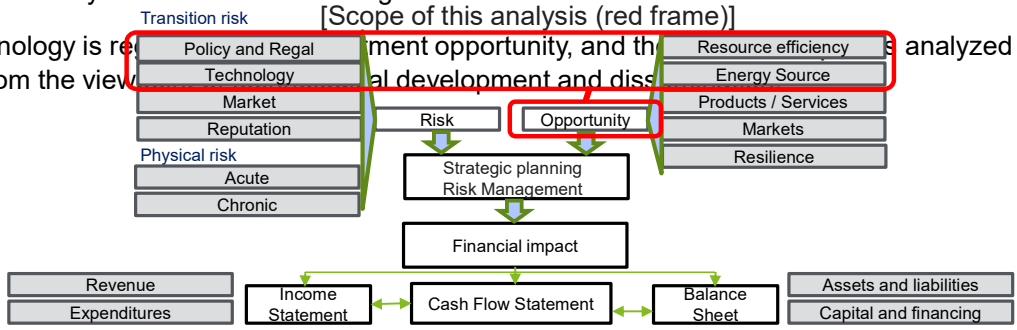
⇒ Focus on technological innovations and risks and opportunities due to policies and regulations aimed at realizing a low-carbon society and a decarbonized society.

- It is necessary for us to envision various economic and social scenarios in the future, including climate-related risks and opportunities, and to consider the optimal portfolios accordingly.

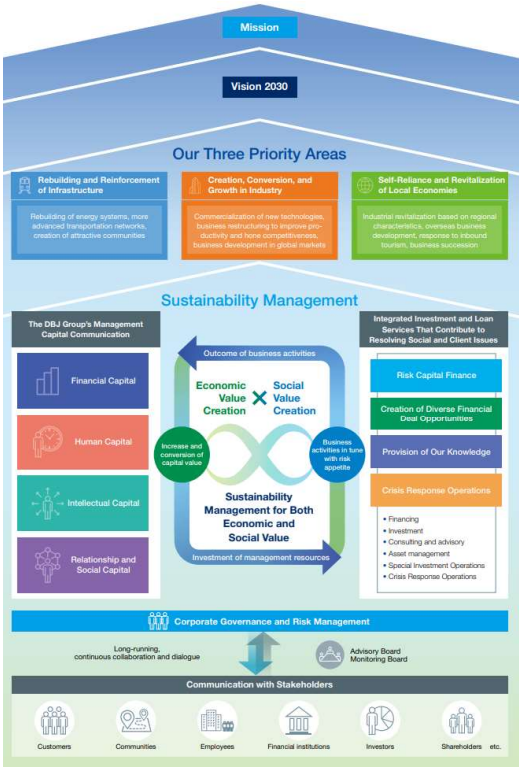
⇒To take into account socio-economic trends associated with climate change, utilizing the "Shared Socioeconomic Pathways: SSP" scenarios

- 5 technologies (CCS, EV, biomass, hydrogen, renewable energy) are focused as a trial basis from among technologies closely related to climate change.

⇒Each technology is re ment opportunity, and th analyzed and evaluated by scenario from the view al development and diss



Sectors to be analyzed



- We select 3 sectors (A, B, and C) from our “Three Priority Areas” (Materiality), taking into account the balance of money loans and other factors.
- Opinions from departments in the relevant sector are also reflected in the analysis.

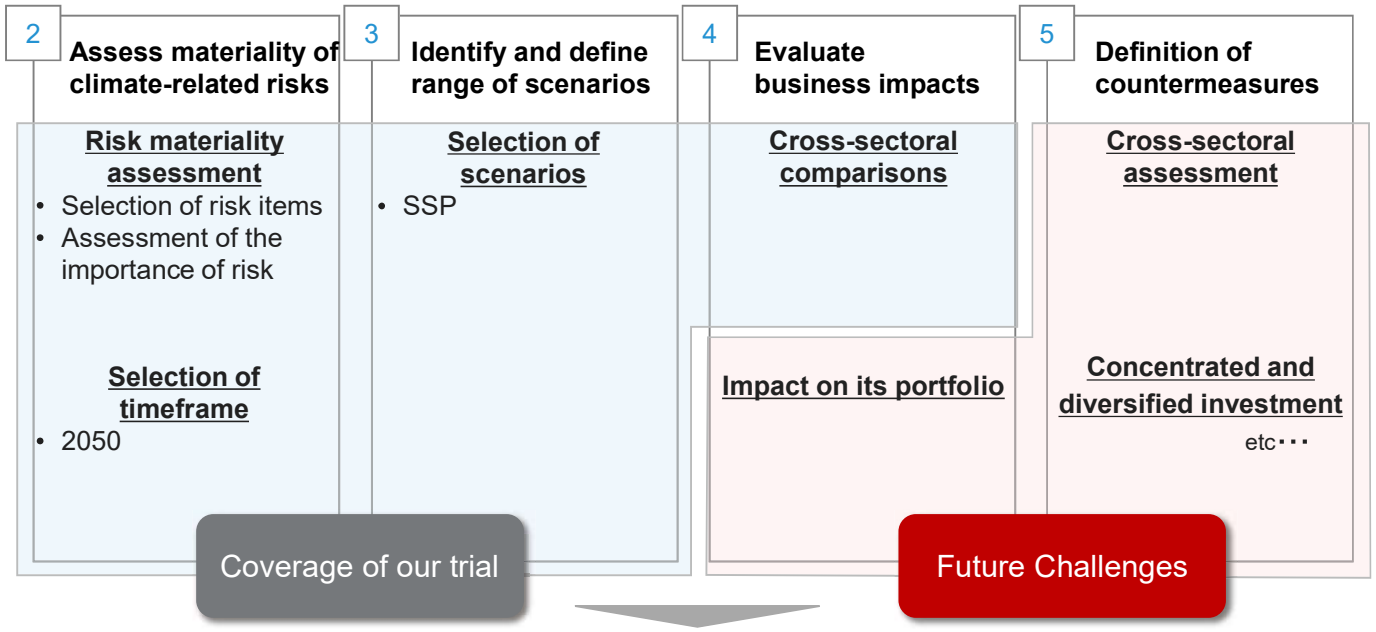
Our Three Priority Areas

The DBJ Group has established infrastructure, industry, and the regions as its three priority areas based on the roles it has played and the functions it has undertaken to date, the social value it has realized, and future changes in the external environment. Leveraging its professional strengths, the Group is assessing long-term changes in the external environment to provide creative solutions to issues confronting clients in infrastructure, industry, and the regions and thereby play a part in creating a sustainable society.

Rebuilding of energy systems, more advanced of transportation networks, creation of attractive communities	Rebuild energy and transportation infrastructure, upgrade public infrastructure Promote urban growth
Commercialization of new technologies, business restructuring to improve productivity and hone competitiveness, business development in global markets	New technologies and businesses (promote innovation) Reorganization Overseas expansion
Industrial revitalization based on regional characteristics, overseas business development, response to inbound tourism, business succession	Solve issues specific to each region Play a role connecting regions to Tokyo, regions to regions, and regions to the world

1 [Overview]

Steps to implement scenario analysis



For this analysis, we select assessment of the importance of risk(technologies/policies), timeframe (2050), and SSP Scenarios.

2 [Evaluation of the importance of risk]

Step 2 3 4 5

Risk materiality assessment and analytical perspectives after step 3

① Selection and assessment of risk items (example)

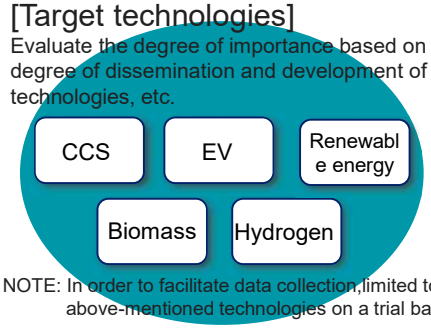
Risk item	Business impact/Uncertainty	
Small classification	Discussion	Assessment
Carbon price	➢ Introduction of carbon prices to electricity generates additional costs for the company's power generation and increases the company's expenditure. Consumer burdens increase when costs are reflected in electricity sales prices, but consumers are more likely to choose renewable energy that gives them a competitive advantage in terms of carbon prices.	Large ～ Medium ～ Small
Dissemination of renewable energy and energy-saving technologies	Classify each risk item, and consider and assess the business impact and uncertainty associated with each item.	
Developing next-generation technologies		
Carbon Emissions Targets/Policies in Each Country		
Changes in the energy mix		

■ In the many of scenario analyses, company classifies each risk item specifically and assess the importance risk according to temperature targets: 1.5℃, 2℃, and 4℃.

② Viewpoints of the analysis after step 3

[Target technologies]

Evaluate the degree of importance based on the degree of dissemination and development of technologies, etc.

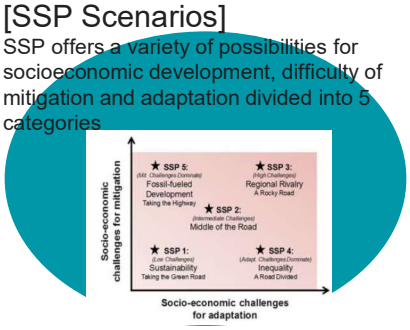


NOTE: In order to facilitate data collection, limited to the above-mentioned technologies on a trial basis

×

[SSP Scenarios]

SSP offers a variety of possibilities for socioeconomic development, difficulty of mitigation and adaptation divided into 5 categories



■ Afterwards, we will focus on "technology" as an investment opportunity, which is included in risk items. In order to consider the economic and social factors behind climate change, analysis was conducted using the SSP Scenarios.

Selection of SSP scenarios

	Scenario name	IPCC temperature zone	Overview of the worldview	Focusing on achieving a decarbonized society	International cooperation
Sustain-able	SSP1	1.5℃	Decarbonized society worldwide	✓ Policies for sustainability have been adopted, and a decarbonized society is highly likely to be realized. Optimization methods are applied to renewable energy.	✓ Assuming a world in which international cooperation is advancing and the Paris Agreement is respected
	SSP3	4℃	Nationalism/Regionalism caused by economic disparities	✓ Policies on environmental issues are of low priority, and it is difficult to achieve a decarbonizing society.	✓ Assuming a world that prioritizes domestic interests and values rather than international cooperation such as the Paris Agreement
	SSP5-1	2℃	Fossil-fueled Low-carbon society	✓ The society depended on fossil fuels, but low carbon will progress to some extent with the use of CCS and other technologies.	✓ Assuming a worldview based on cooperation aimed at by the Paris Agreement
Conventional development	SSP5-2	4℃	Fossil-fueled conventional development society	✓ Expecting growth depended on fossil fuels, it is difficult to achieve a decarbonizing society.	✓ Assuming a worldview that does not presuppose cooperation aimed at by the Paris Agreement

(Reference) Economic and policy background data on SSP1-5 scenarios

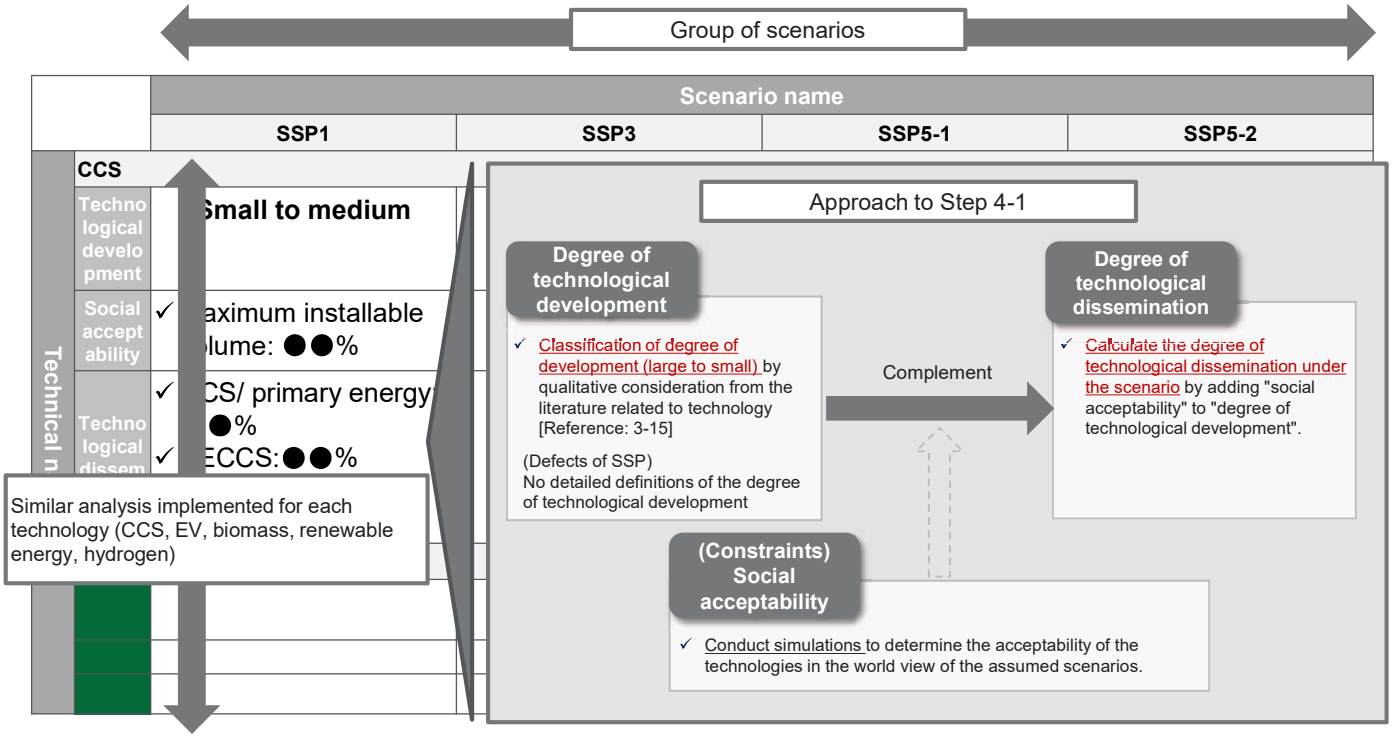
		SSP1	SSP2	SSP3	SSP4	SSP5
Economic and lifestyle	Economic growth	Growth rates are high in low-and middle-income countries, and moderate in high-income countries.	Medium, heterogeneous	Slow (low)	Low-income countries have low growth rates. Others are medium	High
	Disparity	Disparity narrows in Japan and overseas	Different conditions for the elimination of disparities in Japan and overseas	There is a large gap between Japan and overseas.	Expansion especially in Japan	Disparity narrows sharply in Japan and overseas
	International trade	Medium	Medium	Enforcement of strong restrictions	Medium	Trade is active. Production with comparative advantage of each country
	Globalization	Markets are unified and production is carried out in each region.	Some degree of freedom in globalization	Reverse from globalization. Active regional security policies	Elite employees have global connections	Globalization advances and markets move toward unification.
	Consumption trend	Physical consumption decreases in high-income countries. Expand meat-free meals	Consumption centeres on physical consumption, moderate meat consumption	Mainly physical consumption	Consumption levels are high among elites, but low among others.	Material consumption, tourism and mobility consumption Meat-centric life
Policies and Related Organizations	International cooperation	Have the effect	Relatively weak	Weak	Globally unified markets outside of vulnerable people	Targets for development are achieved, but targets for the environment are not achieved.
	Environmental policy	Improved management at regional and global volume levels. Strengthening pollution regulation	Although there are concerns about pollution at the local level, putting into practice is successful	Priority on environmental issues is low.	Middle-and high-income countries focus on environmental issues, without measures for vulnerable people	Focus on domestic policies, but lack of interest in global initiatives
	Policy direction	Sustainability policy	Focus less on sustainability	Concentration of security-related policies	Policies that benefit the business elite	Implementation of policies related to free markets, human resources development, and development
	Relevant agencies	The state and international organizations have influence	Have a moderate influence	Weak influence of international organizations	Effective measures for politics and business elites	To foster a competitive market, relevant agencies will cooperate more closely

Source: Brian C. O'Neill et al. (2017) "The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century"

Steps to evaluate business impact

	Step 4-1	Step 4-2	Step 4-3
Overview of Evaluation	Evaluation of 5 technologies (Qualitative & Quantitative) ✓ Classify of the technological development and acceptance by scenarios.	Business impact evaluation (Qualitative) ✓ Evaluate sector impact based on scenario worldview and technology evaluation	Business impact evaluation (Quantitative) ✓ Quantify the degree of impact of technology in the scenario and Japan's strengths in technology, and consolidate them into sectoral units to evaluate "business impact."
Analytical methods	✓ Extract technology-related descriptions from multiple literature on climate change and classify "technological progress" into 3 stages ✓ We conduct simulations for each SSP scenario and calculate "degree of technological dissemination" by taking into account the results.	✓ Qualitatively evaluate the external impact of 3 sectors × 4 scenarios using 5Force analyses	✓ Select recommended technologies for investment by sector and scenario, and construct our investment portfolio ✓ Scored "degree of impact of technology" (up to 6 points) from the viewpoint of necessity of government support and coverage of technology ✓ Evaluation of Japan's technological strengths on a 3-stage scale based on comparison with other countries' policies and budget requests in Japan

Step 4-1 Diagram



(Reference) “Degree of technological development” by scenarios

	Scenario name			
	SSP1	SSP3	SSP5-1	SSP5-2
Technical name: CCS	＊～＊＊	＊～＊＊	＊＊＊	＊＊＊
Technical name: Bio…				
Technical name: Hyd… e				
Technical name: R… energy				

Approach to Classification of "Development"

(Classification examples)

Degree of technological development			
	High（＊＊＊）	Medium（＊＊）	Low（＊）
Technical name: CC(U)S	• **CCS**：Realization of great cost cut. Technologies related to BECCS become commercialized and spread	• **CCS**：Technological development advances, as well as cost cut	• **CCS**：Technology would not advance. EOR project would be promoted

- Descriptions on each technology were extracted from several literature on climate change, and discussions were made based on their tone volumes, etc., and finally, the degree of technological progress was classified into 3 stages.
- Due to the nature of the classification, some combinations of technologies and scenarios are represented by ranges as shown in the dashed lines.

Step 4-2 Diagram: Qualitative evaluation and 5Force analyses

Sector A
(Global)

: Expected actions

Supplier

<SSP1's worldview>
✓ Globalization: The market is unified and production is carried out in each region.

<Total sectors>

<Sub-…

<Sub-…

<Sub-sector 7>

New comer

Industry/ Company

<SSP1's worldview>
✓ Diparities: Narrows in Japan and overseas

<Total sectors>

<Sub-sector 7>

Customer

<Total sectors>

<Sub-sector 5>

<Sub-sector 6>

Government

<SSP1's worldview>
✓ Emphasizing global and national development and achieving sustainability goals
✓ Growth rates: high in low- and middle-income countries but unchanged in high-income countries
✓ International cooperation: achieving both international mitigation and adaptation to climate

…ward

…ment of …cies at …lobal

<Sub-sector 5>

<Sub-sector 6>

<Sub-sector 7>

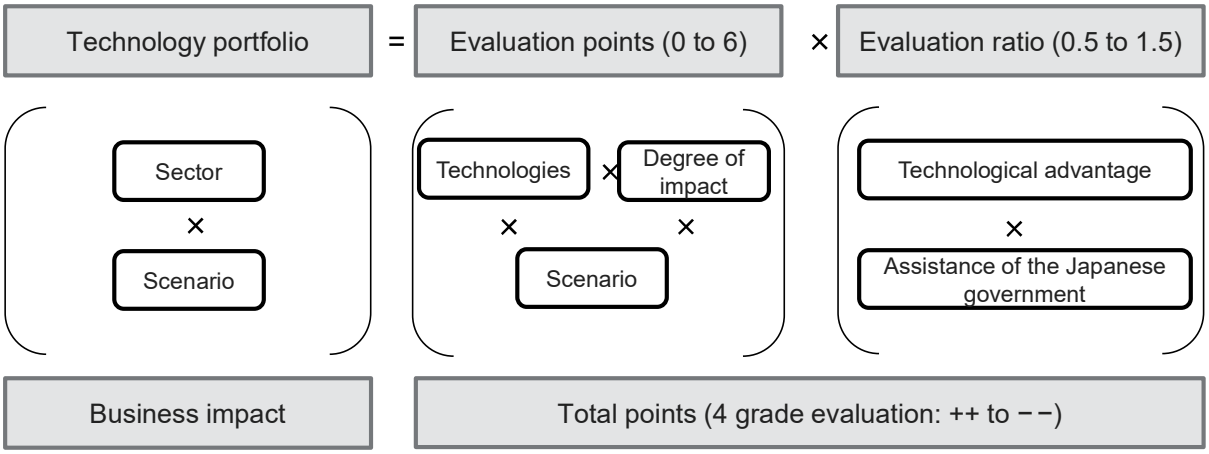
- Describe sectoral impact in a narrative manner based on scenario worldview and evaluation of technology
- Conduct similar analyses by sector and by scenario
- These analyses clarify the relationship between "sectors" and "technologies" related to climate change
- Based on these analyses, construct technology portfolio for investment (Step 4-3)

Approach to evaluate business impact

■ Quantify "degree of impact of technology" and "Japan ‘s strengths" for relative evaluation. Based on these results, construct technology portfolio to conduct business impact evaluation

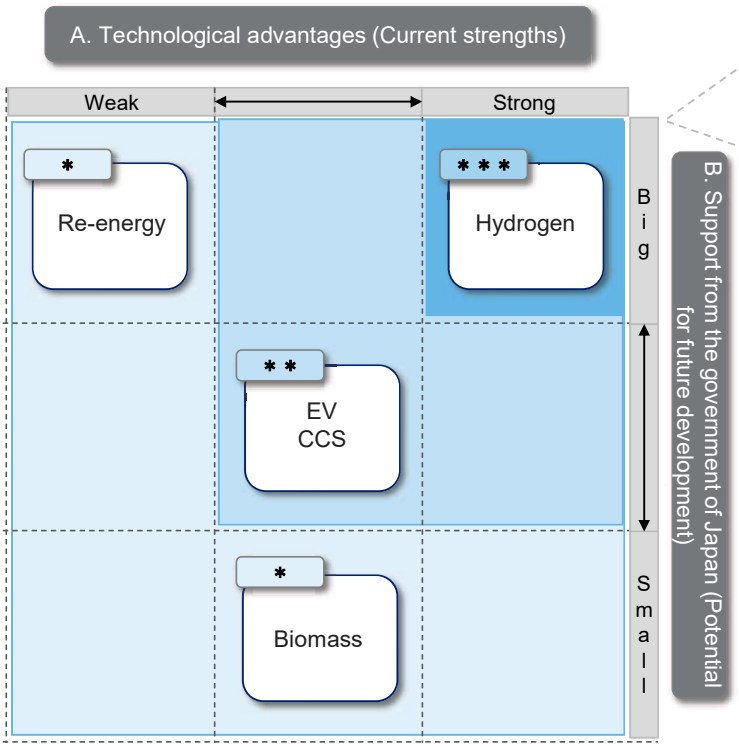
Evaluation Summary

- ✓ Based on 5Force analyses, select recommended technologies for investment by sector and scenario, and construct our investment portfolio in each sector
- ✓ Scored as "degree of technological impact" (up to 6 points) by adding consistency with global data to "degree of technological dissemination" selected in STEP1.
- ✓ Evaluation of Japan's technological strengths on a scale of small to large
  "Strengths" in this analysis: Defined as an evaluation ratio whether Japan has the uniqueness of its technology and has the potential to promote it worldwide in the future. [Reference: 3-18]



(Reference) Approach to evaluate Japan's technology strengths

■ Setting technologies in which Japanese companies have relative advantages



Evaluation	Points	Significance of Evaluation
* * *	1.5	✓ Japan has a high degree of uniqueness regarding technology, and the size of the government's budget is also large.
* *	1	✓ Medium both in terms of technical uniqueness and budget size in Japan
*	0.5	✓ Other countries are ahead of the other countries in terms of technology, and the budget is low.

Evaluation Standards

A. Current strengths

- Comparing the content of reports published by the government and related organizations, if the technology strategy is unique, it is evaluated as strong, and if the technology is implemented in Europe, Central America, it is evaluated as weak, depending on the strategy's expansion.

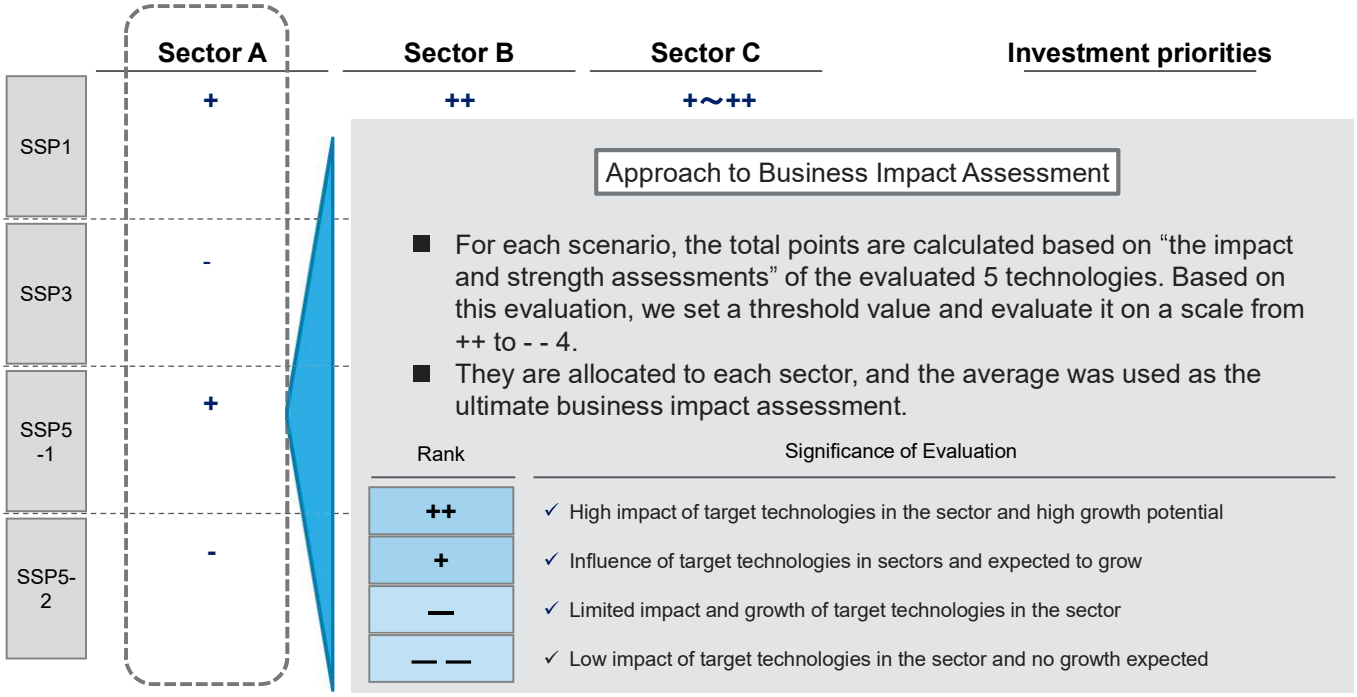
B. Assistance of the Japanese government

- Referring to METI's "Outline of Resource and Energy Related Budget" for FY2020, evaluation is made on a big scale when the budget is JPY50 billion or more, on a medium scale when the budget is JPY10 billion or more, and on a small scale when the budget is less than JPY10 billion.

Note: Created based on information as of February 2019

Step 4-3 Diagram: Business impact evaluation

■ Consider the priority of investment based on the evaluation of business impact



Future challenges

■ During the scenario analysis, we only focused on scenario building on “future world view” and analyzing opportunities this time.
⇒ Consider utilizing the scenario analysis as one of the tools for strategic investment in the future. Issues to be addressed are developing the scenario analysis and establishing organizational structure.

Points of Attention and Issues		
Enhancement of scenario analysis	Development of evaluation tools	Update and review of technology parameters
		Adoption of the Japanese version of SSP
	Research of other risks	Physical risk
		Transition risk
To build a system	Organizational Collaboration	Communication with related departments
		Investigation of evaluation method
	Business continuity	Establishment of a monitoring system

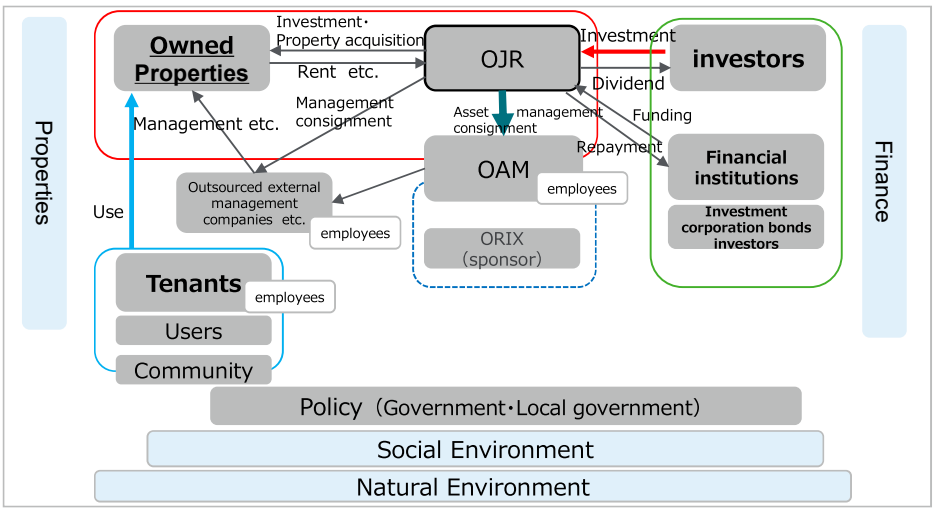
Financial Sector (Asset Management)

✓ Practice Case ①: ORIX Asset Management Corporation

2 [Covered business]
We will cover OAM's management of REIT assets

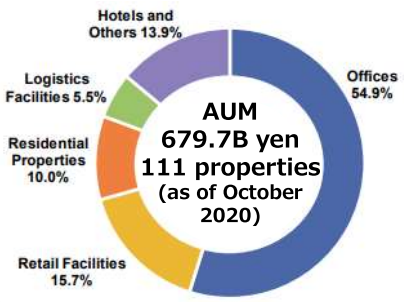
ORIX Asset Management Corporation (OAM) is the asset management company of ORIX JREIT Inc. (OJR), a listed REIT. The scenario analysis will cover the management of OJR's assets.

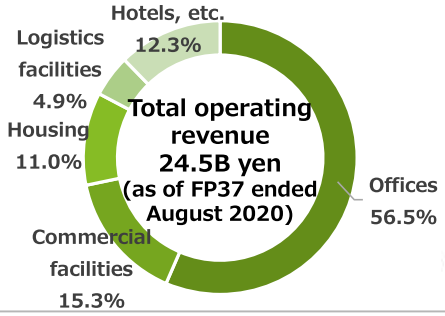
-OJR: Purchases real estate, etc. with funds procured from investors and financial institutions and leases it to tenants. OJR then distributes the money it has gained from rents to investors after deducting administrative fees, etc. The assets being managed are owned by the investment corporation, and thus OJR is subject to making disclosures in compliance with the TCFD. However, investment corporations are legally forbidden to hire employees, and must outsource management operations.
-OAM: OAM has been entrusted with the authority to manage OJR's assets, and makes investments in physical real estate and real estate trust beneficiary rights.
OAM is the entity that will consent to TCFD guidelines and participate in this support program.

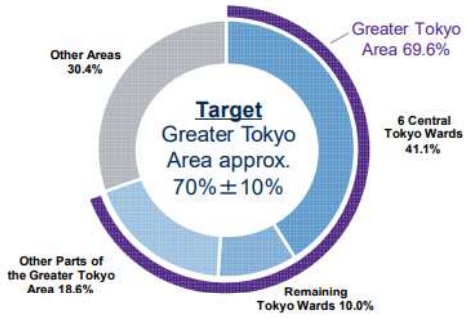


2 [Covered business]
We analyzed the ownership/management of all 111 properties in OJR's portfolio

OJR's portfolio







Key parameters in OJR's value chain

Funding

-Changes in evaluation and goals for investors, lenders, etc.,

Property acquisition

-Measures toward greenhouse gas (GHG) emission regulations
-Measures toward carbon taxes and carbon pricing
-Changes in tenant/user needs and behavior

Ownership/management

-Extreme weather conditions
-Increased average temperatures
-Measures toward GHG emission regulations
-Measures toward carbon taxes and carbon pricing
-Changes in tenant/user needs and behavior
-Elevated sea levels
-Spread of technology for renewable energy/energy conservation
-Changes in the energy mix
-Shifts in energy demand

Funding

Property dispositions

-Measures toward GHG emission regulations
-Measures toward carbon taxes and carbon pricing
-Changes in tenant/user needs and behavior

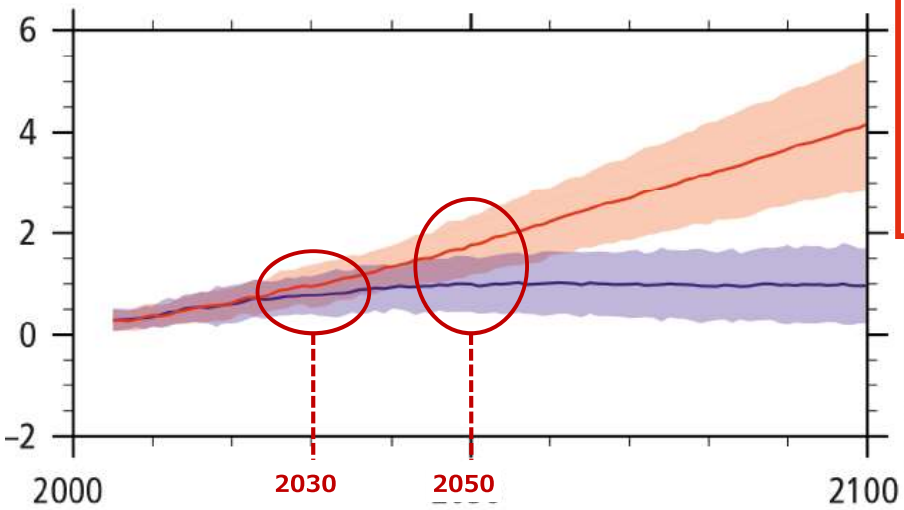
We will focus on initiatives here this time

2 [Risk significance assessment: risks and opportunities]
Value chain risks and opportunities in the real estate (REIT) industry

Transition risks	Carbon taxes / carbon pricing	Higher material procurement costs and fuel/electricity fees due to an increase in tax for climate change mitigation	High
		Increased comparative value for existing projects in cases where new development would result in increased costs	
		Increased fees for energy with a higher CO2 emission factor, incentives for adopting energy sources with low emissions	
	Greenhouse gas emission regulations	Strengthened greenhouse gas emission regulations, increased operating expenses due to the expansion of the cap and trade system	High
		Strengthened building energy efficiency regulations, increased operating expenses due to the need to meet energy conversation requirements for owned properties and a strengthened reporting system	
	Changes in customer behavior (customers/tenants)	A shift in customer demand toward buildings with high environmental performance	High
	Changes for investors/lenders (evaluation/goals)	Changes in how investors evaluate businesses, a strengthened platform for procuring funds through the expansion of the ESG investor base	High
		Expanded sources of funding through Green Bonds and loans	
	Other	Changes in the energy mix, shifts in energy demand, spread of technology for renewable energy/energy conservation, changes in employment competition	Med. - Low
Physical risks	Increased average temperatures	Higher operating expenses due to higher cooling demands at owned properties, a need for measures toward ensuring comfort	High
		Decreased work efficiency for employees and workers, restrictions on work attendance, difficulty performing construction operations during the summer	
	Extreme weather conditions	Damage from flooding and power outages at owned properties, increased costs for restoration and pre-emptive measures	High
		Limitations on which days business can be conducted and on usage	
		Decreased asset value for properties in areas with high risk of flooding/storm surge	
		Securing a competitive advantage through strengthening disaster responses, increased rental revenues and customer use	
		Increased property insurance premiums	
	Other	Changes in precipitation and weather patterns, elevated sea levels	Med. - Low

3 [Selected scenarios]
2˚C and 4˚C scenarios have been selected for transition risks as of 2030 and physical risks as of 2050

[Projected average global surface temperature change]
(compared with the average from 1986–2005)



Prior to 2030, the change in temperature is nearly the same in both the 2˚C and 4˚C scenarios. The gap between the scenarios widens after 2030.

Definition of 4˚C (2.7˚C+) scenarios

4˚C scenario:
3.2-5.4˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

Over 2˚C (2.7˚C-4˚C) scenario:
2.7-4.0˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

2˚C scenario:
0.9-2.3˚C higher than pre-Industrial Revolution levels if strict measures are taken

(Reference) 1.5˚C scenario:
We are highly likely to achieve an increase of less than 1.5˚C compared to pre-Industrial Revolution levels if a radical transition to a new system is made.

The TCFD recommendations for scenario analysis suggest that multiple temperature range scenarios be selected, including those below 2˚C

3 [Table of parameters used]
Definitions of various worldviews based on scientific evidence from IEA and other sources

*Exchange rate: 1 USD = 105 JPY (based on the November 12, 2020 rate)

Key risks/opportunities		Parameter	Currently	Transition risks: 2030 / Physical risks: 2050		Source
				4˚C (over 2˚C)	2˚C	
Transition risks	Carbon pricing	1. Carbon taxes	**2.6** USD/t	**2.6** USD/t	**100** USD/t	• IEA WEO2019 • We assume that levels in the 4˚C scenario will be equivalent to current levels
		[Added] power rates	**217** USD/MWh	**209** USD/MWh	**231** USD/MWh	• IEA WEO2018
	Responses toward GHG emission regulations	2. Energy consumption intensity for buildings	Global forecast (compared to 2014)	(**13.5** %)	(**20.5** %)	• IEA ETP2017
			Target for Japan (compared to 2013)	—	Commercial (**14** %) Home (**27** %)	• Ministry of Land, Infrastructure, Transport and Tourism
		3. Zero emission targets for Tokyo Metropolitan	CaT reduction target (compared to 2002 - 2007)	—	(**35** %)	• Tokyo Metropolitan
		4. Grid emission factors	**0.46** kg-CO2/kWh (2019)	**0.31** kg-CO2/kWh	**0.16** kg-CO2/kWh	• IEA WEO2020
		5. Mandatory adoption of ZEB/ZEH (government target)	ZEB total floor space **0** billion ㎡ (2014)	**2.5** billion ㎡	**1.65** billion ㎡	• IEA ETPAgency for Natural Resources and Energy: Basic Energy Plan 2017
			Target for Japan	—	**ZEB 100%** for new buildings **ZEH 100%** for new housing	• Agency for Natural Resources and Energy: Basic Energy Plan (July 2018) • Ministry of Economy, Trade and Industry
	Changes in customer behavior	6. Increases/decreases in rent based on environmental performance	**+3.64 – 5.9**%	—	An additional **+1 - 5**%	• Smart Wellness Office Research Committee, xymax, Japan Real Estate Institute, DBJ
Physical risks	Increased average temperatures	[Added] AC costs	**19** USD/person	**61** USD/person	**35** USD/person	• IEA "The Future of Cooling"
	Extreme weather conditions	7. Flood damage costs	**3.3** billion USD/year	**7.3** billion USD/year (2030)	—	• WRI "The Aqueduct Global Flood analyzer"
		8. Changes in volume of rainfall/flow and frequency of flooding in Japan	Frequency of flooding (compared to 2018)	Approx. **4**x (2040)	Approx. **2**x (2040)	• Review Meeting of Technologies Related to Flood Control Planning Based on Climate Change: "A proposal for flood planning based on climate change" (2019)
		9. Typhoons/cyclones	26/year (2016)	There is a possibility that the frequency will decrease while the intensity increases		• Japan Meteorological Agency, Ministry of the Environment, others
		10. Elevation of the average global sea level	Compared with the 1986 – 2005 average	**+0.25** m	**+0.20** m	• Ministry of the Environment, Japan Meteorological Agency

3 [Selected scenarios]

Overview of selected scenarios (hypotheses for transitional risks as of 2030, and physical risks as of 2050)

Item	4 ºC scenario	2 ºC scenario
Carbon taxes	Carbon taxes are not introduced, and there is no stimulation of activities such as emission credit trading	Carbon prices are expected to soar
Energy consumption intensity for buildings	No active investment occurs, and energy consumption rates do not improve beyond a certain level	Significant improvements are made globally, with an up to 30% reduction of building energy consumption in Japan
Zero emission targets for Tokyo Metropolitan	Total CO2 emissions are reduced by 35% by 2030	Total CO2 emissions are reduced by 35% by 2030, and similar systems are implemented on a nationwide scale
Grid emission factors	Improvements are limited	Efforts such as the promotion of initiatives lead to significant improvement in emission factors
Mandatory implementation of ZEB/ZEH	Regulations remain weak, penetration is limited, and costs remain high	Related markets are stimulated by ZEB/ZEH penetration. Implementation leads to increased competitiveness
Domestic electricity retail prices	Decrease	Increase
AC costs	Significantly increase	Increase
Increases/decreases in rent based on environmental performance	We hypothesize that rent will increase, but could vary depending on the scenario	
Flood damage costs	Flood damage costs in urban areas more than double	
Changes in volume of rainfall/flow and requency of flooding	There is increased rainfall/flow volume and flooding frequency over both scenarios	
Typhoons	(Precise figures could not be determined due to the high degree of uncertainty)	
Elevation of the average global sea level	We hypothesize that there will not be a significant increase in sea levels in 2050, and there are no major differences between either scenario on this. However, there are concerns about flood damage caused by storm surges from the synergistic effects of large typhoons and "guerrilla rainstorms"	

3 [Scenario group definition]

4°C 2°C

No progress is made in low-carbonization trends, resulting in the need for responses toward emerging physical risks

4°C worldview

: Actions for responding to risks

: Actions for seizing opportunities

Properties

- Damage from inland flooding caused by large typhoons and storm surges due to extreme weather conditions
- Higher restoration costs due to higher frequency of damage from extreme weather conditions
- Higher cooling demands and a need for more/stronger cooling equipment due to an increase in average temperatures

-Update the scope of asset valuation to include physical risks, optimize portfolios
-Strengthen disaster preparedness for owned properties

Tenants

Carbon tax fees are kept at their current levels, and there are no significant changes in utility costs by unit

- Low interest in the environmental performance of tenanted properties, and no increase in the number of companies preferring "green buildings"
- Increased costs due to higher cooling demands and more/stronger cooling equipment due to an increase in average temperatures
- Reduced number of days where business can be conducted and reduced numbers of users due to damages

Property rental/REIT/OJR

- Movement toward low-carbonization is slow, and there is little incentive for reducing GHG emissions from new buildings
- Energy-saving costs remain high due to limited progress in energy-saving technologies, and there is no increase in demand for "green buildings"
- Disaster preparedness for held assets will become necessary due to an increased frequency of damage caused by large typhoons and inland flooding
- Accelerated deterioration for held assets and reduced asset value due to elevated average temperatures and an increased amount of rainfall
- Emergence of REITs that actively promote the disaster resistance of properties

Natural environment

- Increased flood damage due to extreme weather conditions (e.g. concentrated rainfall, typhoons, floods)
- Elevated average temperatures, increased number of heat waves

Funding sources (investors/financial institutions)

- Low-carbonization measures have no effect on investment activities
- Properties with high physical risk are avoided as investment targets

-Devise measures against physical risks and perform an external disclosure

Policy

- There is no increase in petroleum or coal taxes, and carbon tax fees are kept at their current levels
- Emissions credit trading does not become more widespread than it is currently due to slow movement toward low-carbonization and no increase in external pressure from the international community
- There is progress in government-led strengthening of disaster preparedness in building codes and disaster prevention/mitigation plans, including mandatory measures against flooding in coastal areas

-Promptly obtain information on policies concerning disaster preparedness
-Strengthen disaster prevention/mitigation plans

4℃ 2℃

3 [Scenario group definition]
While there is an increase in low-carbonization costs, there are also increasing business opportunities for contributing to GHG reduction

2℃ worldview

: Actions for responding to risks
: Actions for seizing opportunities

Properties
- Increased costs for fuel used in owned facilities due to expensive carbon taxes being set
- Increase in companies preferring "green buildings" from the perspective of GHG emissions reductions and lowered costs
- While the impact is less than in the 4℃ scenario, sites may be damaged to a certain extent by extreme weather conditions

-Expand ZEB/ZEH assets and renovate owned properties to make them energy efficient
-Update the scope of asset valuation to include transition risks/opportunities, optimize portfolios

Tenants
- Increased costs for fuel used in owned facilities due to expensive carbon taxes being set
- On the other hand, cost effectiveness is improved due to increased energy efficiency
- Increase in companies preferring "green buildings" from the perspective of GHG emissions reductions and lowered costs

Property rental/REIT/OJR
- Impact is felt from the taxation of GHG emissions introduced to promote decarbonization
- The ratio of "green buildings" in owned properties increases in response to the increase in demand
- It will be necessary to renovate existing held assets to make them energy efficient in order to respond to tenants who are concerned about environmental performance
- While the impact is less than in the 4℃ scenario, held assets may be damaged to a certain extent by extreme weather conditions
- Emergence of REITs that actively promote the environmental performance of properties

Natural environment
- Compared to the 4℃ scenario, the increase in damage caused by extreme weather conditions has been curbed

Funding sources (investors/financial institutions)
- Properties' environmental performance (whether or not they have received a certification label) will have increasing importance as a matter for basing investment decisions on
- Track records for areas such as GHG emission reductions will have increasing importance as factors for basing investment decisions on
- The impact of physical risks on property investment decisions are limited

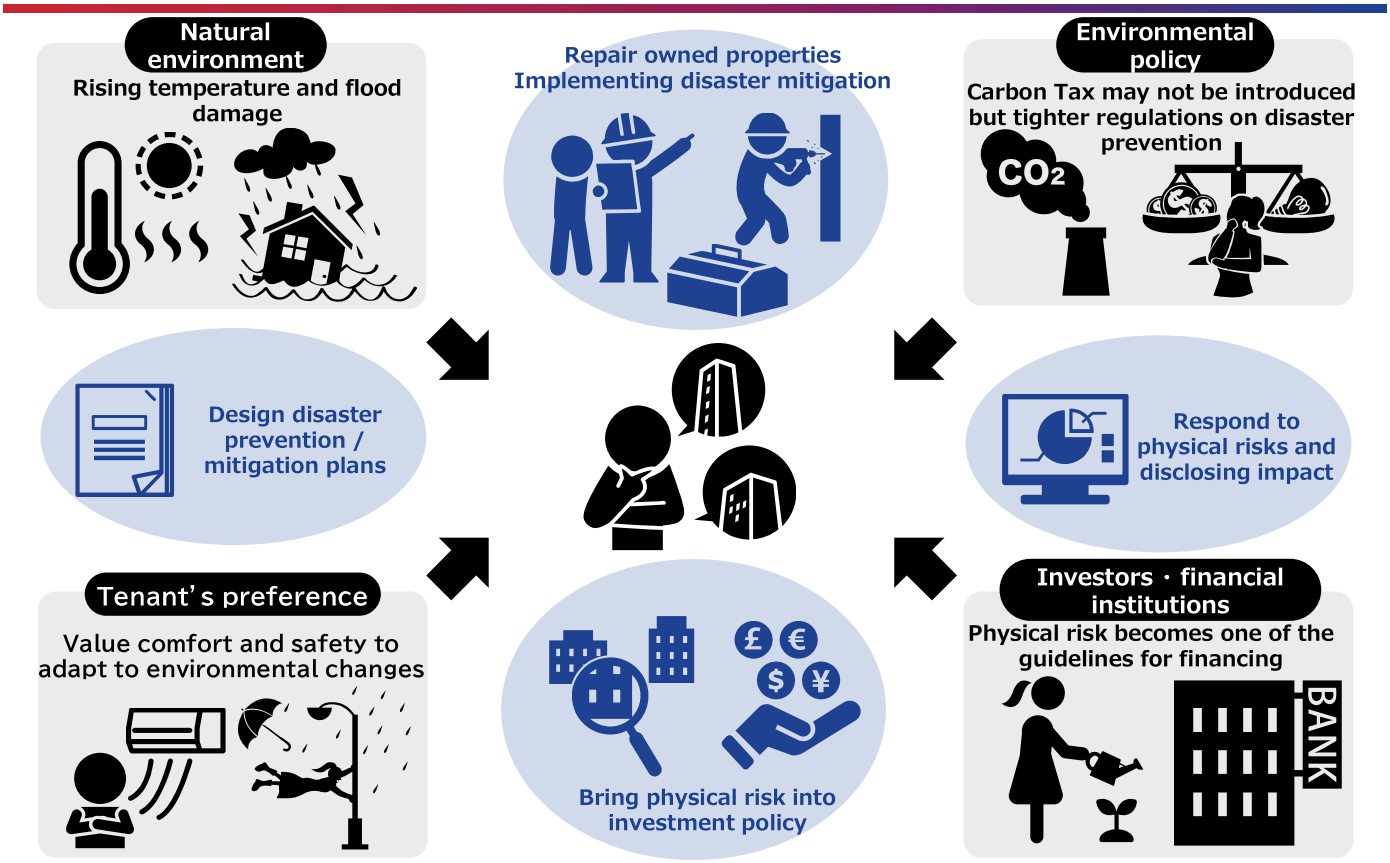
-Use certification obtained for environmental performance as a point for appealing to funding sources

Policy
- The "cap and trade" system expands to include all of Japan (stimulating emissions credit trading), and progress is made toward introducing carbon taxes
- Subsidies related to ZEH and ZEB are expanded as ZEH is made mandatory for new buildings and ZEB is implemented
- While a certain amount of progress is made in government-led strengthening of disaster preparedness in building codes and disaster prevention/mitigation plans, it is limited compared to the 4℃ scenario

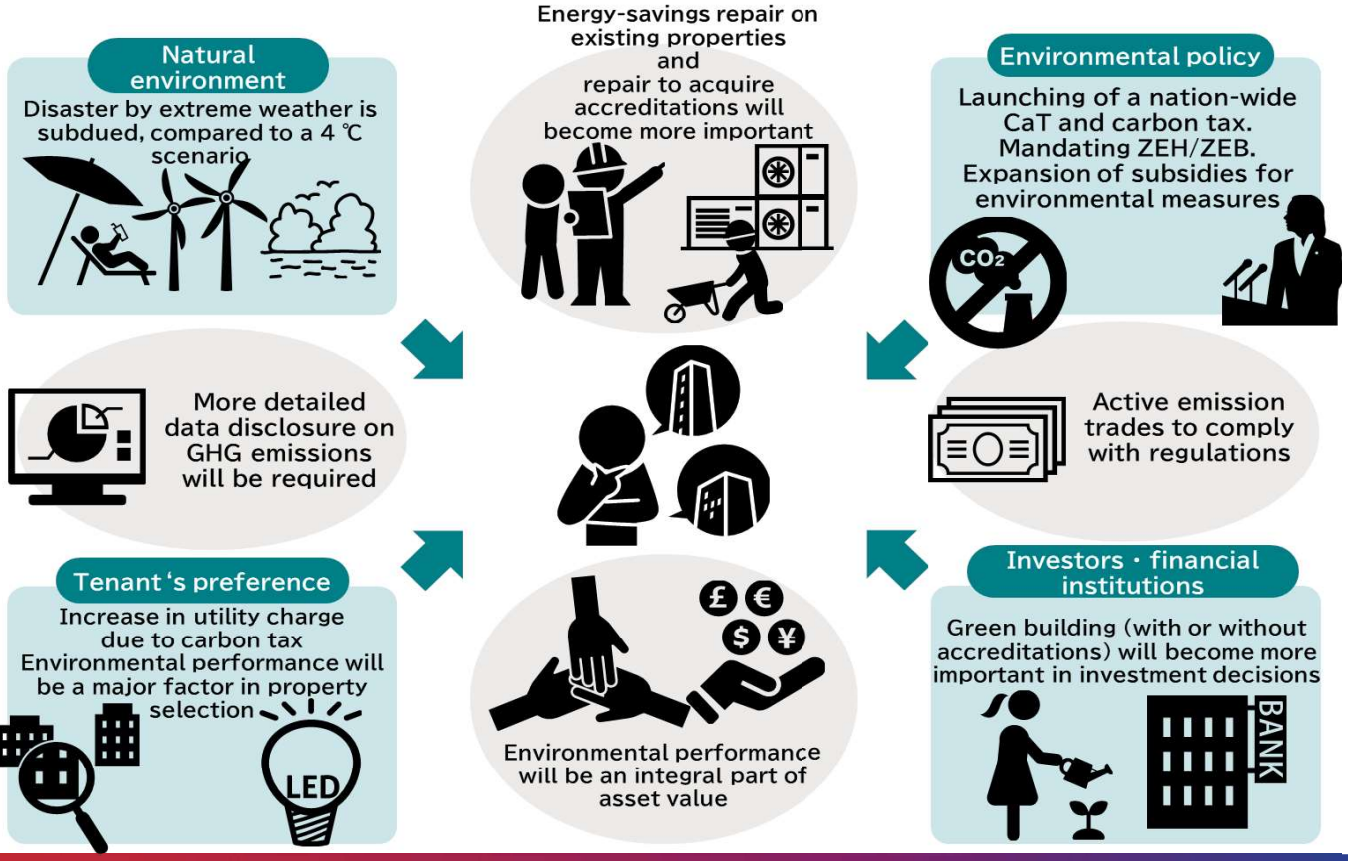
-Promptly obtain information on policies (including subsidies) concerning decarbonization and disaster preparedness
-New buildings: acquire ZEB/ZEH properties
-Existing buildings: implement energy-saving/renewable energy facilities

4℃ 2℃

3 [Future social image in a 4℃ scenario]
Further reduction of disaster risks in asset portfolio will be required

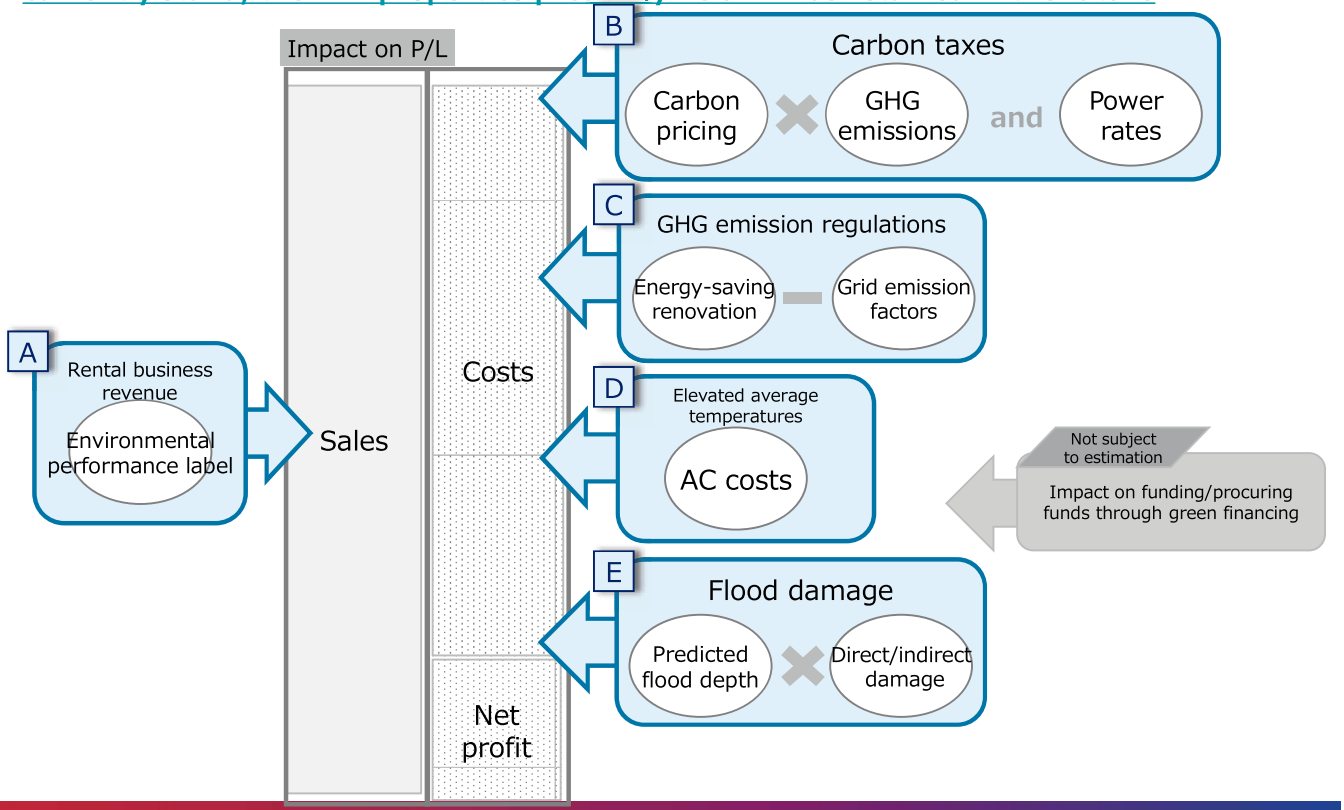


3 [Future social image in a 2℃ scenario]
Agenda will be to optimize energy efficiency across the portfolio.



4 [Business impact evaluation]
We investigate the impact of each risk item on the profit and loss statement (P/L)

[Hypothesis] We make no changes in the portfolio and assume that, based on how things currently stand, the 111 properties presently held will be retained in the future



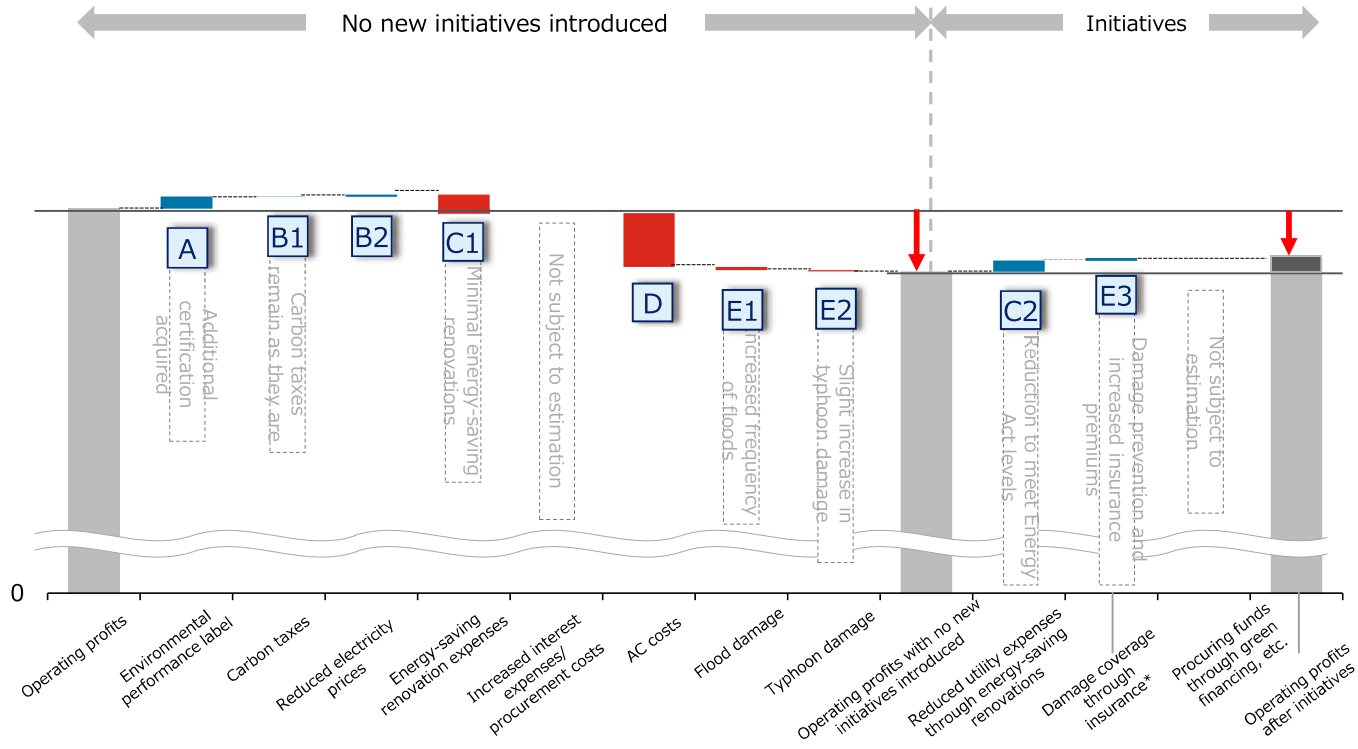
4 [Calculation results for each risk]
We hypothesize that there will be significant financial impact from changes in customer behavior, GHG regulations, increased average temperatures, and extreme weather conditions

		Risk	Scenario 4°C	Scenario 2°C
Transition risk	A	Changes in customer behavior (environmental performance label)	Rental fee premiums are created through additional certification	Premiums are added to rents, causing rents for certified properties to increase
		Carbon pricing (carbon taxes)	Current measures remain as they are (tax for climate change mitigation)	Increased operating expenses from taxation of GHG emissions
	B	Carbon pricing (exemption from carbon taxes through energy-saving renovations)	(Not subject to estimation) N/A	Reduced carbon tax fees through using renovations to reduce GHG emissions
		Electricity prices	Operating expenses are kept in check by reduced electricity prices	Electricity prices go up, but electricity expenses are reduced due to less of it being used
	C	Responses toward GHG emission regulations (energy-saving renovation)	Energy-saving renovations are implemented to reduce emissions to meet the levels specified by the Act on the Rational Use of Energy (1%/year)	Energy-saving renovations are implemented to reduce emissions to meet government target levels
		Responses toward GHG emission regulations (reduced utility expenses through energy-saving renovation)	Utility expenses are kept in check by the energy-saving renovations listed above	Utility expenses are kept in check by the energy-saving renovations listed above
	D	Changes for investors and lenders (increased interest expenses / procurement costs)	(Not subject to estimation) N/A	(Not subject to estimation) N/A
Physical risk		Elevated average temperatures (AC costs)	Summer air conditioning costs increase due to increased temperatures	Summer air conditioning costs increase due to increased temperatures
	E	Extreme weather conditions (flood damage)	Emergency measures become necessary for hazard areas, and there is a loss of profits	Emergency measures become necessary for hazard areas, and there is loss of profits
		Extreme weather conditions (typhoon damage)	In the past three years, we have seen the arrival of some of the biggest typhoons ever recorded	In the past three years, we have seen the arrival of some of the biggest typhoons ever recorded
		Extreme weather conditions (insurance coverage for damages)	Flood damage can be handled by insurance, but insurance premiums increase	Flood damage can be handled by insurance, but insurance premiums increase slightly

4 [Business impact evaluation: 4°C scenario]

4°C 2°C

In the 4°C scenario, initiatives are used to keep the impact of reduced revenue down to approximately 20 percent

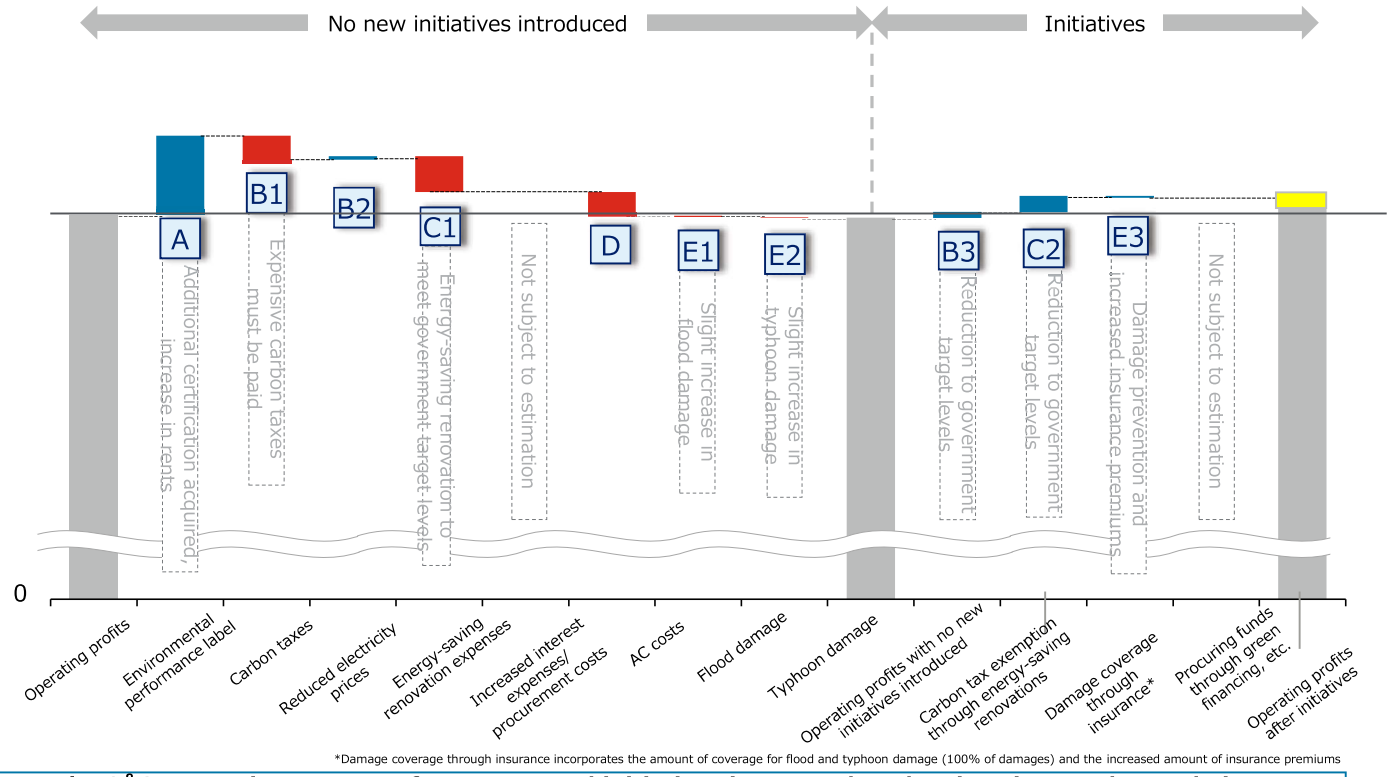


*Damage coverage through insurance incorporates the amount of coverage for flood and typhoon damage (100% of damages) and the increased amount of insurance premiums

In the 4°C scenario, there is a significant increase in expenses from air conditioning costs, but the reduction in utility expenses makes up for a portion of this

4 [Business impact evaluation: 2˚C scenario]
In the 2˚C scenario, initiatives can be used to turn the impact of reduced revenue into a positive situation

4˚C 2˚C

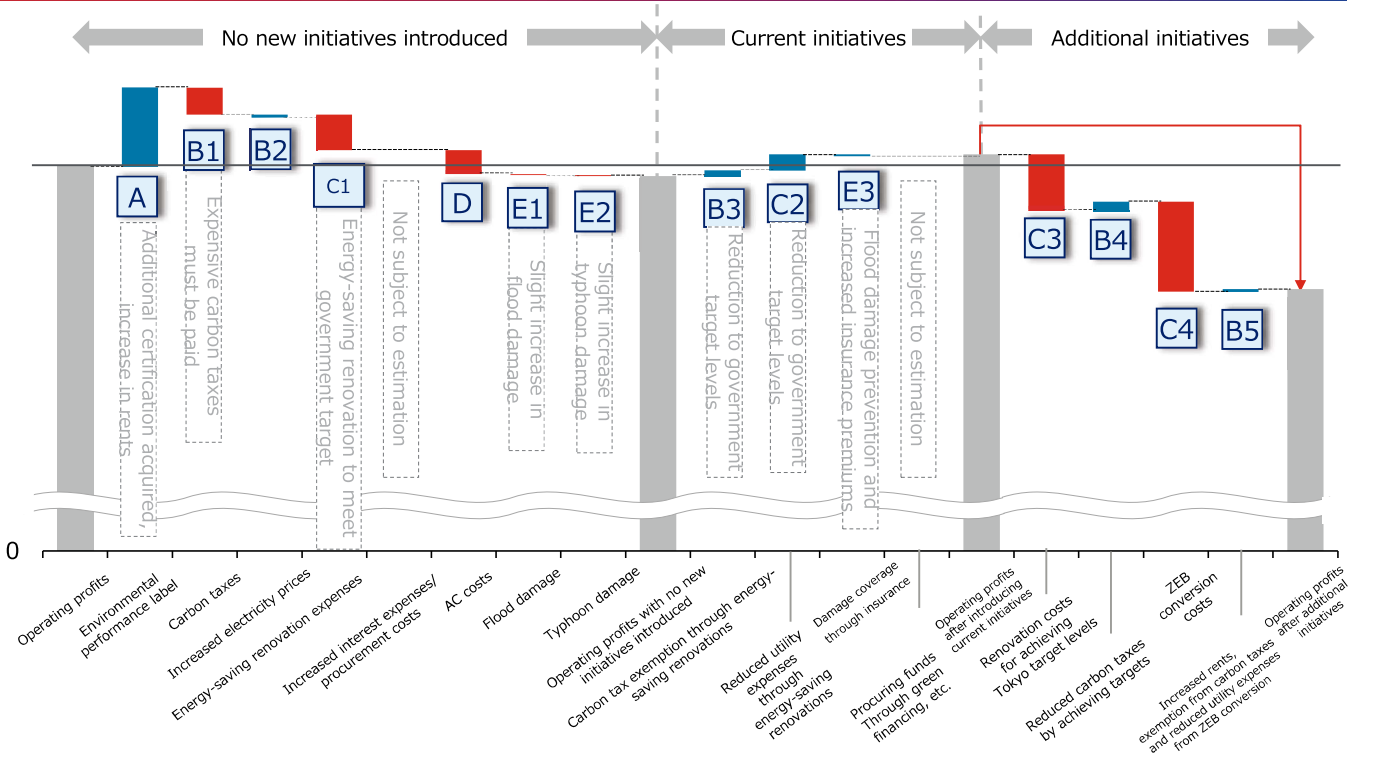


*Damage coverage through insurance incorporates the amount of coverage for flood and typhoon damage (100% of damages) and the increased amount of insurance premiums

In the 2˚C scenario, expenses from taxes and initiatives increase, but the situation can be made into a positive one through environmental performance labels and energy efficiency

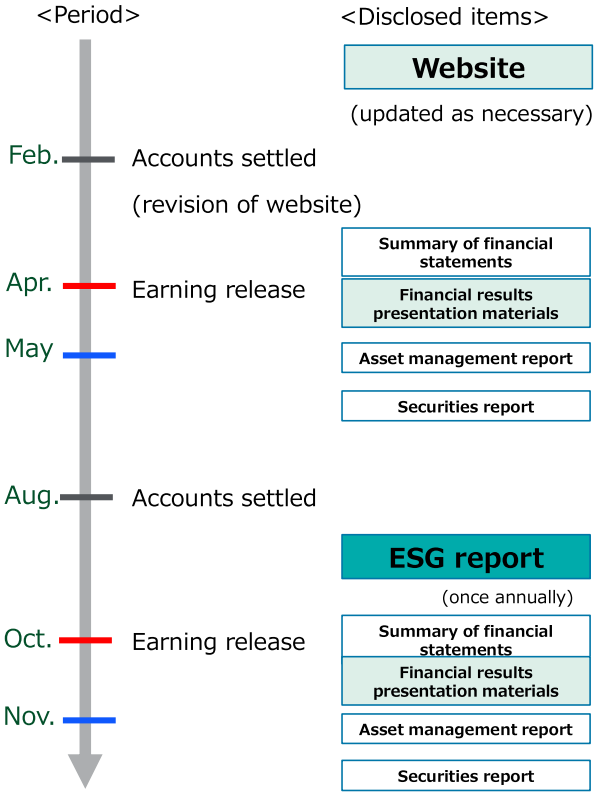
5 [Impact from additional initiatives: 2˚C scenario]
In the 2˚C scenario, additional initiatives make further carbon reduction possible, but the outcome is negative from the perspective of benefits that can be quantifiably measured

4˚C 2˚C



We hypothesize even demanding emission reduction targets and stronger ZEB implementation in 2030 in preparation for the goal of net-zero emissions by 2050

6 [Considerations in preparing for disclosure]
What should be disclosed, and how much information should be given? Start by moving ahead with the disclosure, and make improvements based on investor reactions/evaluations



- OJR settles its accounts twice annually
- At present, we assume that it will make disclosures using the following media:
  -Website
  "ESG initiatives" page
  -ESG report (once annually)
  -Financial results presentation materials
- Start by disclosing items such as recognized risks/opportunities, scenarios, and worldviews, then have discussions with investors and flesh out responses while confirming their reactions.
- Management is aware of scenario analysis results and investor evaluations, etc., and uses these to improve value.
- We will give further consideration to disclosure methods for business impact, given the limited scope of the current analysis.

Energy

✓ Practice Case ①: Chiyoda Corporation

Define range of scenarios

Analytical Assumptions	Target
Target	2040
Scenarios	4℃ → Without any countermeasures (ex: no carbon tax, etc.) 2℃ → Promote countermeasures against climate change (ex: introduction of carbon tax, etc.)
Reference data	Sources: IEA WEO 2019 (Unless it doesn't cover necessary data)
Sectors	LNG/ Green Energy EPC/ Non-EPC such as hydrogen, CCU, and distributed composite utilities * EPC = Engineering, Procurement, Construction * CCU = CO2 Capture and Utilization
Financial Data	Extending the data to 2040 based on business plan until 2023 disclosed in recovery plan.

CHIYODA CORPORATION

[Step 2: Assess materiality of climate-related risks]

Step 2 | 3 | 4 | 5 Scenario 4℃ 2℃

Future climate change poses significant risks and opportunities for Chiyoda Corporation

Risks and Opportunities		Business impact			Assessment
Major classification	Small classification	Index	Discussion: Risks	Discussion: Opportunities	
Transition Risk	Carbon price	Revenue	➢ The introduction of carbon prices is expected to reduce the demand for fossil fuels (to reduce the demand for petroleum plants), which will have a medium-scale impact on PL.	➢ Developments in carbon tax markets could create new opportunities in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	Large
	Carbon emission targets/policies of each country (including subsidies)	Revenue	➢ **Regulatory tightening affects orders for fossil-fuel-derived plants, affecting PL**	➢ **The market for green energy, hydrogen, etc. is expected to expand with the advancement of policy support, and the demand for plant and energy transportation, etc. is expected to increase, creating business opportunities.**	
	In the energy mix Change	Revenue	➢ **Large impact on PL due to changes in fossil fuel-derived power generation rate, which affects plant orders**	➢ **Alternatives to coal such as LNG and natural gas may increase demand for plant production, which can be an opportunity as well as a risk** ➢ **Increased demand for green energy creates new business opportunities**	
	Energy Demand	Revenue	➢ **Significant impact on PL due to decrease in demand for gasoline and decrease in orders for petroleum refineries** ➢ **Smaller plant size and diversification of customers and regions reduced business opportunities.**	➢ Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia) ➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
	Spread of low-carbon technologies	Revenue	➢ **Influence on PL due to the spread of electric vehicles, reduced demand for gasoline, etc., affecting the volume of orders received for petroleum plants.**	➢ Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia) ➢ New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities	
	Developing next-generation technologies	Revenue Spending	➢ **Popularization of decarbonizing materials (bio-plastics, etc.) reduces the market size of petroleum products and has a large impact on orders for petroleum refineries**	➢ **New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities**	
Other	Changes in customer reputation, changes in investor reputation, rising mean temperatures, rising sea levels, and extreme weather conditions	Revenue Spending	➢ Die investment accelerated for oil and LNG, and plant orders declined or were suspended. In addition, the postponement and cancellation of projects have an impact on PL. ➢ Construction delays caused by extreme weather conditions have an impact on PL due to increased construction costs, etc.	➢ Investors' evaluation improves due to orders received for projects aimed at realizing a low-carbon society such as renewable energy. ➢ Expected increase in demand for plant resilient to natural disasters, etc.	Small to medium

The effects of "Carbon price","policy","change in energy consumption","demand transition" and "new technology",which have an influence on orders, are significant. It is also assumed that the development of next-generation technologies linked to market opportunities will have a great financial impact.

[Step 3: Identify and define a range of scenarios]

Step 2 **3** 4 5 | Scenario **4℃** **2℃**

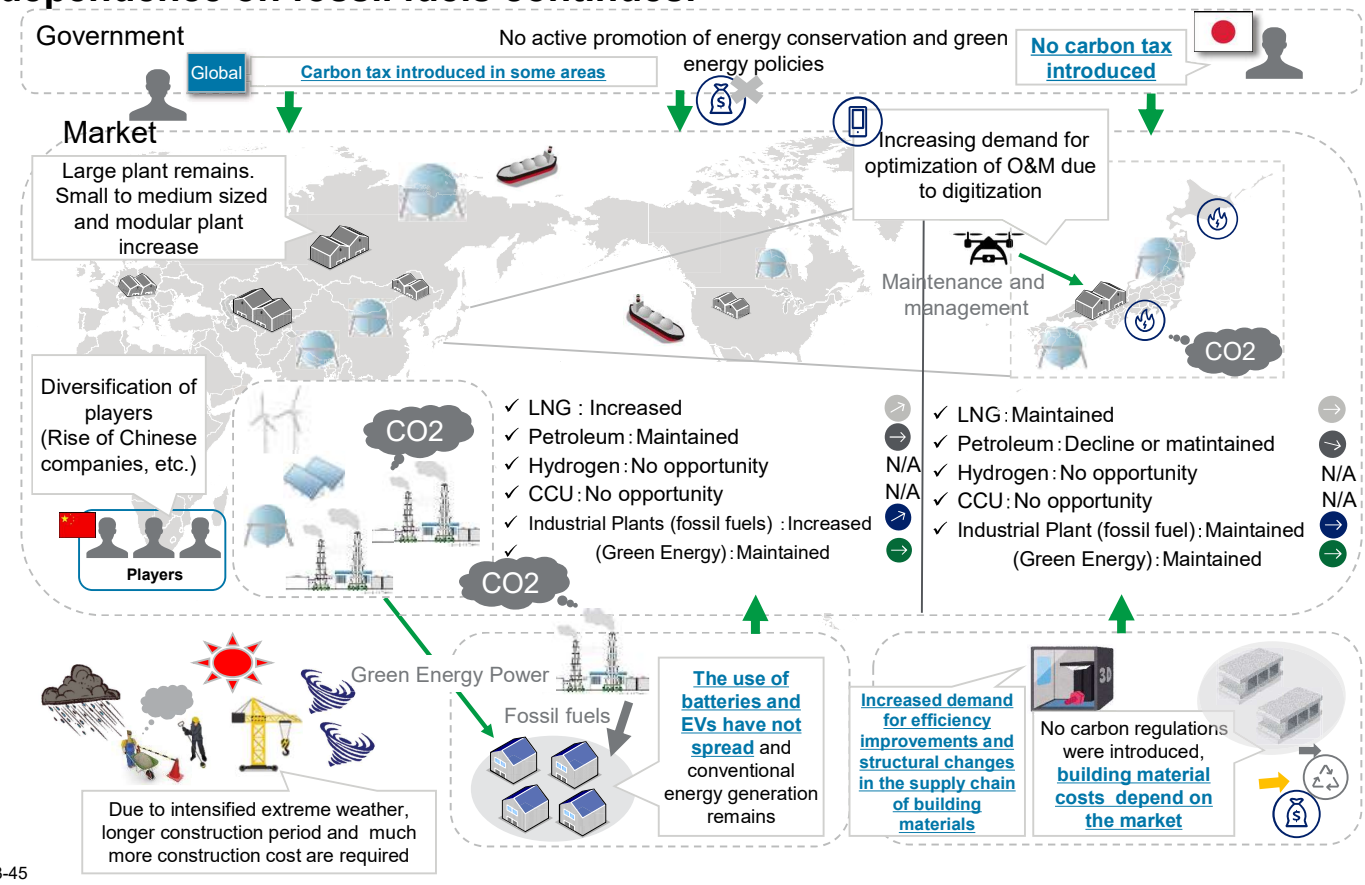
Defining worldview for each scenario based on scientific evidence from IEA and others.

		At present	2040			Source
			4℃(STEPS)	2℃(SDS)	(Reference) 2° C (FPS)	
Carbon price	**Carbon tax**	-	$31 to $39/t	$125 to $140/t	$25 to $100/t	• IEA WEO2019 • PRI FPS scenarios
Carbon Emissions Targets/Policies in Each Country	**GHG emissions** (Millions of tCO2)	Japan :1,078 Global: 6,087 (2018)	Japan :666 Global: 7,117	Japan :287 Global: 3,748	No FPS data	• Ministry of the Environment, "FY2017 Greenhouse Gas Emissions" and "Long-term Strategy as a Growth Strategy Based on the Paris Agreement" • IEA WEO2019
Energy Change in mix	**Power Supply Composition (TWh)**	Japan :1,069 Global: 26,603 (2018)	Japan :1,062 Global: 41,373	Japan :1,005 Global: 38,713	Japan: no FPS data Global: 40.4 thousand	• IEA WEO2019 • PRI FPS scenarios
Energy Demand trends	**Primary energy demand (Million tons)**	Japan :434 Global: 14,314 (2018)	Japan :353 Global: 17,723	Japan :300 Global: 13,279	Japan: no FPS data Global: 13,469	• IEA WEO2019 • PRI FPS scenarios
	Final energy demand (Million tons)	Japan :293 Global: 9,955 (2018)	Japan :234 Global: 12,672	Japan :185 Global: 9.5 thousand	No FPS data	• IEA WEO2019
	LNG: Pipeline ratio (bcm)	352:436 (2018)	729:549	636:358	No FPS data	• IEA WEO2019
Low-carbon technologies Penetration	**ZEV ratio**	58 thousand units (EV, PHV, FCV) (2017)	PHV/ZEV:7% (123.81 million units)	PHV/ZEV:63% (1023.44 million units)	No FPS data	• IEA Report and Global Calculator
	World's storage capacity	4.67 TWh (2017)	No IEA data → 6.71~7.96 TWh	No IEA/FPS data → 12.22-15.75 TWh for IRENA		• IRENA Report
Next generation technology Progress	**Hydrogen penetration rate**	0 (To the final energy of the world Hydrogen demand in 2018	(No spread at 4° C)	2. 7EJ/ years	Steel sector: 4. 0EJ/ years Cement Division: 2. 0EJ/ years	• IEA WEO2019 • PRI FPS scenarios
	CCU penetration rate	CO2 reductions by CCUs: 0 (2018)	113 million tons	1,770 million tons	No FPS data → For ICEF data, CCU market size: US$1.5 trillion	• IEA WEO2019 • ICEF Roadmap
	Penetration rate of bioplastics	Domestic Bio-plastics shipments: 70 thousand tons (2013) Global disposable plastic raw materials usage: 3.4Mb/d (2015)	Japan: No IEA data Global: No IEA data → In the BP data, 6.1Mb/d used	Japan: No IEA/FPS data → According to data from the Ministry of the Environment, 3.07 million tons were shipped. Global: No IEA/FPS data → In the BP data, the amount of raw materials used is zero.		• Ministry of the Environment's Global Warming Prevention Plan • BP"Energy Outlook 2019" ET scenarios

[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 | Scenario **4℃** 2℃

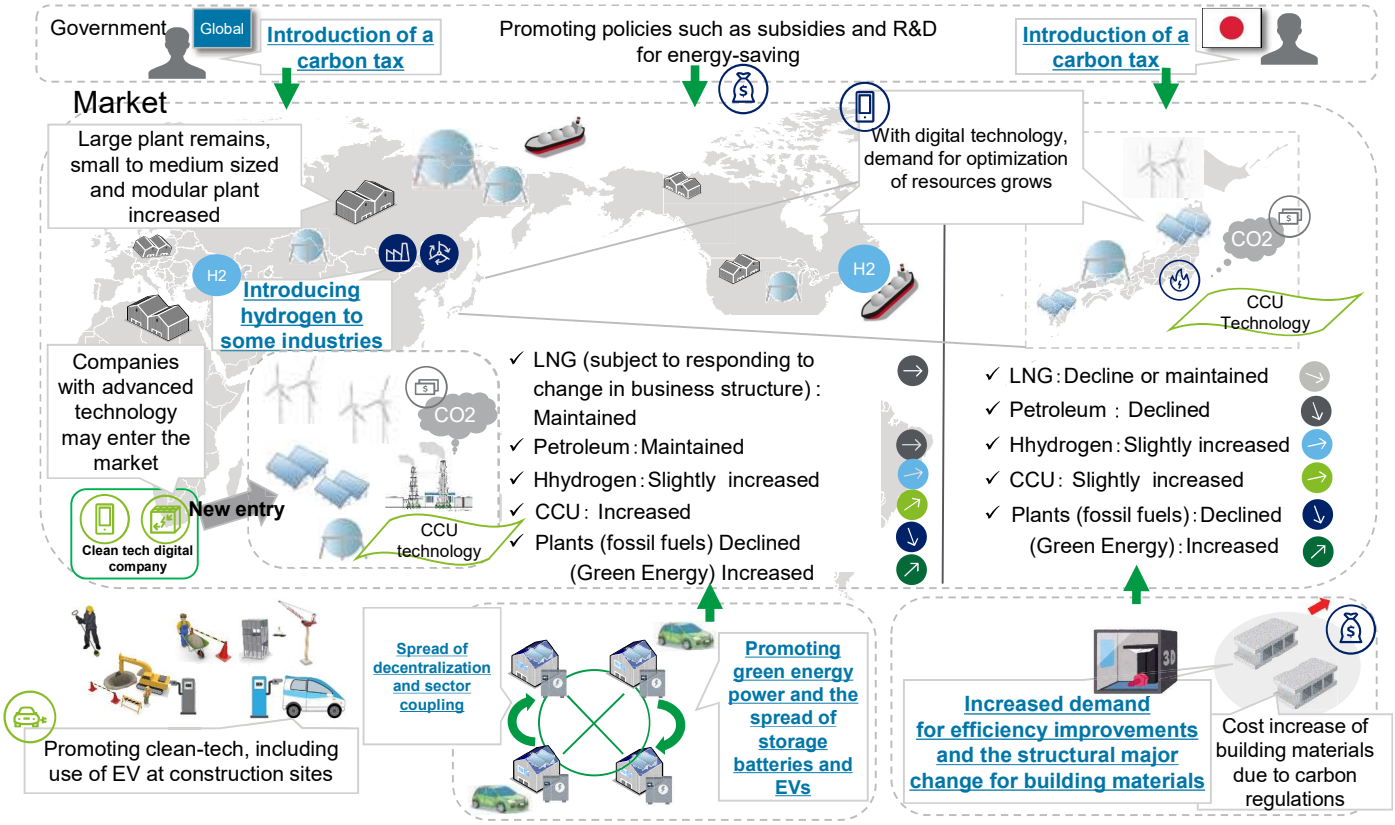
In the 4° C world, low carbon and carbon cycles are not promoted, and dependence on fossil fuels continues.



[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 Scenario 4℃ **2℃**

In the 2° C world, low carbon and carbon cycles are promoted, and demand for green energy facilities expands. The introduction of hydrogen and CCU is accelerated



3-46

[Step 4: Evaluate business impacts]

Step 2 3 **4** 5 Scenario **4℃** **2℃**

Considering the direction of the calculation (business as usual/our potential) from "market growth" and "market share"

	Market growth	×	Share	=	Direction of Estimation: Business as usual	Direction of Estimation: Our Potential
LNG	Market expansion		In response to structural changes in business promotion		No increase in profit beyond the business plan	No "counting" of potential
Green Energy (PV/Biomass)			The present market share maintained		Due to the small market expansion **Profit declined**	**Not counted**
Green Energy (Offshore wind power)			Assume 10% *1 acquisition of Japanese market		**Not counted**	Market expansion is counted as an opportunity
Oil-related	Market Shrink or expand		The present market share maintained		Profit declined due to the shrinking market	Market expansion is counted as an opportunity*2
Utility	Market expansion (Creation of new markets)		Assume 1% acquisition*3 of the market		**Not counted**	Market expansion is counted as an opportunity
Hydrogen			Assume 2% acquisition*4 of hydrogen supply		Profit increased due to the market expansion	**Not counted**
CCU			Assume 5%*3 acquisition of CCU market		**Not counted**	Market expansion is counted as an opportunity

*1: Assuming an internal share ratio of 10%, *2: At 4° C, the oil-related market will expand, so there will be no decrease in sales at the time of completion. *3: Since entry into a new market and major players have already been established, it is temporarily set at 1%. *4: Assuming that 2% of hydrogen supply will be obtained from our efforts to date, *5: Entering into a new market, it is temporarily set at 5%.

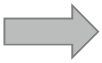
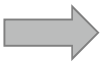
3-47

[Step 5: Identify potential responses]

Step 2 3 4 **5** Scenario **4℃** **2℃**

Considering the direction of countermeasures for responding to risks and securing opportunities

Summary of impact calculations and policy for countermeasures

Items (Impact on our company)	2℃	4℃	Policy for countermeasures
LNG			Provide services that respond to changes in the business structure
Petroleum Fossil fuel plant			Respond to optimization of customer assets by utilizing digital technology
Hydrogen		-	Early entry into the market and securing market share is required due to increasing demand for low-carbon and carbon cycle
CCU		-	
Green Energy Plant			Develop utility business based on future trends

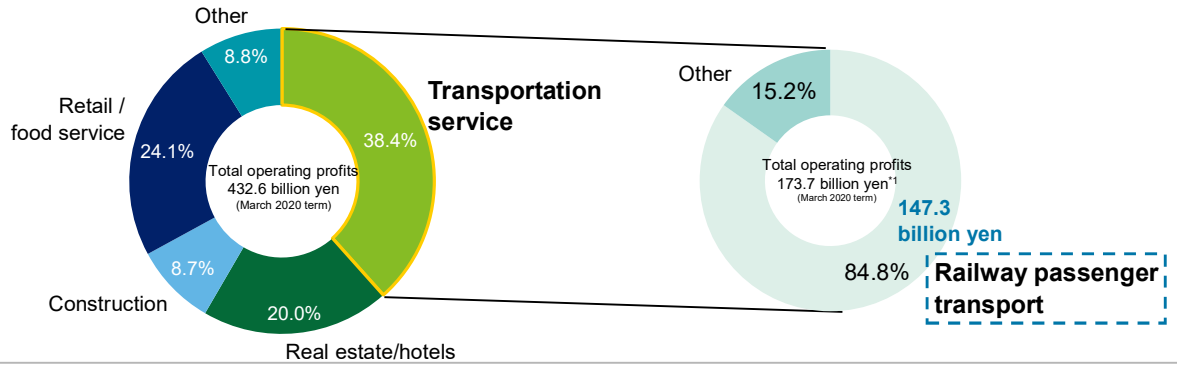
Transportation

✓Practice Case ①：Kyushu Railway Corporation

1. Covered business

[Selection of businesses covered in this project]
We assume that the railway business in the "transportation" service group, which is significant in the company's portfolio, will be covered

Business portfolio



Value chain for the covered business (hypothesized)

Transition risks	Transition risks		Transition/physical risks
Train cars procurement	Energy procurement	Power transformation/ energy supply	Operations
• Development of low-emission products • Spread of low-carbon technologies • Spread of renewable energy/energy-efficient technologies	• Carbon pricing (gasoline tax) • Changes in prices for significant commodities/products (electricity/gasoline prices) • Policies for energy efficiency (stricter energy efficiency standards) • Shifts in energy demands • Subsidy policies for renewable energy, etc. • Fossil fuel subsidies	…	• Extreme weather conditions • Changes in precipitation/weather patterns • Increased average temperatures • Changes in reputation with customers • Development of next-generation technologies • Water stress (droughts) • Elevated sea levels

Source: Created using JR Kyushu's website and integrated report (2020)
Note 1: Prior to the elimination of inter-segment transactions

Scenario analysis steps

1 **Establishing governance**
Incorporate scenario analysis into strategy formulation and risk management processes. Perform monitoring of relevant board meetings. Identify which internal/external stakeholders to involve and how to involve them.

2 Risk significance analysis

Market changes/ technology changes	Reputation
Government policies and laws	Physical risks

3 Scenario group definition
Multiple scenarios that include transition risks/physical risks related to the organization

4 Business impact assessment
Impact on business:
- Implementation costs
- Business costs
- Revenue
- Supply chain
- Suspension of operations
- Timing

5 Definition of countermeasures
Countermeasures:
- Business model reforms
- Portfolio reforms
- Investment toward capabilities and technology

6 **Documentation and information disclosure**
Direction of disclosure as a tool for internal/external dialogue, disclosure of significant products and technologies

Source: TCFD – Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities

2. Significance assessment of risks/opportunities

Climate-related risks and opportunities in JR Kyushu's railway business

Type			Evaluation	Risks	Opportunities
Transition	Policy/regulation	Increase in carbon tax (Increase in carbon price)	Large	(Medium to long term) ・Energy procurement cost increase ・Materials procurement cost increase due to rise in price of iron and steel ・Decrease in sales due to passing of procurement costs on to wages	(Medium to long term) ・Insignificant influence on energy procurement costs from measures to address trend toward energy saving and de-carbonization
		Regulations related to carbon emissions and the use of fossil fuels	Moderate	(Medium to long term) ・Increase in development/manufacturing costs for rolling stock to address regulations (Long term) ・Difficulty in operating diesel rolling stock if unable to address regulations	(Medium to long term) ・Increase in sales accompanying maintenance of environmental superiority of railways resulting from early adoption of de-carbonization
	Market	Change in energy mix Change in energy prices	Large	(Medium to long term) ・Energy procurement cost increase ・Decrease in sales due to passing of energy procurement costs on to wages	(Medium to long term) ・Lower costs and higher sales due to introduction/expansion of renewable energy businesses accompanying advances in photo-voltaic power generation and electricity storage technologies
	Technologies	Adoption of next-generation technologies	Large	(Medium to long term) ・Decline in sales due to decrease in environmental superiority of railways resulting from adoption of electric vehicles, etc. ・Failure of investment in new technologies for environmentally friendly rolling stock, etc. (Long term) ・Decrease in sales following loss of railway superiority due to adoption of self-driving technologies for automobiles, etc.	(Short to medium term) ・Lower costs due to adoption of self-driving technologies for railways (Medium to long term) ・Decrease in costs due to efficient inspection operations accompanying advances in weather forecasting ・Increase in sales accompanying active use of public transportation due to adoption of MaaS (Long term) ・Decrease in maintenance costs and increase in environmental superiority due to introduction of next-generation rolling stock, increase in sales due to increased environmental superiority
	Reputation	Changes in customer preferences	Large	(Short to medium term) ・Decline in sales if the environmental superiority of railways decreases, resulting from a shift to alternative means of transportation due to higher environmental consciousness among customers	(Short to medium term) ・Increase in sales if the environmental superiority of railways is maintained, resulting from a shift to the use of railways due to higher environmental consciousness among customers
		Change in reputation among investors	Small	(Short to medium term) ・Decline in reputation among investors if environmental measures are not considered to be aggressive	(Short to medium term) ・Attraction of ESG investment due to shift to low-carbon, environmentally friendly businesses

2. Significance assessment of risks/opportunities

Business risks and opportunities in JR Kyushu's railway business

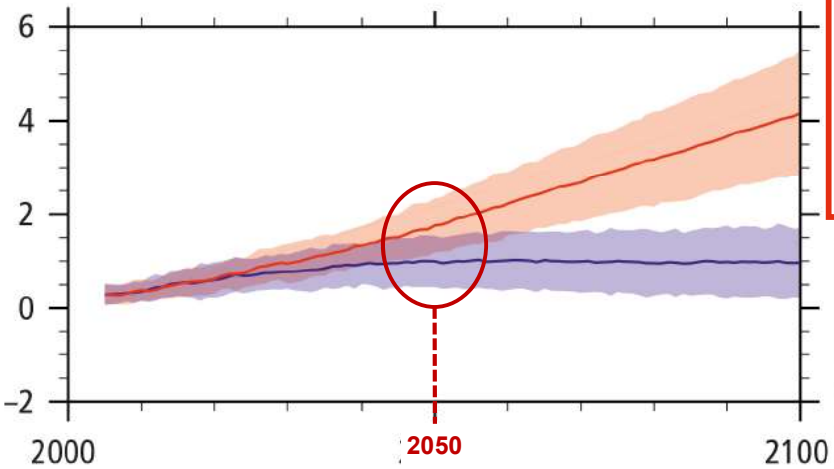
Physical	Acute	Increased frequency/severity of natural disasters	Large	(Short term) ・Decrease in sales due to disaster recovery cost increases and service suspensions accompanying increased or longer incidents of rain/strong winds (Short to medium term) ・Influence on business continuity due to supply chain interruption ・Decline in asset value in regions with high disaster risk	(Medium to long term) Decrease in disaster restoration costs and increase in sales due to operation of a railway business that is disaster resilient.
	Chronic	Rise in average atmospheric temperature	Large	(Short term) ・Increase in air-conditioning costs ・Increase in costs to address heatstroke ・Increase in costs due to breakdown of electrical equipment and other railway assets and to rail buckling (Short to medium term) ・Decline in sales due to trend toward refraining from going out	-

3. Scenario group definition

Step 2 3 4 5

[Selected scenarios]
2˚C and 4˚C scenarios as of 2050 have been selected for this project in consideration of long-term risks. For a portion of the parameters in the 4˚C scenario, we employed the IEA DRS scenario, which incorporates a delay in recovery from the COVID-19 pandemic

[Projected average global surface temperature change]
(compared with the average from 1986-2005)



Prior to 2030, the change in temperature is nearly the same in both the 2˚C and 4˚C scenarios.
The gap between the scenarios widens after 2030.

Definition of 4˚C (2.7˚C+) scenarios

4˚C scenario:
3.2-5.4˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

Over 2˚C (2.7 ˚C-4˚C) scenario:
2.7-4.0 ˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

2˚C scenario:
0.9-2.3˚C higher than pre-Industrial Revolution levels if strict measures are taken

(Reference) 1.5˚C scenario:
We are highly likely to achieve an increase of less than 1.5˚C compared to pre-Industrial Revolution levels if a radical transition to a new system is made.

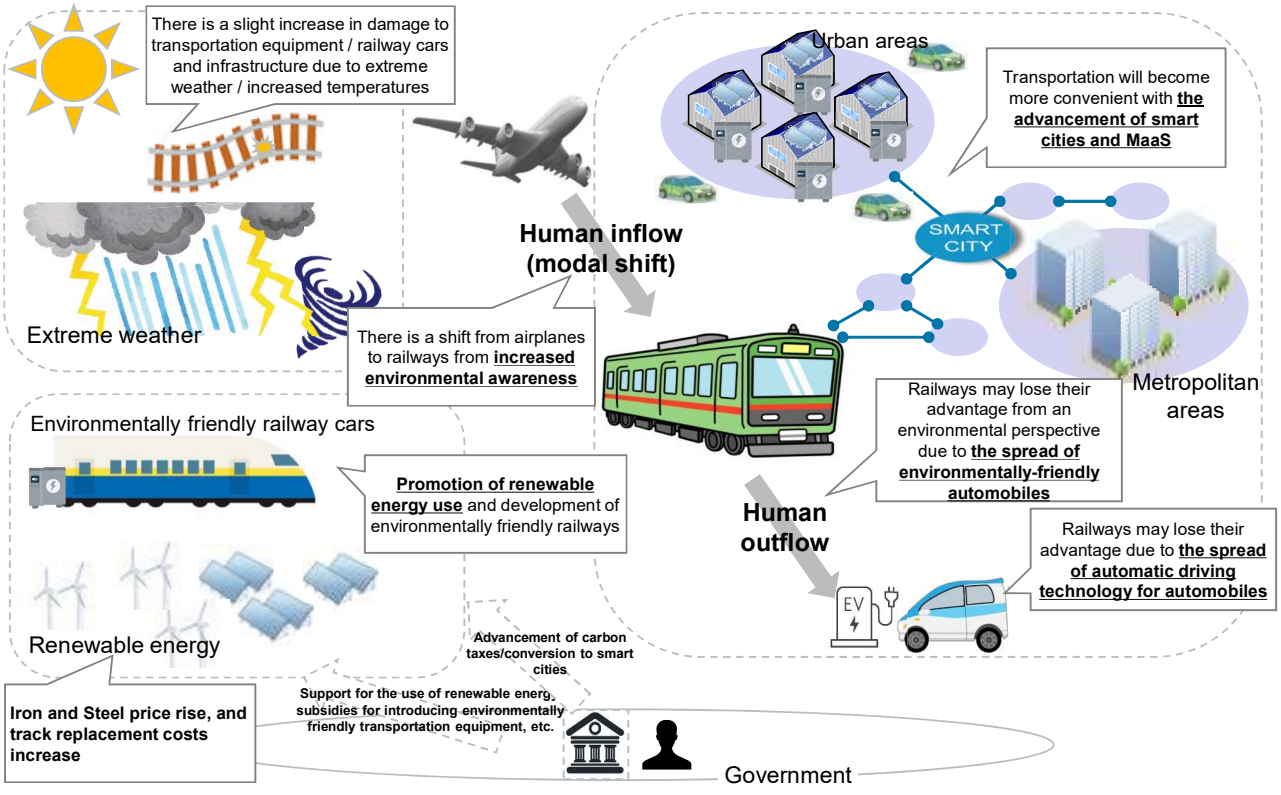
The TCFD recommendations for scenario analysis suggest that multiple temperature range scenarios be selected, including those below 2˚C

3. Scenario group definition

Step 2 3 4 5

[Visual representation of a 2˚C scenario future society (assumed as 2050)]
Low-carbonization moves forward and modal shifting occurs; renewable energy and smart cities become popular

2˚C 4˚C



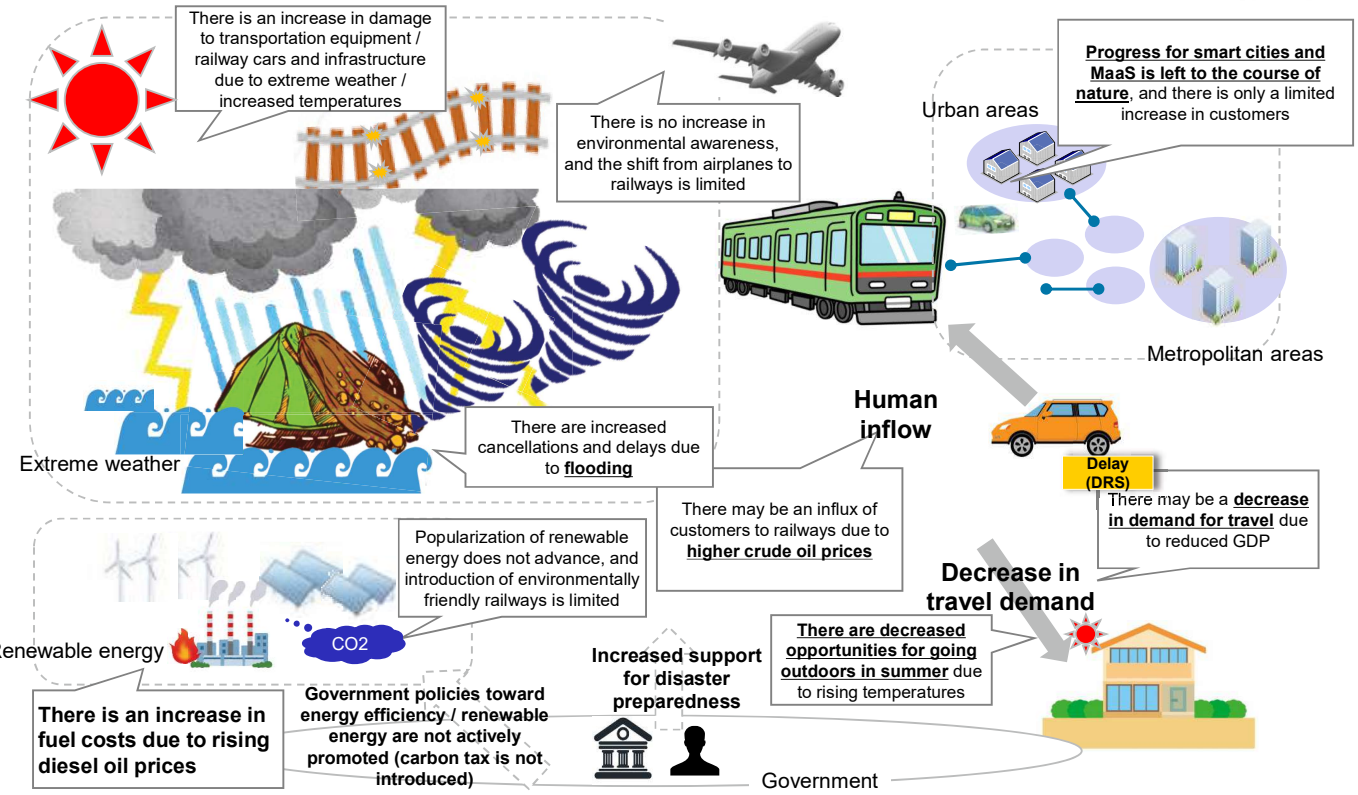
3. Scenario group definition

Step 2 **3** 4 5

[Visual representation of a 4˚C scenario future (assumed as 2050) society]

Extreme weather becomes more severe, and progress for smart cities is left to the course of nature

2˚C **4˚C**



4. Business impact assessment

Step 2 3 **4** 5

[Table of parameters used]

*Exchange rate: 1 USD = 105 JPY (based on the October 1, 2020 rate)

We performed an estimate based on scientific evidence from IEA and other sources

		Currently	2050		Source
			4˚C	2˚C	
Transition risks (increase in expenses)	Carbon tax	---	---	$191/t-CO2	• IEA: "World Energy Outlook 2020" • We assume that levels in the 4˚C scenario will be equivalent to current levels
	Electricity price	$216/MWh	$184/MWh	$242/MWh	• IEA: "World Energy Outlook 2018"
	Crude oil price	$63/Barrel	$96/Barrel	$48/Barrel	• IEA: "World Energy Outlook 2020」
	Iron and Steel price	$350/t	$382/t	$506/t	• 2ii: "The Transition Risk-o-Meter Reference Scenarios for Financial Analysis"
Transition risks (spread of low-carbon technologies)	Air passenger volume growth rate	6,290 billion/pkm	Domestic/international: 158%	Domestic/international: 80% Domestic: 47%、International: 99%	• 2ii: "The Transition Risk-o-Meter Reference Scenarios for Financial Analysis"
	Number of automobiles with low-carbon technology	—	1,525,850,630	1,339,099,724	• Estimated using IEA: "Energy Technology Perspective 2017"
	Number of EVs/fuel cell vehicles in use	—	380,981,575	963,804,456	• Estimated using IEA: "Energy Technology Perspective 2017"
	Number of self-driven vehicles in use	—	641,900,000	641,900,000	• Estimated using Fuji Chimera Research Institute: "2020: Future prospects for the automated driving/AI car market"
Physical risks	Increase in temperature	—	Average +2.04˚C	Average +1.2˚C	• World Bank: "Climate Change Knowledge Portal"
	Flood frequency	1x	4x	2x	• Review Meeting of Technologies Related to Flood Control Planning Based on Climate Change: "A proposal for flood planning based on climate change"
	Probability of landslides	10%	12%	12%	• A-PLAT: An information platform adapted to climate change
	Probability of track buckling	0.6 - 0.63%	0.94%	0.65%	• ELSEVIER: "Impacts of climate change on operation of the US rail network" 2017

4. Business impact assessment

Step 2 3 4 5

2˚C world: There will be increased costs associated with the transition, but we expect that opportunities will be created if the environmental advantages of railways are maintained
4˚C world: There will be increased costs due to greater severity of natural disasters

Risks		expected event	Impact amount 2℃	Impact amount 4℃
Transition Risks	Increase in carbon tax (Increase in carbon price)	(2℃) Carbon tax will be introduced.(emission factor will be reduced) (4℃) No carbon tax will be introduced.		
	Increase/decrease in procurement costs (Electricity)	(2℃) Renewable energy will advance and electricity prices will rise (4℃) Renewable energy will not advance, and electricity retail competition will lower prices.		
	Increase/decrease in procurement costs (Diesel oil)	(2℃) Crude oil prices down, diesel oil prices down (4℃) Crude oil prices will soar, diesel oil prices will also rise.		
	Increase/decrease in procurement costs (Price of iron and steel)	(2℃) Iron and steel prices rise as carbon tax introduced (4℃) No carbon tax will be introduced.		
	Adoption of next-generation technologies (Adoption of automated driving and ZEVs)	(2℃) EVs, fuel cell vehicles, and self-driving cars will become popular, and Customer outflow from railroads will occur. (4℃) Widespread adoption of EVs and fuel cell vehicles x self-driving cars will be limited.		
	Changes in customer preferences (Change in aviation quantity)	(2℃) Modal shift occurs, Inflow from aircraft will occur. (4℃) Changes in aviation quantity will be left to the course of nature.		
Physical Risks	Rise in average atmospheric temperature (Decrease in the number of users)	(2℃) Travel demand will decrease slightly due to rising temperatures. (4℃) Travel demand will decrease due to rising temperatures.		
	Increased frequency/severity of natural disasters (Increased flood damage)	(2℃) Flood damage will increase slightly at each site. (4℃) Flood damage will increase at each site.		
	Increased frequency/severity of natural disasters (Increase in landslides)	(2℃) Damage caused by sediment will increase slightly at each site. (4℃) Damage caused by sediment will increase slightly at each site.		

5. Countermeasure definition

Step 2 3 4 5

[Future countermeasures against individual risks (planned)]
We expect the main countermeasure to be “promoting the use of renewable energy sources”, including wind power, while “setting long-term targets for reducing CO2 emissions”

Risk initiatives / Opportunity initiatives / Countermeasures toward organizational issues

Item		Category	Risk countermeasures (initial plan)	Category	Initiatives for seizing opportunities (initial plan)
Carbon pricing / energy	Targets For CO2 emissions reductions	Adapted	✓ **Set long-term targets for reducing CO2 emissions** ✓ Set long-term targets for reducing energy usage	Established	✓ **Implement long-term targets for reducing CO2 emissions** ✓ Plant trees to achieve disaster preparedness while acquiring emissions credits for absorbing CO2 at the same time
Advances in low-carbon technologies	Promoting energy efficiency	Adapted	✓ Invest in energy-efficient technologies ✓ Continue introducing energy-efficient train cars		
	Promoting use of renewable energy	Adapted	✓ Develop and introduce renewable energy train cars ✓ Use renewable energy to achieve BCP measures (emergency power generation) while achieving decarbonization at the same time	Adapted/ established	✓ Promote the use of private power generation and sell electricity
Advances in next-gen technologies		Adapted	✓ Develop and introduce of renewable energy train cars	Established	✓ Land prices will increase due to development around stations from the progress of smart cities / MaaS
Extreme weather conditions		Retained	✓ Utilize data to increase the sophistication of risk models	Established	✓ Plant trees to achieve disaster preparedness while acquiring emissions credits for absorbing CO2 at the same time

6. Direction for information disclosure

Start the disclosure by referring to the TCFD's four recommended items for disclosure "Governance", "Strategy", "Risk management" and "Parameters and targets" and disclosing what you are able to in line with these

Governance

Strategy

1 Risks and opportunities
2 Scenario Analysis and Future Policies and Initiatives

Risk management

Parameters and targets

2. Scenario Analysis and Future Policies and Initiatives

We analyzed the effect of climate change on our railway business, based on 2℃ to 4℃* scenarios outlined by specialist institutions, such as the IPCC (Intergovernmental Panel on Climate Change) and IEA (International Energy Agency). Under the 2℃ scenario, which anticipates an increase in carbon taxes and cost increases due to the adoption of renewable energy, if the environmental superiority of railways can be maintained, then there will be a shift of customers from other means of transportation, and we will be able to secure opportunities to increase sales.

In addition, under the 4℃ scenario, due to the increasing frequency/severity of natural disasters caused by climate change, there will be damage to railway assets and an increase in maintenance costs, as well as a decline in sales due to the suspension of operations.

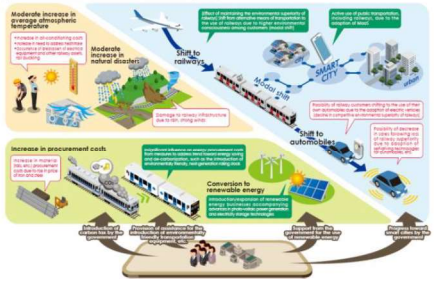
For society and for the Company, The Group will work to advance initiatives for the achievement of the 2℃ world to facilitate the realization of a sustainable society.

* Including IEA 2020 scenario of 2.7℃ or higher

<Major scenarios used in scenario analysis>

Used primarily to analyze transition risks	IEA: SDS, STEPS, DRS
Used primarily to analyze physical risks	IPCC: RCP2.6, RCP8.5

◇Global outlook under 2℃ scenario (2050)

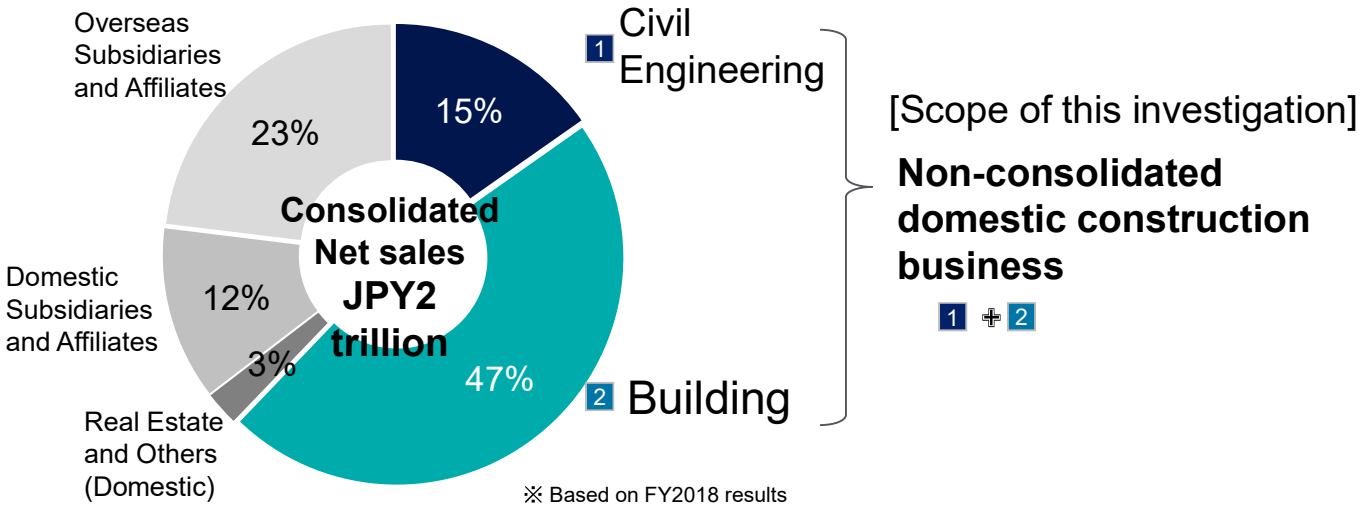


Building

✓Practice Case ①：Kajima Corporation

[Sales Composition of Kajima Group, Scope of Review]

The scope of consideration is domestic construction (civil engineering + building construction), which accounts for more than 60% of consolidated net sales.



2 [Step2: Assess materiality of climate-related risks]

From the characteristics of the industry, it was evaluated that the risks related to the market and technology were large in addition to the policy trend.

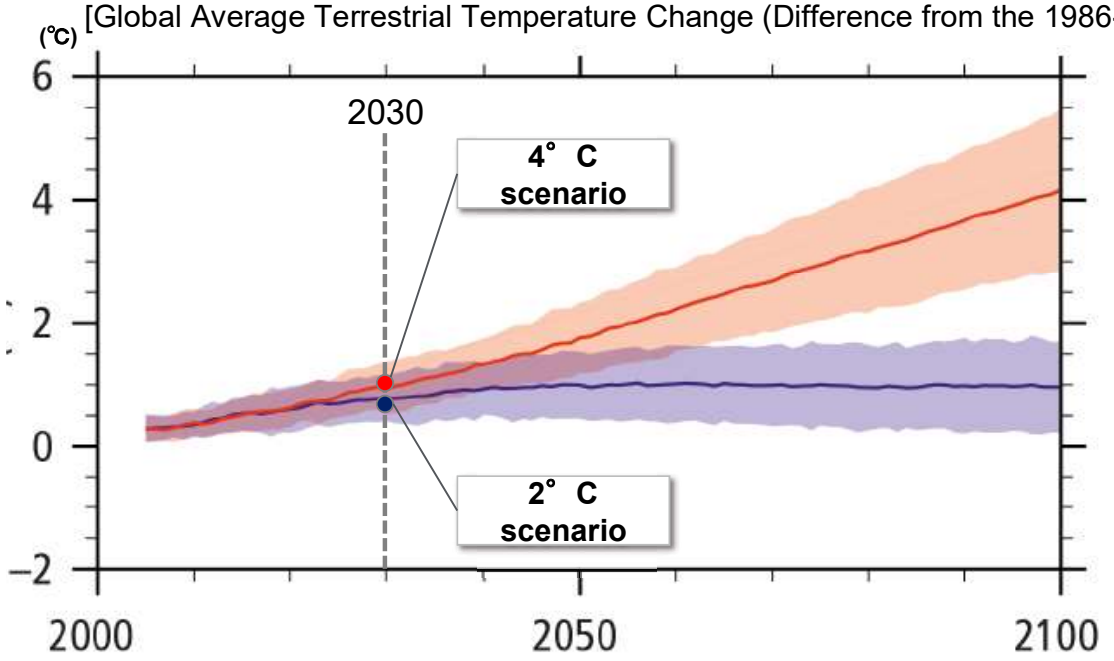
	Classification		Consideration of Risks and Opportunities	Assessment
Transition risk	Policy	Carbon price	Price competitiveness including carbon price and development of low-carbon materials and construction technologies are necessary. A delay in the development of low-carbon is subject to patent royalties from other companies, which reduces competitiveness. The use and development of low-carbon building materials progresses. Construction investment decreases due to an increase in construction costs.	Large
	Policy	Carbon Emissions Targets/Policies	Construction investment is restrained by regulations on the total amount of Carbon emissions, our construction revenue is restrained, and sales decline. Additional expenses such as credit purchases are incurred when the upper limit is not achieved. Improvement of design technology on low energy buildings such as ZEB (Zero Energy Building) is required.	Large
	Market	Changes in customer behaviours	Carbon emissions are some of the evaluation items in order competition. The global enterprise demands the low carbon construction of the world standard in the domestic. A decrease in fossil fuel-related construction projects affects orders. The energy mix changes and construction related to renewable energy increases.	Large
	Technologies	Renewable energy and Energy conservation technologies	Technology development costs related to renewable energy and energy conservation increase at the construction stage and at the facility operation stage. The technology required varies greatly depending on the legislation. Competition arises with advanced companies such as from Europe etc. where renewable energy is spreading.	Large
	-	Energy-saving policies, advances in next-generation technologies, recruitment and education to acquire expertise, changes in investor and bank behavior, and increases in energy demand and prices		Medium to Small
Physical risk	Chronic	Deterioration of working and construction conditions	Increased heatstroke risk at construction sites leads to a decrease in productivity and an increase in costs. Changes in construction methods and materials are required to ensure quality. Due to the harsh working conditions, the number of prospective employees decreases.	Large
	Policy	(attributable to increased temperature) Changes in labor laws	Sales decline due to legislation prohibiting outdoor work during the summer season. Progress in mechanization and labor-saving in construction is accelerated.	Large
	Chronic/ Acute	Changes in rainfall and weather patterns/ Increasing severity of extreme weather conditions	Process delays due to rainfall, strong wind, etc. occur, and costs increase due to countermeasures costs. Delay in delivery of (overseas) procured materials and increase in procurement (transportation) costs occur. Demand for flood control and other measures to strengthen national resilience increases. The disaster prevention and disaster mitigation markets expand.	Large
	Market	(Due to an increase in disasters) Lower advantages in location	The domestic construction market shrinks due to the transfer of production facilities in the disaster risk area to overseas.	Large
	-	Subsidence, rising sea levels, tightened disaster response regulations and reduced insurance coverage		Medium to Small

3 [Step3: Identify and Define a range of scenarios]

Analyzed impacts on company by drawing the 2℃ and 4℃ scenarios of 2030 regarding highly uncertain climate change

Given the geographical characteristics of Japan, the possibility that natural disasters will become increasingly severe, which cannot be predicted based on past knowledge. We recognize that the construction industry's mission is to respond to that kind of uncertainty.

[Global Average Terrestrial Temperature Change (Difference from the 1986-2005 Average)]



Source: AR5 SYR Diagram SPM.6

[As is]
The temperature will rise 3.2-5.4°C above pre-industrial levels, unless more rigorous measures are taken.

[Active transition]
The temperature will rise 0.9-2.3°C above pre-industrial levels, if strict measures are taken.

3 [Step3: Identify and Define range of scenarios]

Assumptions based on scientific evidence (such as IEA)

Item	Parameter	At present	2030		Source
			4℃	2℃	
Carbon price	**Carbon tax**	※ Average successful bid in the European EU-ETS: Approx. $8 per tonne	-	**88 USD/t**	• IEA WEO 2018 SDS (Developed countries)
Carbon Emissions Targets/Policies	**Target values for emissions**	100% as a benchmark	-3%	-66%	• GoJ Targets • IEA ETP B2DS
Changes in customer behaviors	**Power Supply Composition**	Coal thermal:337 TWh (32%) Oil thermal:97 TWh (9%) Gas-fired thermal: 440 TWh (42%) Nuclear: 12 TWh (2%) Renewable energy: 73TWh (7%)	Coal thermal:264 TWh (25%) Oil thermal:33 TWh (3%) Gas-fired thermal power: 287 TWh (27%) Nuclear: 216 TWh (21%) Renewable energy: 250 TWh (24%)	Coal thermal:83 TWh (9%) Oil thermal:17 TWh (2%) Gas-fired thermal power: 284 TWh (29%) Nuclear: 247 TWh (25%) Renewable energy: 347TWh (36%)	• IEA WEO2018 NPS (Japan)
Renewable energy and Energy Conservation Technologies	**ZEB target**	-	**On average for new buildings** Realize ZEB	**On average for new buildings** Realize ZEB	• Basic Energy Plan
Deterioration of working and construction conditions **→ "Changes in Labor Legislation" as a policy risk is a derivative.**	**Rate of decline in labor productivity due to heat stress**	0.4%	**0.99%**	**0.99%**	• ILO「Working on a warmer planet」
	Temperature increase	0° C as a benchmark	Average 2.1℃ (2030-2050)	Average 1.9℃ (2030-2050)	• "Climate Change Adaptation Information Platform" by the Ministry of the Environment, etc.
Changes in rainfall and weather patterns	**Days of heavy rain**	2.5 days/year	**3.0 days/year**	**2.5 days/year**	• Ministry of the Environment and Japan Meteorological Agency Report
Increasing extreme weather conditions (typhoons, heavy rains, sediment, disaster, storm surges, etc.) **→ Derivation of location advantage as market risk**	**Flood damage in urban areas**	$3.3 billion/year	**$7.3 billion/year**	—	• WRI "The Aqueduct Global Flood analyze"

3 [Step3: Identify and Define range of scenarios]

- Increased demand due to increased physical risk
- Possibility of labor restriction during summer due to the harsh heat

4℃ 2℃

Assumption of Future Society (4° C scenario)

Direct impact to the construction industry	Effects of Energy mix changes	Changes in the market
• Damage and working stoppages increase due to intensified typhoons, etc • Lower productivity due to heat stress • Restrictions on summer work caused by the extreme heat • Adoption of design and construction methods to cope with climate change (mechanization and labor saving)	• The fossil fuel power plant will continue to exist. • Increase of renewable energy facilities based on the current policy	• Fundamental review of flood control plans, etc. • Relocation from disaster risk areas (Domestic relocation: Increase in demand, Overseas relocation: Decrease in demand) • Significant expansion of the disaster prevention, disaster mitigation, and BCP markets • Strengthening building regulations • ZEB (Zero Energy Building) and energy conservation progress based on the current policy.

3 [Step3: Identify and Define range of scenarios]

Increased demand due to increased physical risk
promotion of renewable energy/ZEB (zero energy building) progress while introducing a carbon tax and reducing fossil fuel power generation as a policy

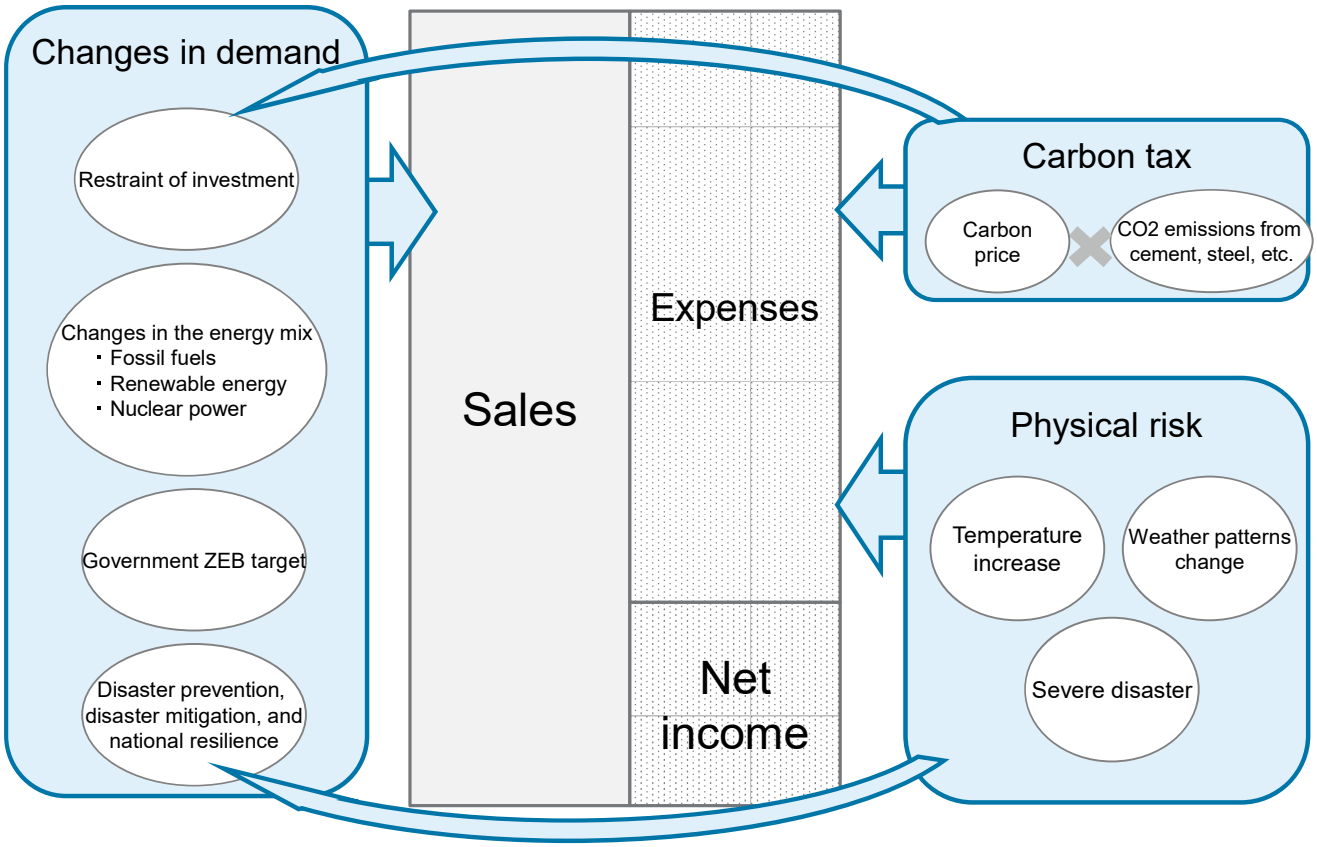
4℃ 2℃

Assumption of Future Society (2° C scenario)

Direct impact to the construction industry	Effects of Energy mix changes	Changes in the market
• Introduction of a carbon tax • Restrictions on business activities due to the introduction of emission allowances • Technological development for low-carbon construction and materials	• Substantial increase in renewable energy • Significant decrease in fossil fuel power generation • Increase in the introduction of hydrogen and other new energy sources	• Significant review of flood control plans, etc. • Review of the location of new buildings • Expansion of the disaster prevention, disaster mitigation, and BCP Market • Rapid spread of ZEB (zero energy buildings) • Increase in energy conservation renewals (decrease in new buildings) / Expansion of energy management services • Market entry from other industries • Increased demand for in-house renewable energy facilities

4 **[Step4: Evaluate business impacts]**

Considering the impact of each key driving force on the income statement (P/L)



4 **[Step 4: Evaluate business impacts] Assumptions: around 2030**

Reflecting disasters with extreme severity, demand for disaster prevention, disaster mitigation, and national resilience is increased

Additionally,
2° C scenario → Rising cost caused by introduction of carbon tax have an great influence.
On the other hand, demand is expected to increase due to the spread of renewable energy and zero-energy-buildings (ZEB).
4° C scenario → The deterioration of working conditions due to the increase in temperature is significant.

Risk/Opportunity Items	4° C scenario	2° C scenario
Cost increase due to carbon tax		- - -
Shrinkage in the construction market due to a tax increase		-
Business restrictions due to CO_2 emission allowances		-
Energy mix change (decrease in fossil fuels)		-
Increase in renewable energy-related demand	+ +	+ +
ZEB (Zero Energy Building) market expansion	+	+ +
Effect on working conditions due to temperature rise	- -	-
Disaster prevention, disaster mitigation, and national resilience	+ +	+ +
Relocation from disaster risk areas	+ -	

5 [Step5: Identify potential responses]

For items with large business impact, future countermeasures were examined. It is necessary to promote technological development that meets market needs.

Response to Carbon Tax and Emission Allowance Regulations

Cost increase due to carbon tax

Contraction of the construction market due to the tax increase

Business restrictions due to CO_2 emission allowances

① Promote activities to reduce CO_2 during construction
② Development and promotion of introduction of low-carbon materials
③ Securing renewable energy

Technological development in response to new markets and climate change

Energy mix change (decrease in fossil fuels)

Increase in renewable energy-related demand

ZEB (Zero Energy Building) Market Expansion

Effect of rising temperature on working conditions

① Selection of focus areas based on energy mix
② Development of engineering and construction technologies for renewable energy facilities
③ Pursuit of ZEB profitability and comfort
④ Development of labor-saving construction technology

Responding to Severe Extreme Weather

Disaster prevention, disaster mitigation, and national resilience

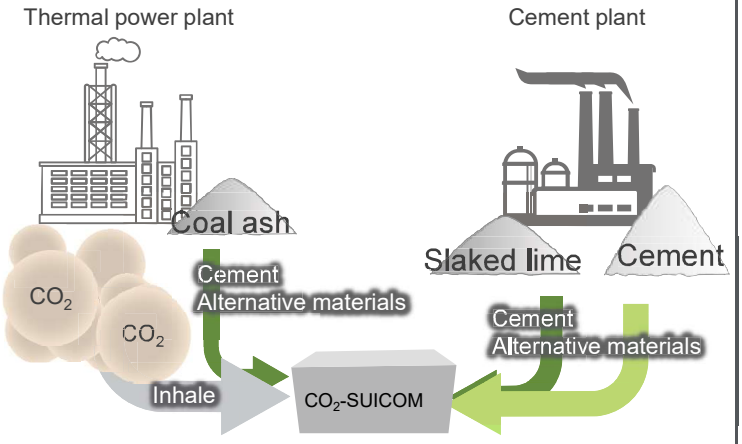
Relocation from disaster risk areas

① Promotion of technical development related to disaster prevention, disaster mitigation, and BCP
② Development and utilization of hazard maps incorporating unique knowledge
③ Construction that contributes to the strengthening of national resilience including buildings and structures

[Development Case of Low-Carbon Building Materials (Concrete)]

CO_2-SUICOM

By "sinking" CO_2 in a way that trees "breath",
Concrete to reduce the amount of CO2 to virtually zero or less

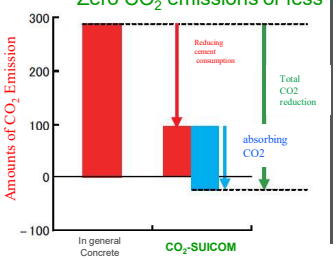


In "CO_2 - SUICOM",

Reducing cement consumption by using coal ash, special admixtures and other materials instead of cement, and absorbing CO_2 into the concrete during manufacturing, we are able to reduce CO_2 emissions to virtually zero or less.

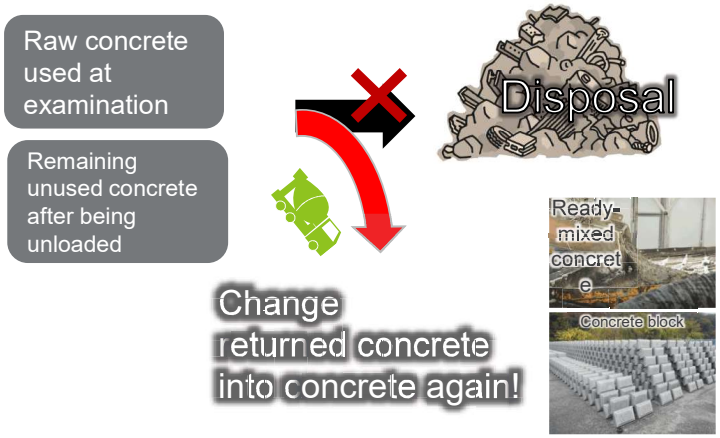
※ Co-developed by Chugoku Electric Power Co., Inc., Kajima Corporation, and Denka Co., Ltd.

Zero CO_2 emissions or less



Eco-cleat R³

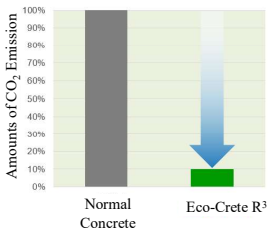
Manufacture by reusing the waste returned concrete
Ultimate Recycling-Oriented Concrete



In "Eco-Crete R³",

This is an environmentally conscious concrete that reuses the returned concrete which had been inevitably disposed. Eco-Crete contributes to resource recycling and reduce in CO_2 emissions.

Reduce CO_2 emissions by up to 90%



Construction Material

✓ Practice Case①：LIXIL Group Corporation

1. Target Business
1 - 1 LIXIL Groups and Target Organizations

[LIXIL core philosophy]

The Group's superior products and services contribute to improving people's comfort and lifestyles.

[Company Overview]
(The fiscal year ending in March 2019)

- Sales JPY1,832.6 billion
- Approx. 75 thousand employees
- Sites in 150 or more countries

[LIXIL's business domains]

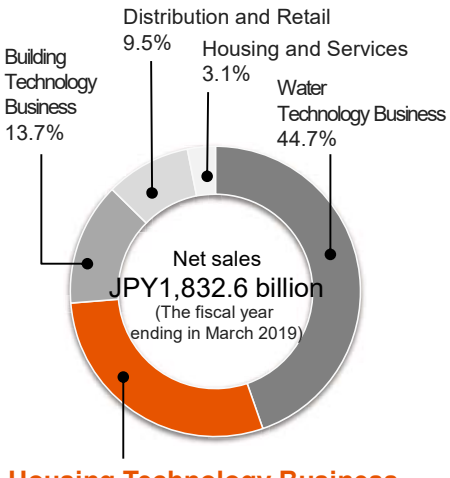
LIXIL Group's products and services support more than **1 billion** people's daily lives worldwide through various partners.

Housing Materials

Housing Equipments

Building materials

[Target organization]



Housing Technology Business
29.5% (Japan 29.0%, Overseas 0.5%)

1. Target Business

1 - 2 Selection of target business divisions

➢ For 2 businesses, estimate financial impacts in 2030 using the 2℃/4℃ scenario.

[Target business]

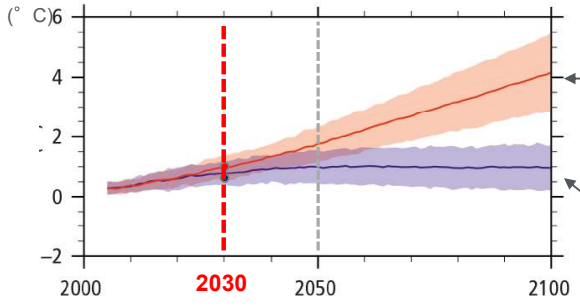
Target business	Reasons for selection
Sash door	Due to the impact of higher costs for raw materials due to tighter regulations and the spread of high-performance products such as energy-saving products
ZEH ※ Net Zero Energy House	Introduction of renewable energy for climate change countermeasures, **As demand for ZEH products is expected to increase**

[Participating departments]

- Sash and door business
- ZEH promotion division
- Technology development
- Environmental division

Cooperation: other related departments at headquarters

[2 future scenarios]



Global Average Terrestrial Temperature Change
(Difference from the 1986-2005 Average)

4℃ Scenario

Scenarios with large physical impacts
- There is no significant tightening of regulations.
- Expansion of damage caused by extreme weather conditions such as typhoons and floods
- Re-energy and ZEH penetration is limited, etc.

2℃ Scenario

Scenarios in which the impact of policy shifts is significant
- Introduction of a carbon tax, drastic tightening of recycling regulations, etc.
- Rising raw material and energy prices
- Increasing use of renewable energy and ZEH, etc.

2. Assessment materiality of climate-related risks

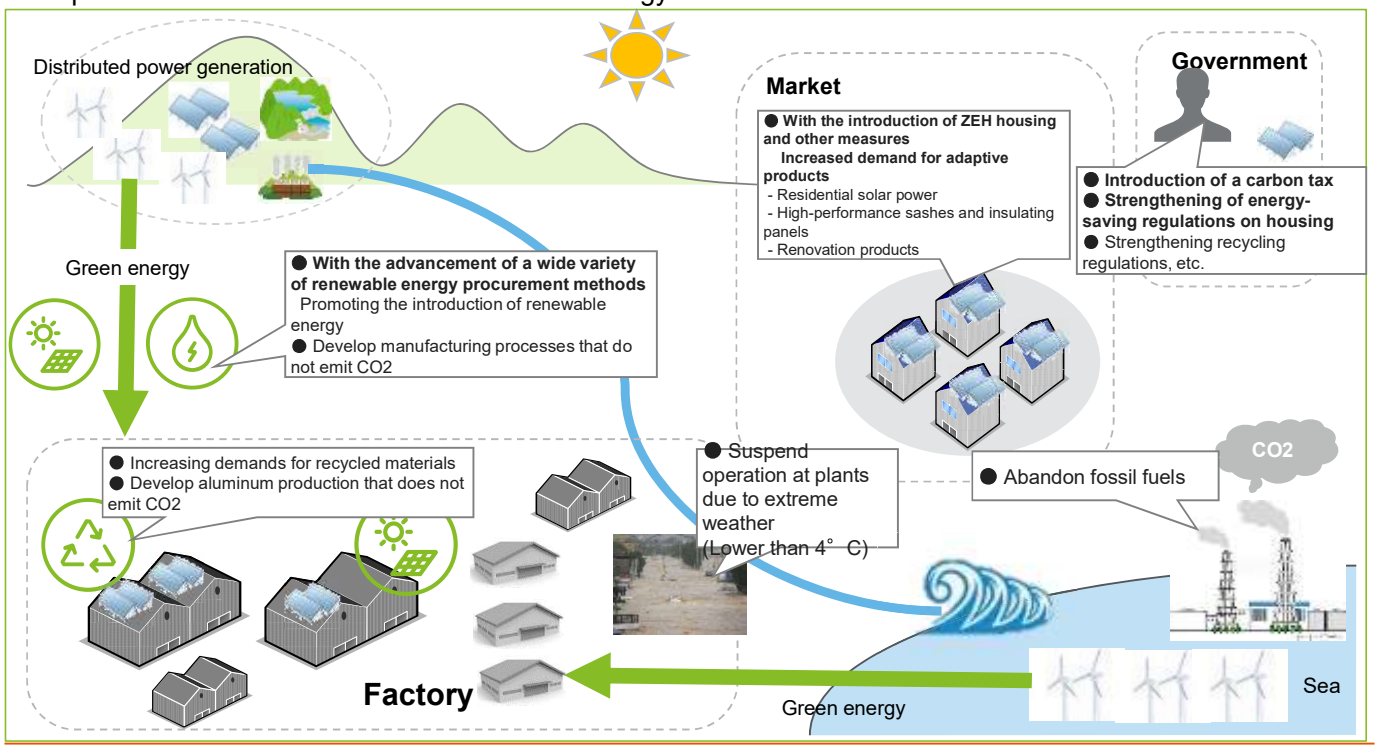
➢ Assumed risks and opportunities were identified, and the impact was assessed from large to small.

Summary of risks and opportunities (only “Large” impact excerpted)

Assumed risks			Anticipated business impact		
Major classification	Medium	Small	Risk	Opportunity	Impact
Transition risk	Policies and regulations	**Carbon tax**	▪ Fuel taxes and soaring electricity prices	▪ To boost efficiency ▪ Increase awareness of energy conservation among customers	**Large**
		Tightening regulations	▪ Tightening of regulations, such as energy-saving standards ▪ Mandatory use of alternative materials and recycled materials → Passing on cost increases to raw materials	▪ Strengthening housing energy conservation standards → Increase in demand for high insulation and renewable energy products ▪ Sustainable raw material utilization	
		Renewable energy policy	▪ Convergence of FITs and subsidies → Decline in consumer demand	▪ Creation of a market for renewable energy-related services ▪ Promotion of in-house renewable energy improvement measures	
	Market changes / technological change	**Technology investment**	▪ Increased investment costs in the manufacturing process	▪ Promoting Innovation in manufacturing processes	
		Changes in the market	▪ Rising prices of raw materials	▪ Development of alternative materials	
Physical risk	Acute	**Extreme weather**	▪ Increase in damage caused by natural disasters ▪ Supply chain disruptions	▪ Business opportunities for disaster prevention products ▪ Increase resilience through BCP measures	
…	…	…	…	…	Medium to small

3. Identify and define a range of scenarios
3-1 Worldview of the 2° C scenario

➢ At 2° C, the strengthening of regulations promotes decarbonization and accelerates the spread of ZEH-related products and the introduction of renewable energy.



3. Identify and define a range of scenarios
3-2 5Force analysis of the 2℃ scenario

Housing materials industry

: Required actions

Seller (Raw Material Suppliers)
- **Cost increase of raw materials** due to carbon regulations
- Shift to recycled materials

Review of low-carbon procurement methods, etc., and response to physical risks

Seller (energy, etc.)
- **Increase in renewable energy ratio**
- Renewable energy costs decreased

Securing power sources for private consumption Investment in renewable energy Reducing the carbon content of factories

New comer
- Companies in other industries, such as IoT technology and power-related businesses

Strengthening of collaboration (Alliances, M&A)

Industry competition
- Promote the reuse and electrification of energy at factories
- Reducing the carbon content of raw materials and promoting R&D of recycled materials
- Expansion of sales channels through the spread of ZEH and renewable energy

For low-carbon production R&D and development

(Alternative)
- Emergence of disaster response-type products, etc.
- Diversification of re-rnergy-related Systems

Development of high performance and new high-value-added products

Buyer (Customers)
- Promotion of energy-efficient products (including recycling) ⇒**Needs for energy-saving products** increase
- Customers' energy conservation needs increase due to the promotion of ZEH and energy conservation policies→ Expanding **needs to high insulation products for houses**
- Increased **demand for residential solar power and other renewable energy-related services due to customers' renewable energy needs and rising electricity prices**

Development of value-added products for reducing the cost and carbon, recycled materials, residential solar power

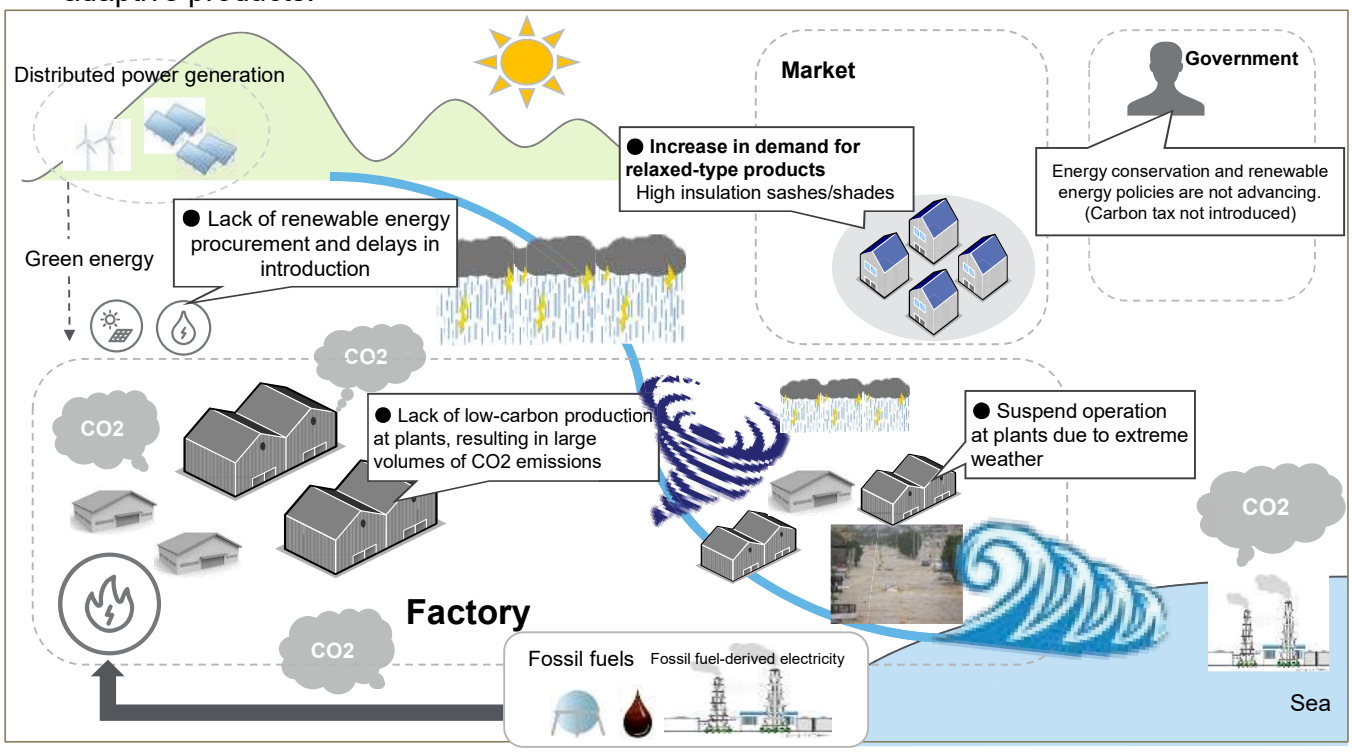
Government
- Introduction of carbon tax
- Promoting **energy conservation, renewable energy, electrification, ZEH**, low-carbon policies, and subsidy enhancement to achieve CO2 reduction targets
- **Establishment of a system for the widespread use of ZEH**
- Subsidies (breakwater, etc.) for increased flood damage have been developed to a certain extent.

In cooperation with the government, make an ecosystem/rule on low-carbon markets

3. Identify and define range of scenarios
3-3 Worldview of the 4° C scenario

STEP 1 2 3 4 5

- At 4° C, policies are not implemented, increasing physical risks and increasing demand for adaptive products.



3. Identify and define range of scenarios
3-4 5Force analysis of the 4° C scenario

STEP 1 2 3 4 5

Housing materials industry

: Required actions

Seller
(Raw Material Suppliers)
- There is no carbon regulation.
- No shift to recycled materials
- **Physical risks emerge** in some factories and resource suppliers

Consideration of diversified procurement, etc.

Seller
(energy, etc.)
- Renewable energy will spread to a certain extent, but depend on fossil fuels

Optimization of renewable energy-related investment

New comer
- There is no particular entry.

Industry competition
- Re-energy and energy-saving measures implemented as in the past
- Development of adaptive products
- **Physical risks at the company's sites become apparent**

Promotion of measures for renewal and energy conservation, and examination of portfolios of sites with high physical risks, etc.

(Alternative)
- Develop products for market entry with the increasing needs for air conditioners

To consider new high-value-added products

Buyer
(Customers)
- Political support weakened and environmentally conscious products were successful.
- Needs for low-carbon, recycled materials, etc. are low.
  ⇒Stakeholders would not require Response
- **Demand for high insulation and sunlight shielding products increased** due to higher temperature.
- Due to flooding damage, demand in high-rise regions has expanded and demand for rental properties has expanded.
- **Increasing needs for adaptive products**

Providing products that meet new needs

Government
- As the trend of low carbon/decarbonization weakens and external pressure from the international community weakens, regulations such as carbon tax and the use of recycled plastics are not introduced.
- In some countries, CO2 emissions at factories are regulated, and emissions trading is expected to be more active (not to be introduced in Japan).
- ZEH/ZEB penetration has not progressed, and there are no aggressive policies.
- Subsidies (breakwater, etc.) will be provided due to rising sea levels and increased water stress.

Rapid access to policy information and securing of subsidies (mainly in collaboration with the government on physical risks)

3. Identify and define range of scenarios
3 - 5 Assumptions for each scenario

STEP 1 2 3 4 5

		At present	2030		Source
			2° C world	4° C world	
Carbon price	Carbon tax	-	**$100/t**	(Not installed at 4° C)	• IEA WEO 2019
Renewable energy policy	ZEH penetration rate	Newly built houses 54,352 units (2018)	Newly built homes **100**%	(market at 4° C)	• Japan environment co-creation initiative "Net Zero Energy House support project survey presentation 2019 materials"
		Existing houses 159 units (2018)	- %	(market at 4° C)	
Investments in low carbon technology	Regulation of recycled plastics	-	**14%** (Price is assumed to increase by 1.2 times)	(No restriction at 4° C)	• EU "The plastic strategy"
Increase/decrease in prices of heavy-use products	Price of aluminum	$2,108/mt	- (1.25 times higher at 4° C with introduction of carbon tax)	$2.2 thousand/mt	• World Bank "World Bank commodities forecast "
Increasing disasters with extreme severity	Frequency of floods	1 time	**1.7 times**	**3 times**	• Technical review committee on flood control plans based on climate change "Recommendations on water control plans based on climate change"

4. Evaluate business impacts
4 - 1 Estimated items for business impact evaluation

STEP 1 2 3 4 5

➢ Select risk/opportunity items to be prioritized in the current scenario analysis.

Estimated Risks and Opportunities	
Risk	Increase in energy costs due to introduction of carbon tax
	Rising raw material prices and rising costs due to regulations
	Increase in operating costs due to flood damage, etc.
Opportunity	Increase in sales of high-performance products for new homes
	Increase in sales due to expansion of renovation market
	Increase in sales due to market expansion of adaptive products
	Reduction of business activity costs through promotion of energy conservation and renewable energy measures

STEP 1 2 3 4 5

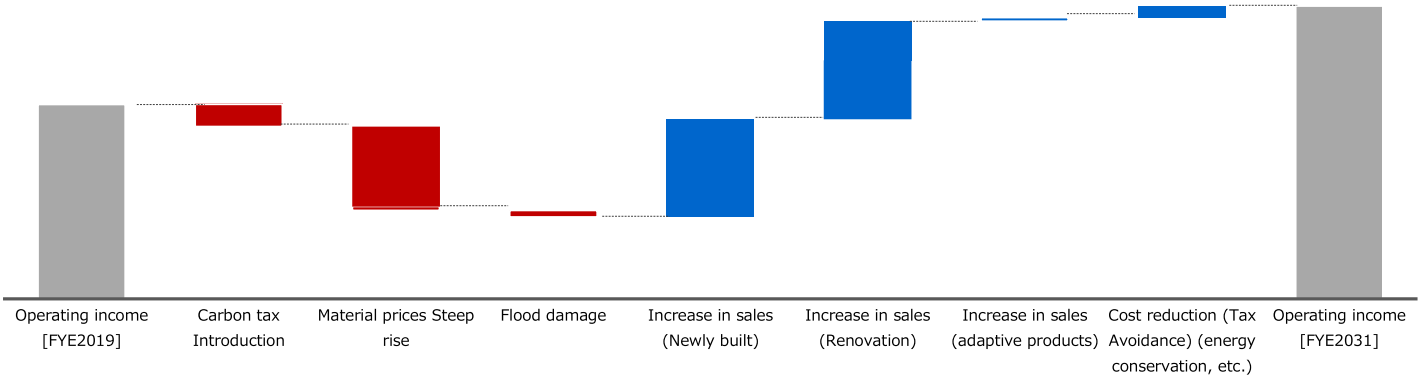
4. Evaluate business impacts
4 - 2 Business impact evaluation (summary of the 2° C Scenario)

2℃ Scenario

- In the 2° C scenario, there is **a large increase or decrease in profit** due to institutional development by the government, tightening of regulations, and changes in consumer preferences.
- Especially, **the renovation of the existing house which occupies the majority of the house is indispensable.**
- In the analysis, we assume that national policy is expanded.

Risk There are risks such as **"introduction of a carbon tax"** and **"soaring material prices".**

Opportunity There is the possibility of cost reduction **due to sales increase by the renovation market's expansion** and **the introduction of energy saving and creating facilities** to factories, etc.



STEP 1 2 3 4 5

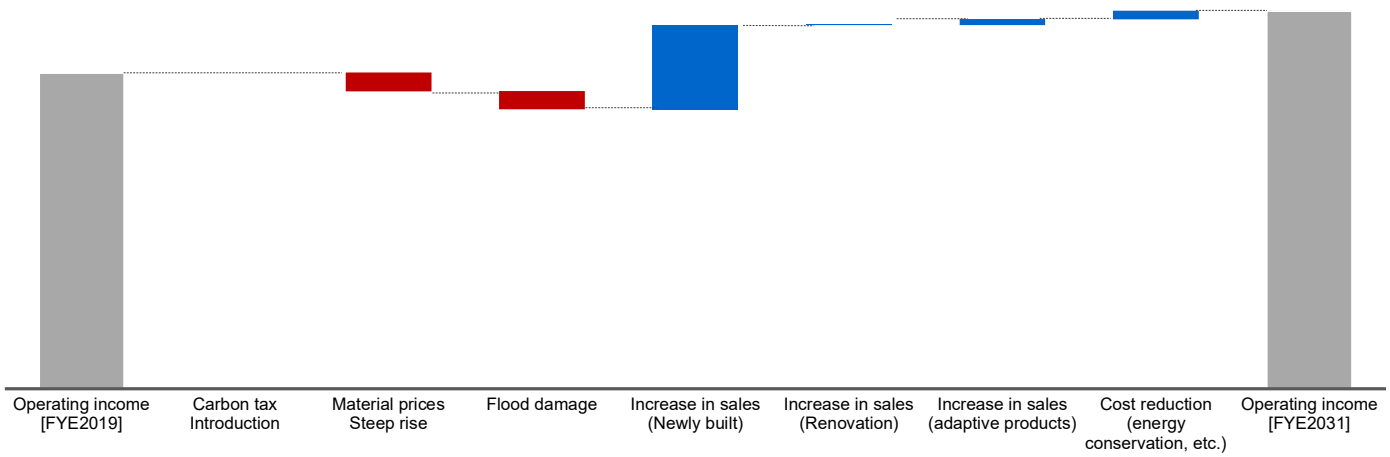
4. Scenario analysis results
4 - 3 Evaluation of Business Impact (Summary of the 4℃ Scenario)

4℃ Scenario

- As the 4° C scenario is an extension of the current scenario, the increase and decrease of profit is **relatively small**.

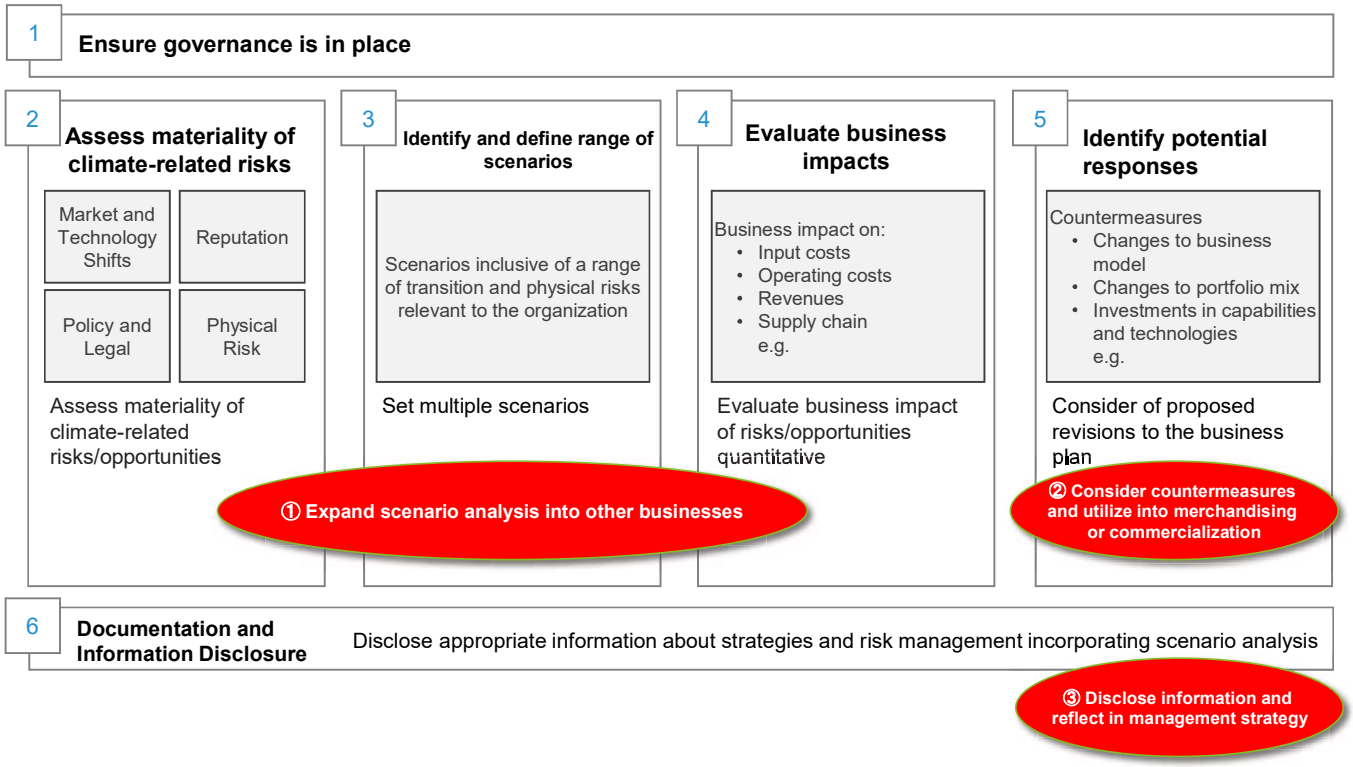
Risk Risks such as **"steep rise in material prices"** and **"flood damage"** exist.

Opportunity Sales increase for high-performance building materials and solar panels due to the dissemination of new ZEH (current pace), in addition to expected increase in profits due to **the expansion of market for adaptive products**.



5. Future Challenges and Plans

- For the next fiscal year and beyond, company plans to ① expand scenario analysis into other businesses, ② consider countermeasures deeply, and ③ disclose information



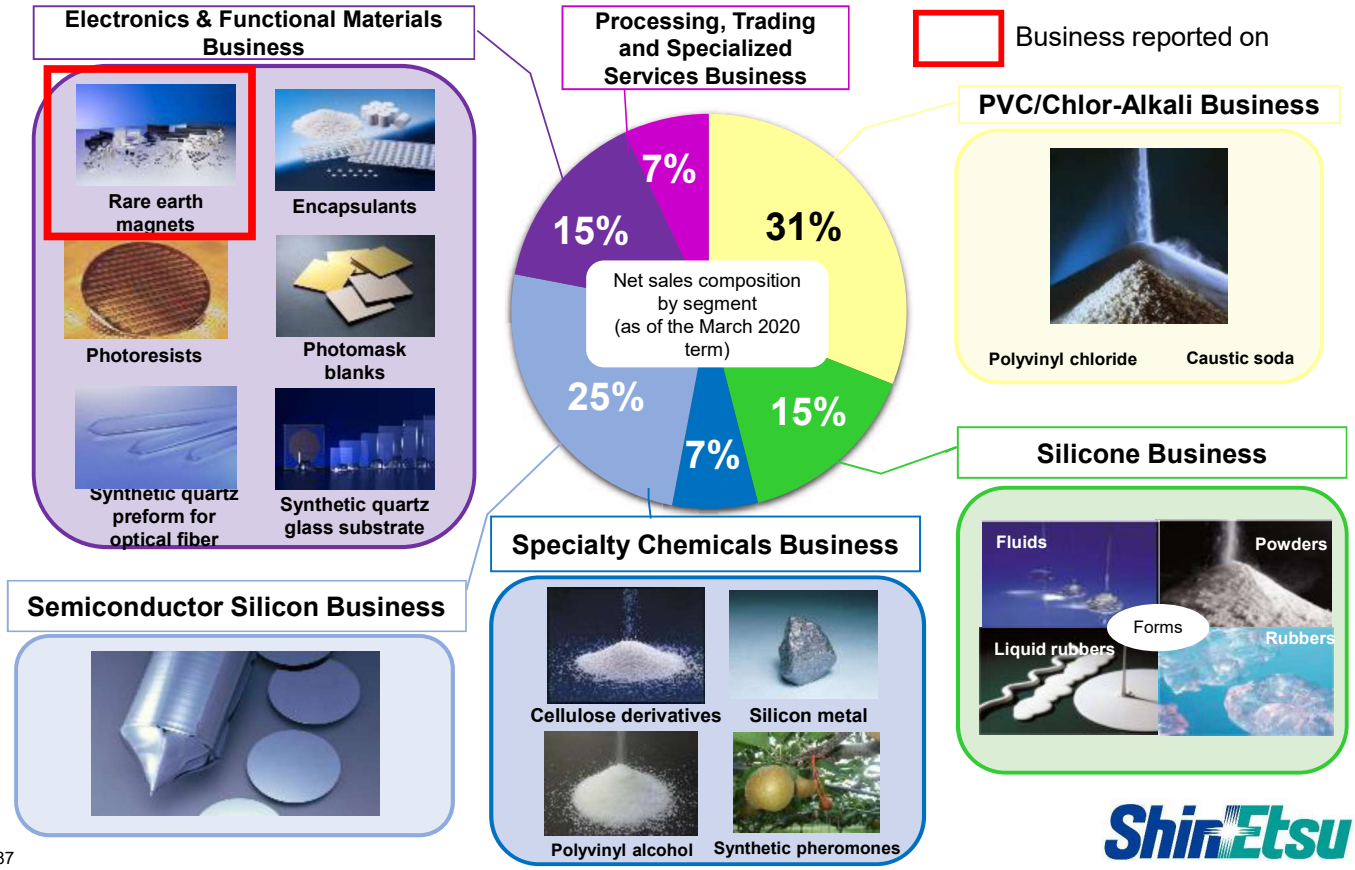
Materials

- ✓ **Practice Case①：Shin-Etsu Chemical Co., Ltd.**
- ✓ **Practice Case②：FUJIFILM Holdings Corporation**
- ✓ **Practice Case③：Furukawa Electric Co., Ltd.**
- ✓ **Practice Case④：Mitsui Mining & Smelting Co., Ltd.**

Overview of the Shin-Etsu Group (as of March 31, 2020)

1	Established	*September 16, 1926*
2	Location of head office	6-1, Ohtemachi 2-chome, Chiyoda-ku, Tokyo
3	Number of group companies	150 Japan: 55/Overseas: 19 countries, 95 companies
4	Number of employees	22,783 (consolidated)
5	Capital	119.4 billion JPY
6	Sales	1.5435 trillion JPY
7	Ordinary income	418.2 billion JPY
8	Market capitalization	Approx. 8 trillion JPY (as of January 26, 2021)

Details of the Shin-Etsu Group's business



Structure for scenario analysis of climate change

Scenario analysis is handled by the Climate Change-related Subcommittee established within the ESG Promotion Committee, as well as the committee members and administrative staff of the divisions being analyzed

[ESG Promotion Committee overview]

Established: April 1, 2005 CSR Promotion Committee established

August 1, 2017 ESG Promotion Committee established

Committee Chairman: Yasuhiko Saitoh (President and CEO)

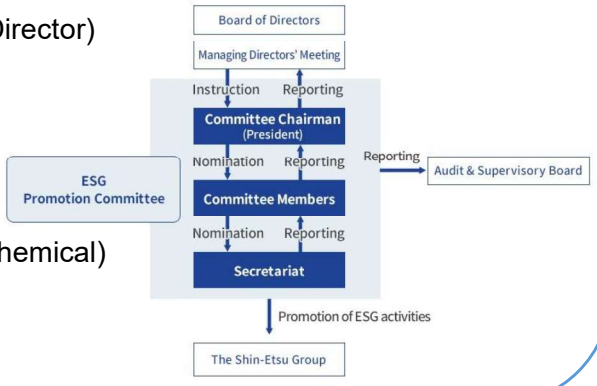
Vice Chairman: Toshiya Akimoto (Managing Director)

Committee members, administrative staff:

Group company ESG officers: 45

(including the 11 directors and

general managers of divisions of Shin-Etsu Chemical)



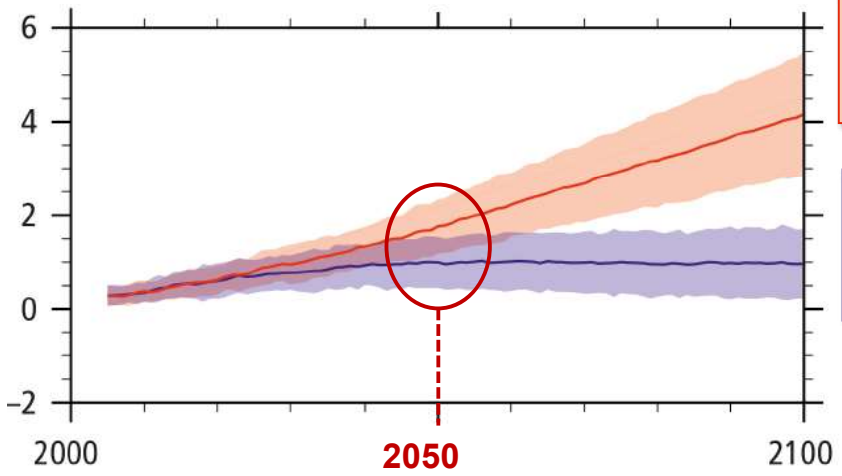
Climate change scenario analysis: Task details

Step	Details
1	Understanding of climate change analysis and each item for disclosure
2	Hypothesizing worldviews for the 2 °C and 4 °C (2.7 °C and above) scenarios Setting the time frame
3	Hypothesizing risks and opportunities to business that may be expected due to climate change, as well as their degrees of significance Assessment of financial impact
4	Evaluation of risk countermeasures and seizing of opportunities
5	Reporting of analysis results (ESG officers, environmental officers)
Future plans	
6	Report to management at the Board of Directors meeting
7	Disclosure of the sustainability report, etc.

Setting the timeframe for climate change scenarios

The 2˚C and 4˚C (2.7˚C and above) scenarios as of 2050 have been selected based on the impact from climate change

[Projected average global surface temperature change]
(compared with the average from 1986 - 2005)



Over 4˚C (2.7˚C and above) scenario:
As of 2100, temperatures will be 3.2-5.4˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

2˚C scenario:
As of 2100, temperatures will be 0.9-2.3˚C higher than pre-Industrial Revolution levels if strict measures are taken

Prior to 2030, the change in temperature is nearly the same in both the 2˚C and 4˚C (2.7˚C and above) scenarios. The gap between the scenarios widens after 2030.

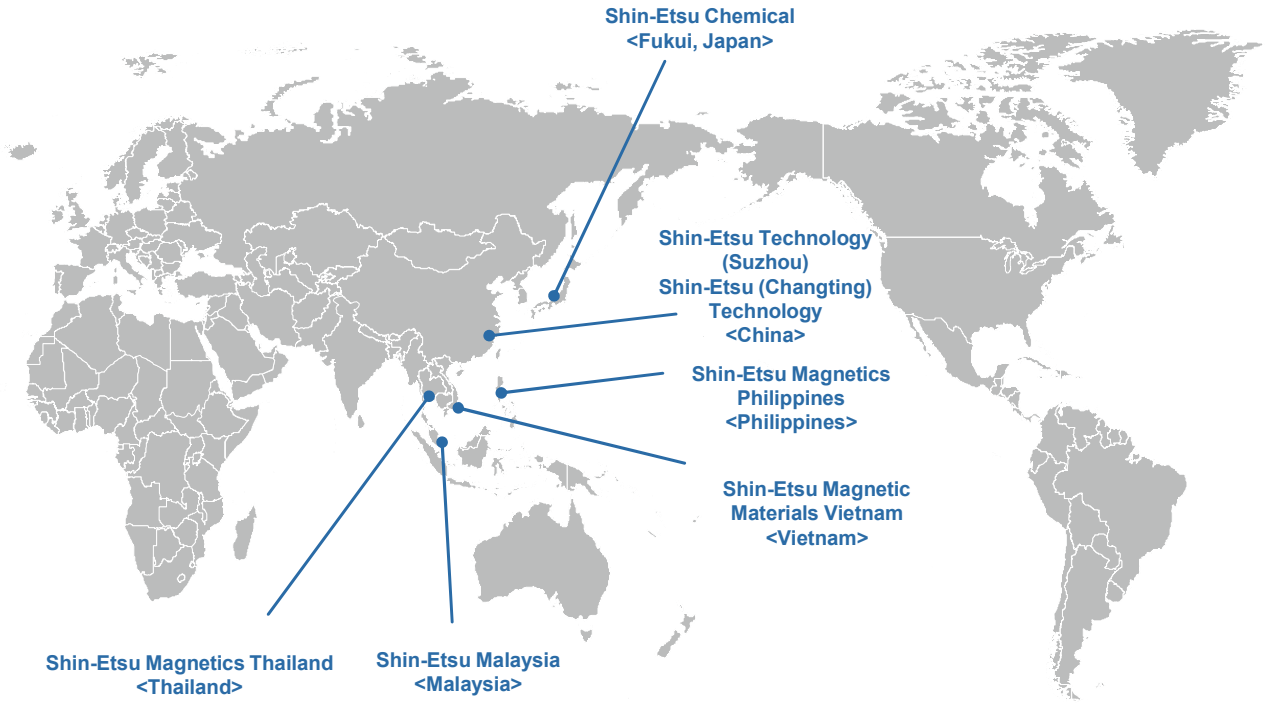
(Source) AR5 SYR, Table SPM.6

We estimated the revenue for 2050 and evaluated the impact of climate change would have on it

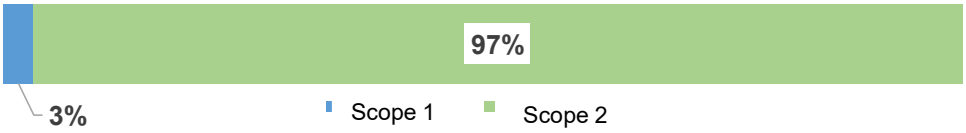
Estimate hypotheses

- Based on the increased production and growing demand for rare earth magnets, we assumed that the company would see a steady growth in sales until 2050
- Operating profits for 2050: We employed the average value over the operating profits for the past three years
- Amount of emissions for Scope 1: We assumed that they would increase in proportion to the increase in the business's sales based on the amount of emissions in FY2019
- We assumed that emission factors for electricity would decrease

Main production sites for the covered business

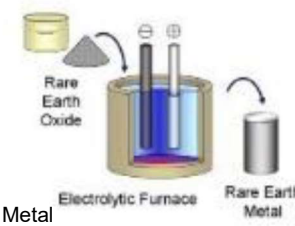


Greenhouse gas emissions for the covered business: ratio by scope

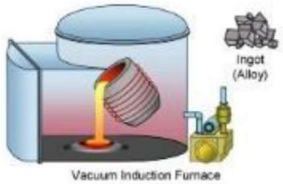


Production process for the covered business

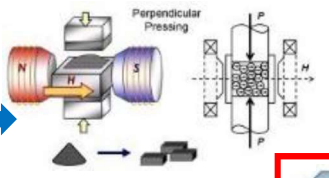
Process using large amounts of energy



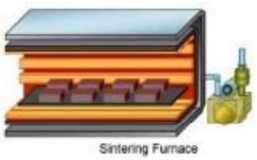
Metal
Individual rare earth oxides are separated from rare earth concentrate and change to metal by electrolytic process



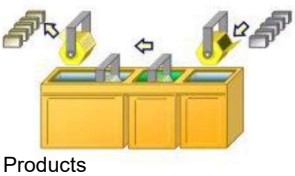
Alloy
Rare earth metals and other raw materials are charge into crucible and melt by high frequency inductive furnace.



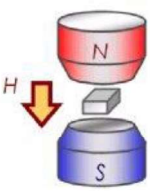
Forming
Alloys are pulverized to fine powder. Put the powder into mold and press in magnetic field.



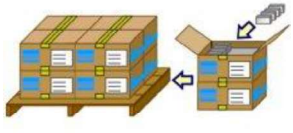
Block
Formed block put into sintering furnace and make sintered block



Products
Sintered blocks are cut and ground into the required shape and the surface is treated by plating or coating.



Magnetizing



Packaging, shipping

Business opportunities from climate change (2˚C scenario)

Application	Details	Impact
Electric vehicles, hybrid vehicles, fuel cell vehicles	The use of high-performance, compact rare earth magnets in the drive motors and other various motors of hybrid, electric, and fuel cell vehicles reduces the overall weight of the vehicles and increases their energy efficiency	High
Wind turbine generators	Rare earth magnets contribute to making offshore wind turbine generators highly efficient and reducing generator maintenance costs	High
Compressor motors for air conditioner	Energy consumption efficiency can be increased and the amount of electricity consumed can be decreased by using rare earth magnets in air conditioner compressor motors	Med.
Aircraft	The weight of aircraft can be reduced and energy efficiency improved by converting to electric or hybrid forms for small aircraft, or by converting to electric hydraulic drives (motor drive) for large aircraft	Med.
Industrial motors	The use of rare earth magnets in industrial motors can increase motor efficiency and reduce the amount of electricity consumed	Med.

Risks from climate change (2˚C scenario)

Event	Risk to Shin-Etsu	Impact on profits	Countermeasures
Increased electricity prices due to the spread of electricity from renewable energy sources	Increased costs for purchasing electricity from renewable energy sources	High	Reduction of Scope 2 emission amounts -Further promotion of production processes that use less electricity and introduction of high-efficiency equipment, etc. -Introduction of a cogeneration system that uses carbon-neutral natural gas (natural gas with emission credits)
Extreme weather conditions (typhoons, river flooding, etc.)	Flooding of production sites Supply chain disruptions	Low	Regrading of production sites Decentralization of production sites Diversification of raw material sources Securing of product inventory Purchase of property insurance
Carbon taxes introduced by various countries around the world, carbon emission quotas set	A carbon tax is imposed Costs created for purchasing emission credits in order to meet carbon emission quotas	Low	Reduction of Scope 1 emission amounts -Further promotion of more efficient production processes and introduction of high-efficiency equipment, etc. -Use of hydrogen-reduced iron materials Set absolute reduction targets for greenhouse gases and achieve them. Collect information on environmental regulations such as carbon taxes for each country, and come up with measures to deal with them.

Risks from climate change (4˚C (2.7˚C and above) scenario)

Event	Risk to Shin-Etsu	Impact on profits	Countermeasures
Increased frequency of extreme weather	Flooding of production sites Supply chain disruptions	High	Regrading of production sites Decentralization of production sites Diversification of raw material sources Securing of product inventory Purchase of property insurance
Increased frequency of flooding due to changes in precipitation patterns, etc.			
Introduction of carbon taxes in certain countries, setting of carbon emission quotas	Carbon taxes and carbon emission quotas will not be introduced in the countries that the production sites of the covered business are located in.	-	-
Electricity prices	According to the IEA's scenario analysis (the scenario for current initiatives), electricity prices will not increase. Because of this, increased electricity prices are not a risk to Shin-Etsu.	-	-

Materials

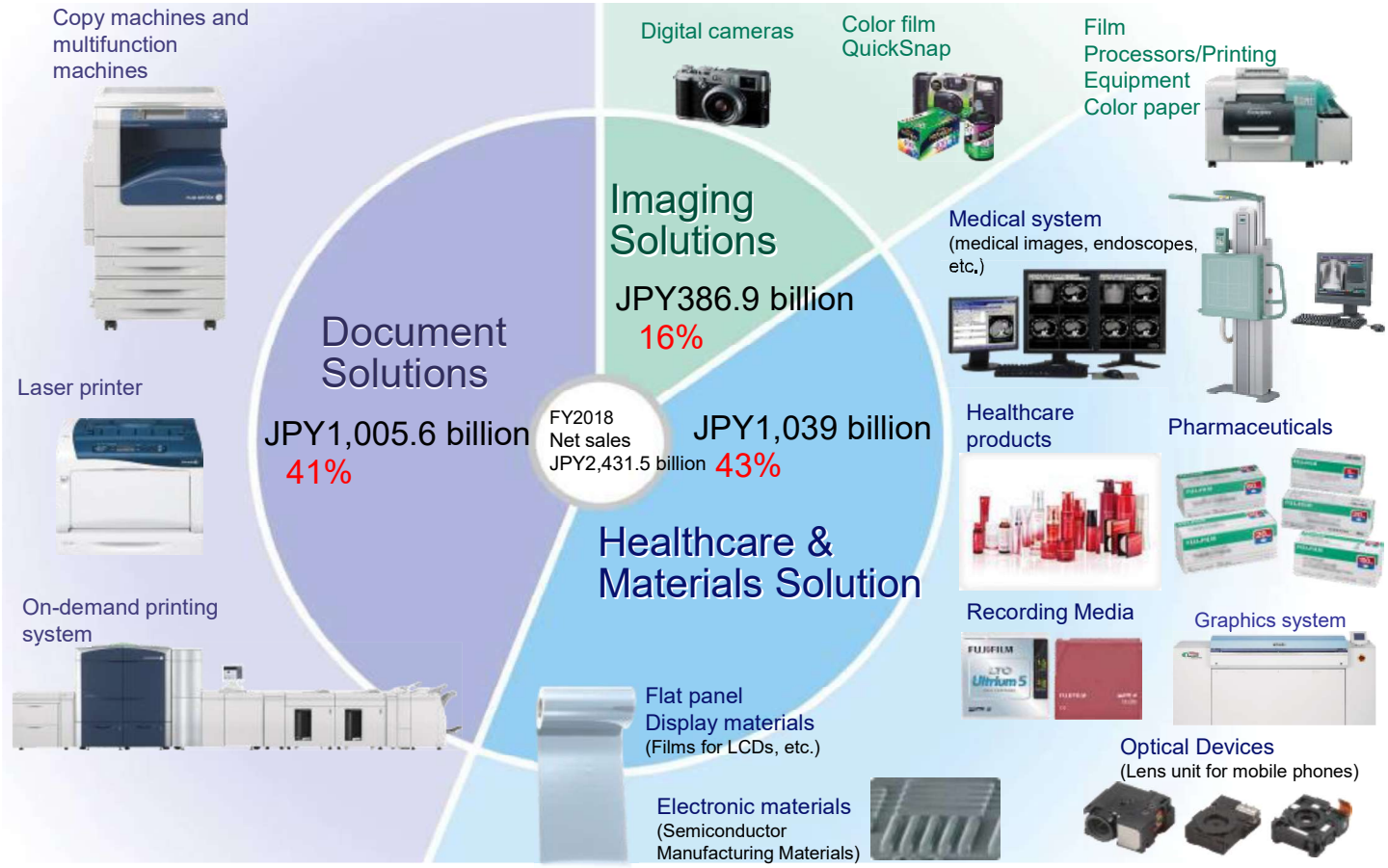
✓ Practice Case①：Shin-Etsu Chemical Co., Ltd.

✓ **Practice Case②：FUJIFILM Holdings Corporation**

✓ Practice Case③：Furukawa Electric Co., Ltd.

✓ Practice Case④：Mitsui Mining & Smelting Co., Ltd.

Fujifilm Group Basic Information (Business Field)



Risk Items in Display Business and Industrial Equipment Business

Risk Item		Business impact	Assessment
Small classification	Index	Discussion (Example)	
Plastic regulations	Spending	➢ Regulations on plastics are progressing led by Europe, and expenditures for replacement of alternative materials, upgrading of recycling, introduction of tracking systems, etc. are increasing, which has an impact on PL/BS.	Large
Developing next-generation technologies	Revenues, expenditures, and assets	➢ **Strategies for plastics such as material recycling and chemical recycling are required, which affects PL/BS.**	
Carbon price		➢ Introduction of a carbon tax will impose taxes on fuel procurement costs, which will increase production costs in factories in countries with higher carbon taxes and have a medium-scale impact on PL/BS.	
Investments in low carbon technology	Revenues, expenditures, and assets	➢ Environmentally conscious and financing drivers increase demand for low-carbon products such as TACs and require conversion from PETs, affecting	
Increasing severity of extreme weather conditions	Expenditur	nvestment in shutdowns, on high-risk land, which will	
Carbon Emissions Targets/Policies in Each Country	Spending Revenues, expenditures, and assets	➢ Transformation to renewable energy is required in order to achieve CO2 reduction target, and correspondence costs such as the purchase of facilities and green power increase, which has a large impact on PL/BS. ➢ CCUS, BECCUS is assumed in low-carbon societies based on 1.5° C and has a large impact on PL/BS.	
Changes in the energy mix	Expenditures and assets	➢ **Changes in the energy mix will greatly change the emission factor, greatly change the achievement of the carbon emission target, and affect P/L and B/S including changes in the site.**	
Renewable energy subsidy policy	Revenue	➢ **Subsidies for renewable energies such as CCUS, BECCUS will accelerate the introduction of renewable energies in the world and affect product liability.**	Medium
Energy-saving policy	Spending	➢ Rigorous regulations governing GHGs emitted from factories could increase the cost of investments and affect PL/BS.	
Customer reputation change	Revenues and expenditures	of	
Increase in the average temperature	Expenditures and	osts for TACs, PETs, etc., and thereby affecting PL/BS.	
Renewable energy subsidy policy	Revenues, expenditures, and assets	➢ Subsidies for renewable energies such as CCUS, BECCUS will accelerate the introduction of renewable energies and affect product liability.	
Changes in Important Products/Prices	Revenues, expenditures, and assets	➢ Changes in prices of raw materials such as PETs and TACs increase procurement costs and affect PL/BS	
Policies on forest protection	Expenditures and assets	➢ Increased production and sourcing costs due to tighter regulations related to decarbonization have an impact on PL/BS	
Changes in the investor's reputation	Revenues, expenditures and capital	➢ The trend of die vestment accelerates, and the winds of enterprises that do not practice environmental management become stronger. As a result, financing costs increase and affect PL/BS.	
Changes in rainfall and weather patterns	Expenditures and assets	➢ The water level of the dam declines due to changes in rainfall, and power transmission from hydroelectric power plants is disrupted, and the plant stops operation and affects PL.	Small
Energy Demand	Expenditures and assets	➢ Changes in energy costs for transporting materials and operating factories, increased operating costs, and medium-sized impacts on PL/BS	
Rising sea level	Expenditures and assets	➢ Water stress increases supply costs, effectively rendering production virtually impossible, and increases in production costs due to tighter regulations on water withdrawals for production, thereby affecting PL/BS.	

- Risks associated with plastics regulations and their response
- Financial risk of introducing carbon tax
- Business opportunities by promoting the introduction of CCUS, BECCUS

Definition of each worldview based on scientific grounds such as the IEA

		At present	2030		Source
			4° C world	2° C world	
Carbon Emissions Targets/Policies in Each Country		13 Million tCO2 (2017)	401 Million tCO2	401 Million tCO2	・Ministry of the Environment, "Japan's draft promise" and "Toward a drastic reduction of greenhouse gases in anticipation of 2050"
Carbon price	Carbon tax (Japan)	Not introduced	(Not installed at 4° C)	$88/t	・Estimated from IEA WEO 2018
Changes in the energy mix	Power Source Composition (Japan)	Coal: 360 TWh Nuclear: 33 TWh Renewable energy: 186 TWh (2017)	Coal: 264 TWh Nuclear: 216 TWh Renewable energy: 250 TWh	Coal: 83 TWh Nuclear: 247 TWh Renewable energy: 347 TWh	・IEA WEO2018 (New Policies Scenario, Sustainable Development Scenario)
			1.6Mt	31.7 Mt	・Estimated from IEA WEO 2018
	Rate of recycled aluminum Production of alu	37% 80	51%	42% 138Mt	・Estimated from IEA WEO 2018
Plastic regulations	Recycled plastics Utilization ratio	1 t		1.7 Times	・Estimated from IEA WEO 2018
Developing next-generation technologies	CO2 recovery by CCSs (Global)	0	(market movement at 4° C)	Industrial sector 0.54 Gt Power generation 0.30 Gt	・Estimated from IEA WEO 2018
In extreme weather conditions Increasing severity	Days of heavy rainfall per year (Japan)	2.5 days	3.0 days	2.5 days	・"Japan's Weather at the End of the 21st Century" (2015) by the Ministry of the Environment and the Japan Meteorological Agency

Introduction of carbon tax

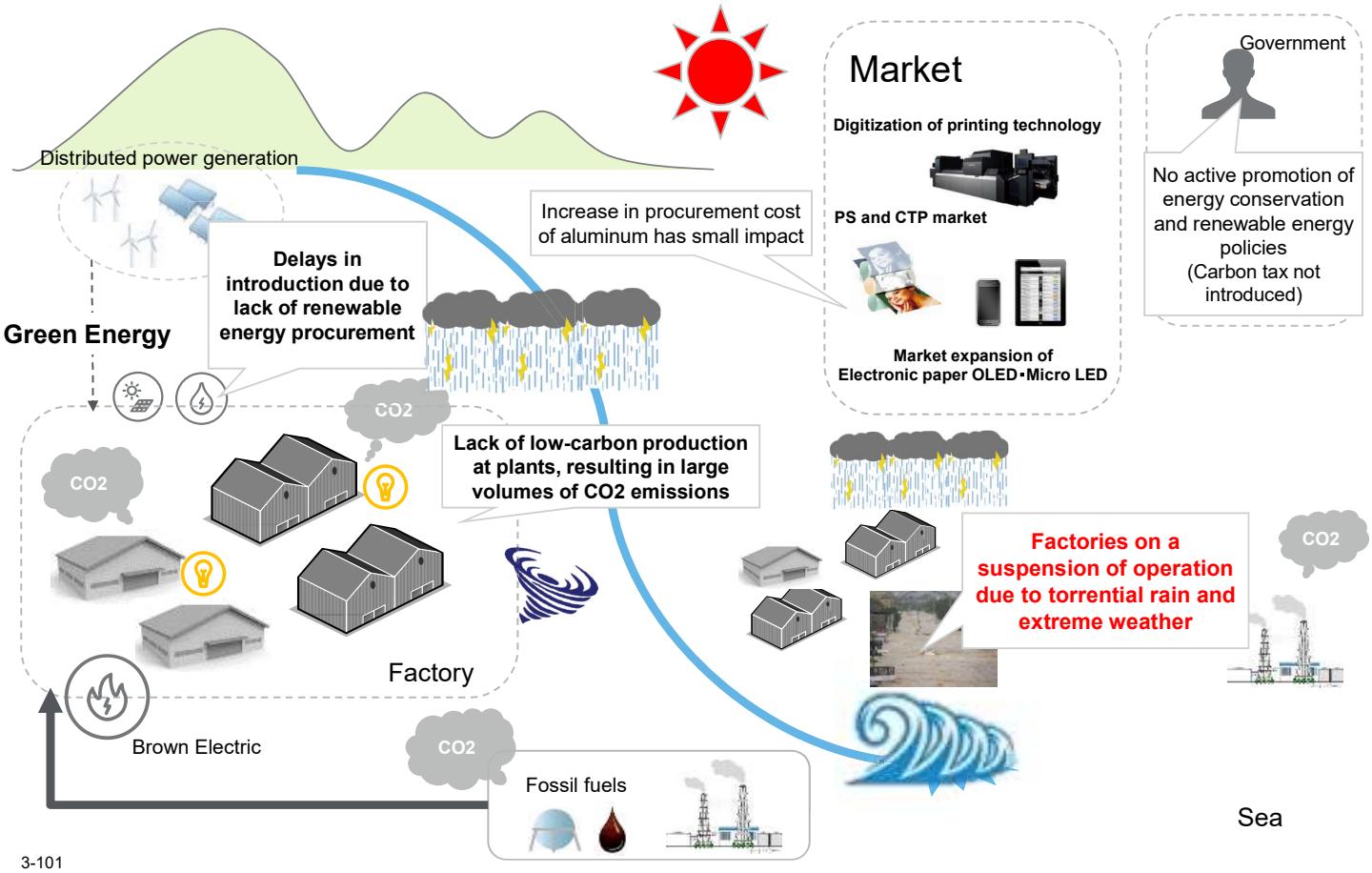
Regulations on the use of recycled plastics

Promotion of CCS

Increasing severity of extreme weather conditions

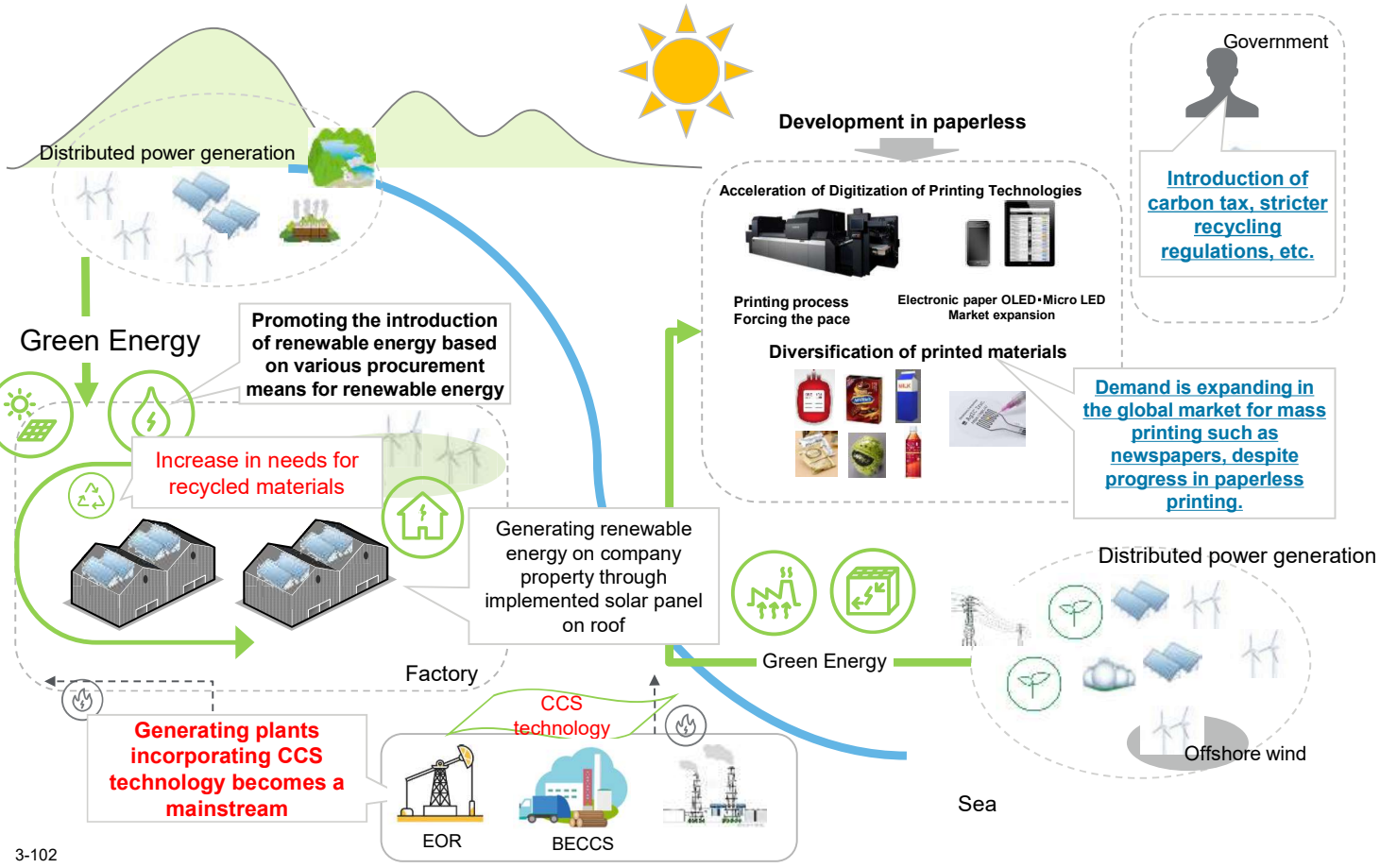
3-100

4° C world: Low carbon/decarbonisation is not promoted and physical risks increase



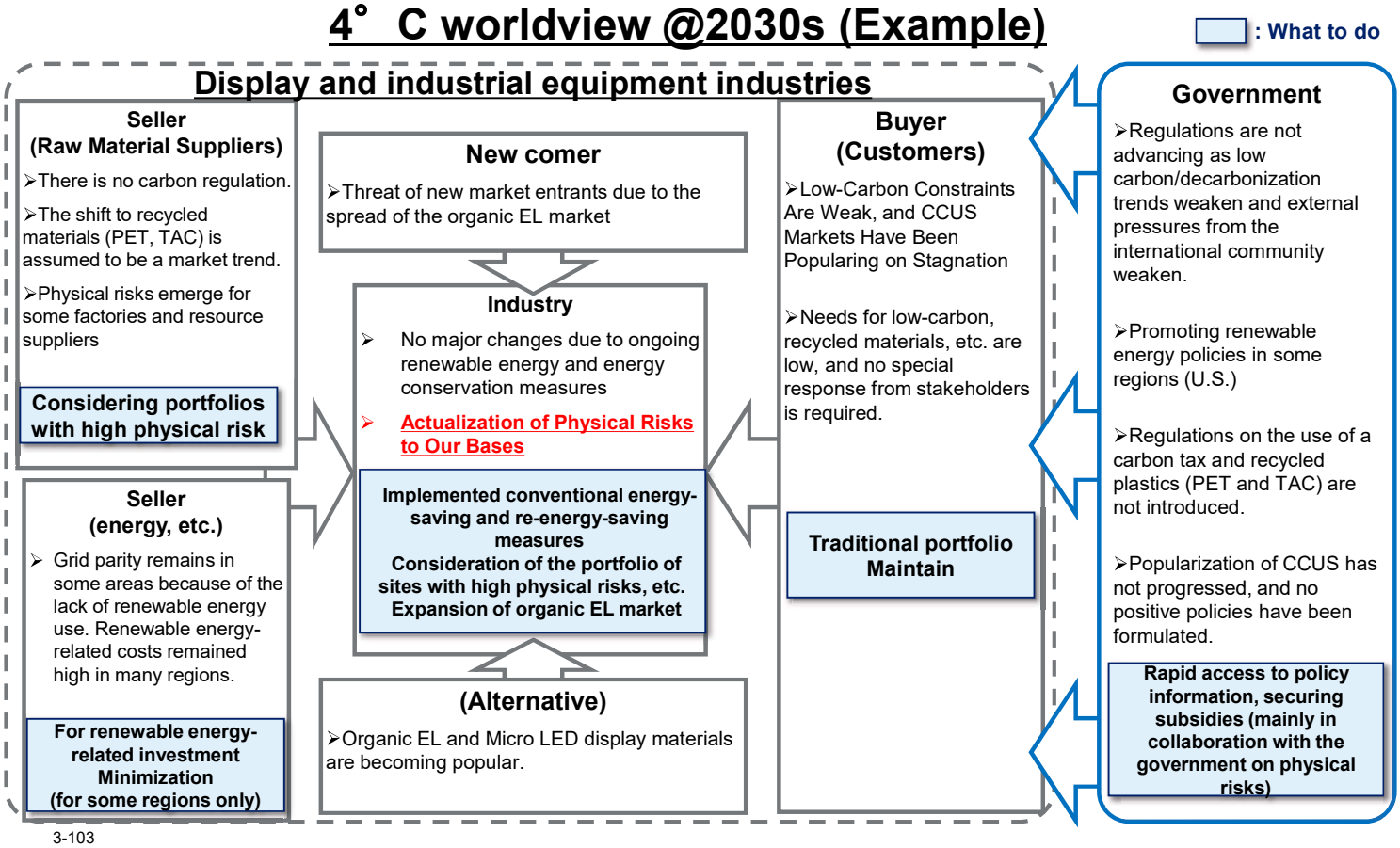
3-101

In the 2° C world: Advanced decarbonization accelerates the progress of adopting renewable energy, recycled plastics, and CCUS.



3-102

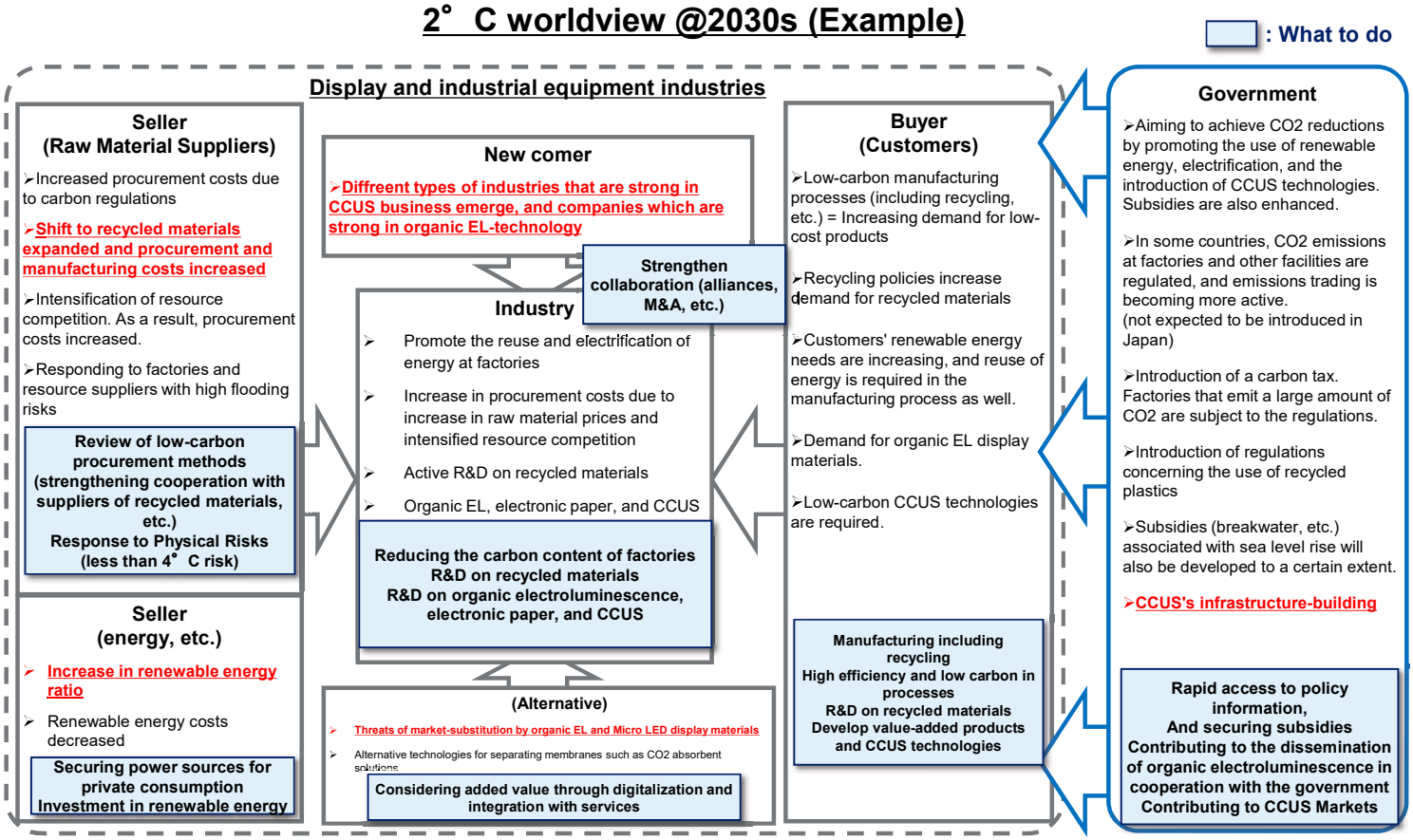
In the 4° C world: Low carbon/decarbonisation is not promoted and physical risks increase



3-103

In the 2° C world: Advanced decarbonization accelerates the progress of adopting renewable energy, recycled plastics, and CCUS.

2° C worldview @2030s (Example)



Business Impact Assessment (Example)

	Business impact items	Assessment
4℃	Response to flood damage caused by heavy rains and floods	- ×× billion yen
	Increase in sales of non-destructive testing services to prepare for extreme weather conditions	+ ××billion yen
	Sub total	●● Billion yen

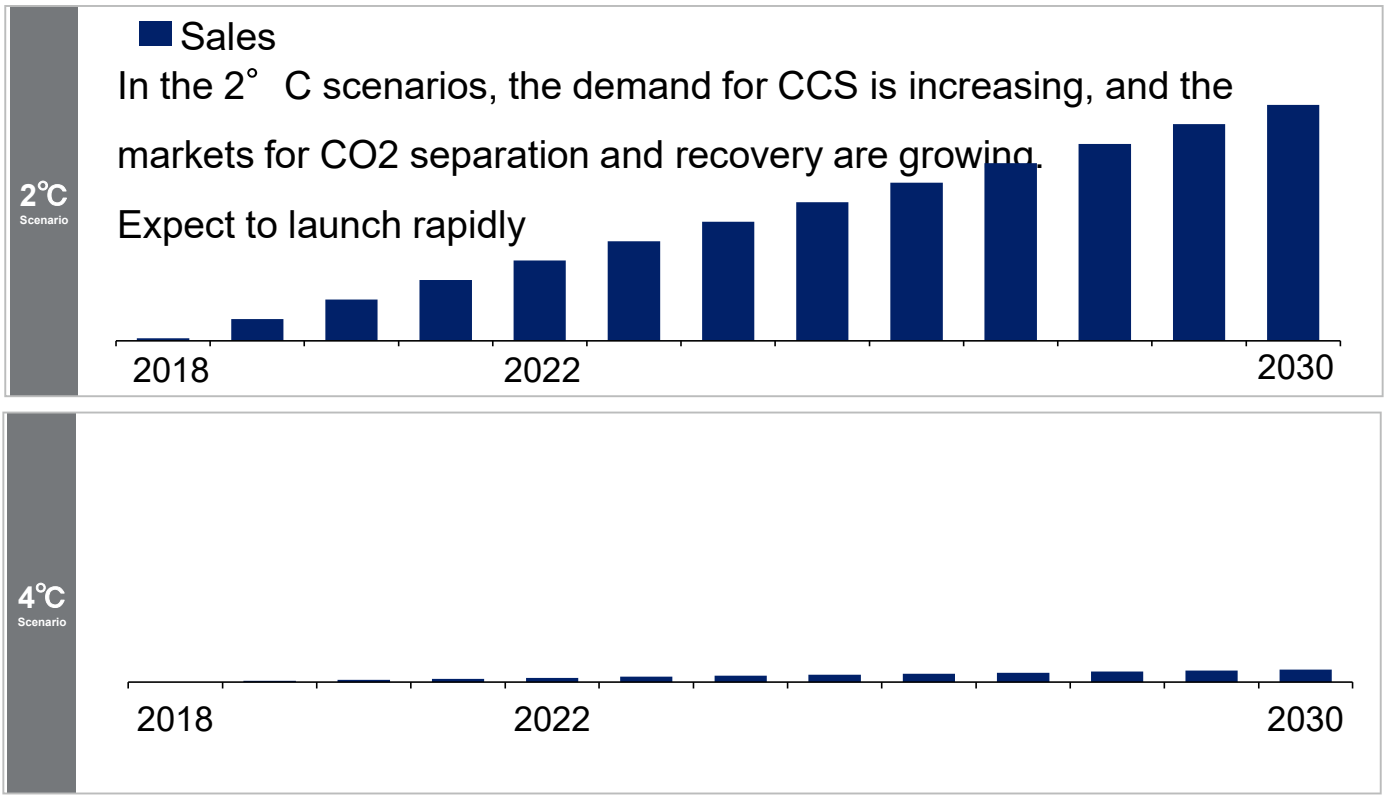
2℃	**Cost for improving the rate of recycled plastics usage**	**- ×× billion yen**
	Responding to the strengthening of carbon taxes and regulations	- ×× billion yen
	Increase in sales of related materials due to CCUS penetration	+ ××billion yen
	Sub total	●● Billion yen

【4℃】
- Physical risks increase in a 4° C world, and costs increase in response to heavy rains and floods
- Increasing need for non-destructive testing services from the perspective of preventive maintenance

【2℃】
- Regulatorys and demand for recycled plastics are rising, and costs for recycled materials and other materials are rising.
- Financial impact of the introduction of a carbon tax and increased investment in energy conservation to comply with regulations
- Increase business opportunities by revitalizing CCS and CCUS markets

Basis of calculation of business financial impact assessment

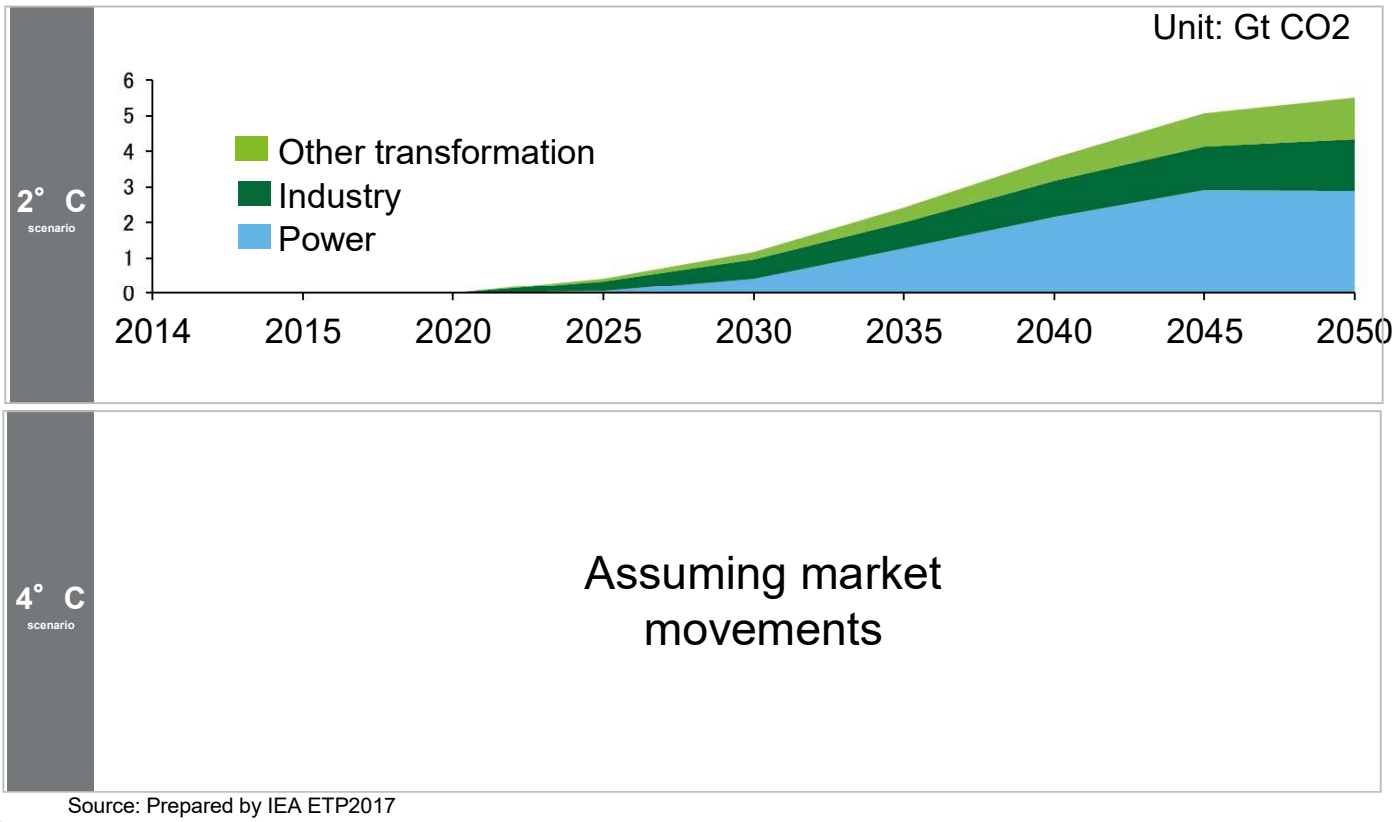
CCS-Related Market Forecasts



3-106 Source: Compiled from IEA ETP2017, etc.

Basis of calculation of business financial impact assessment

CO2 self-storage forecast



Source: Prepared by IEA ETP2017

3-107

Initiatives for Future Scenarios and Examples of Future Measures

(Risk Response)

Possible "risk preparations" for future scenarios

Important items	Current Initiatives	Examples of risk countermeasures
Carbon price	• Reduce CO2 emissions by 30% by FY2030 (compared to FY2013) • Contribute to reducing social CO2 emissions by 50 million tons by FY2030 • Setting targets for the rate of renewable energy usage	• **Reducing CO2 Emissions by Introducing Internal Carbon Pricing** • **Accelerate investment in environmental facilities by issuing green bonds**
Plastics Regulation	• Reduce waste generated by the Group by 30% by FY2030 (compared to the same level as in the previous year) • 30% improvement in resource input per unit of production by our group by FY2030 (compared to the same level above) • Recycling of PET/TAC at Plants	• Strengthened monitoring of regulatory trends related to chemical recycling for PET/TAC films and other display materials • Investigation of setting targets at the recycling PCR rate *1, including external recycling
Developing next-generation technologies	• Demonstration of gas separation membranes at overseas gas fields • Non-destructive inspections have a track record in regular inspections, detailed designs, repair designs, and repair work for the maintenance and management of social infrastructures.	• **To further develop and study methods for CO2 separation and recovery** (In-house development or alliance) • Transform business by developing and utilizing AI and other technologies in non-destructive inspection solutions
Increasing severity of extreme weather conditions (Flood damage)	• Identify water risks using indicators for water stress, water input, and business impact in each country and region.	• Establishment of specific action guidelines for floods and disasters • Preparation for long-term infrastructure disruption (response to power outages, etc.) • Establishment of procurement strategy to minimize procurement risk • Anti-liquefaction, anti-seismic reinforcement and anti-tsunami measures

* 1: post-consumer recycling ratio: Percentage of commercially recovered materials used in recycled materials.

Materials

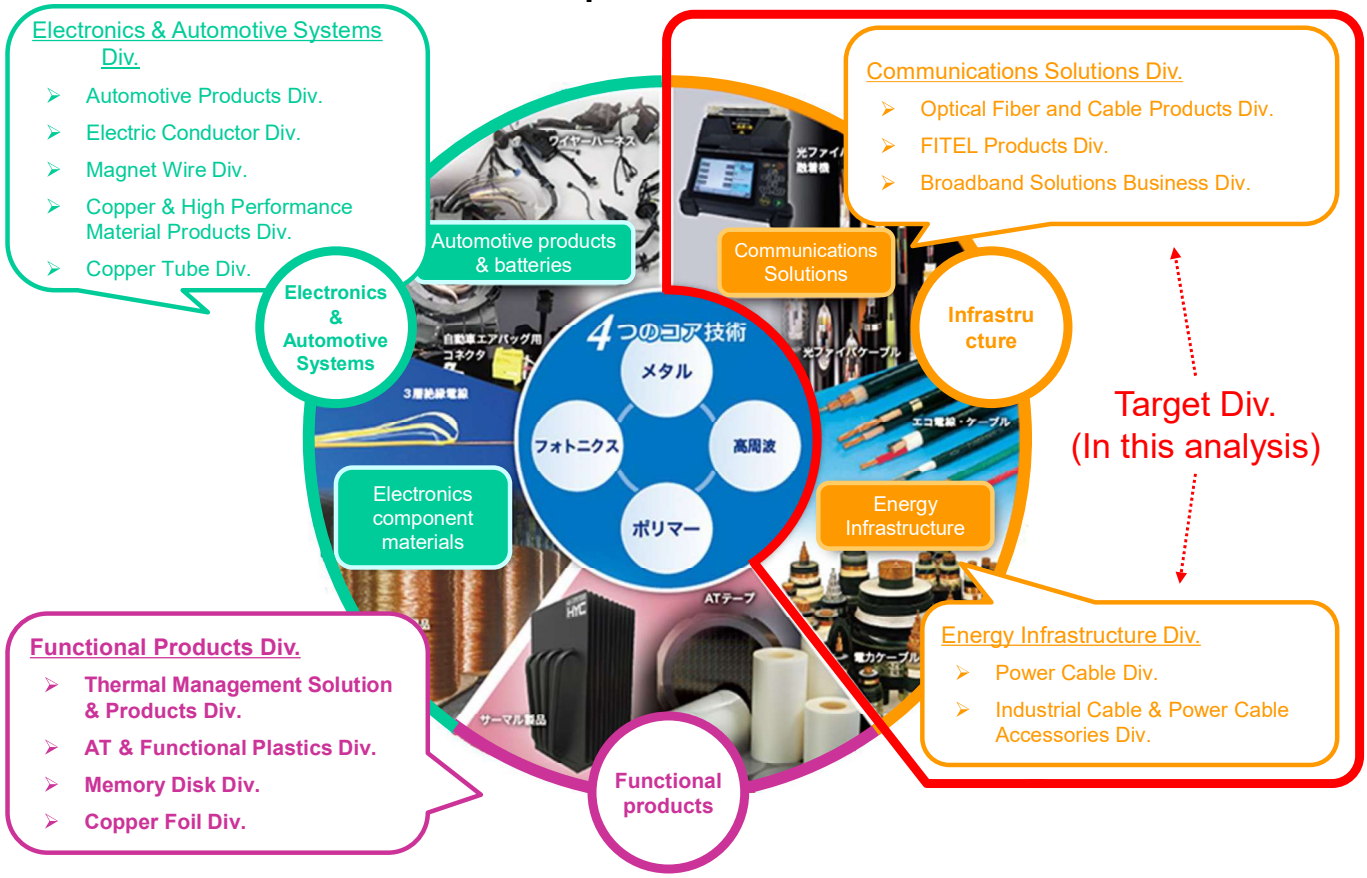
✓ Practice Case①：Shin-Etsu Chemical Co., Ltd.

✓ Practice Case②：FUJIFILM Holdings Corporation

✓ **Practice Case③：Furukawa Electric Co., Ltd.**

✓ Practice Case④：Mitsui Mining & Smelting Co., Ltd.

Overview of Furukawa Electric Group Business



Characteristics of Target Businesses

Item	Communications Solutions Business	Energy Infrastructure Business
Target product category	• **Optical fiber cables**  Optical Fiber  Hikari/Metal Communication Cable	• **Power Cables**  Underground Power Cable  Medium-Low Voltage Cable
Materials used	• **Glass materials (optical fiber)** • **Plastics (fiber, cable dressings, etc.)** • **Copper (metal communication cable)**	• **Copper (Conducting material)** • **Plastics (cable dressings)**
Energy Amount used	• Large amount used in optical fiber manufacturing process	• Be relatively small
Bases	• Expansion of production bases globally (Asia, North and South America, EMEA)	• Japan, China

Scenario development process

Analysis step / Questions / Analysis level	② Assess materiality of climate-related risks	③ Identify and define range of scenarios	④ Evaluate business impacts	⑤ Identify potential responses
	For any variable Do you want to target?	In any scenario Do you set it?	What is the size of which position? Should we calculate in depth?	To the extent of the measures Do you consider it?
Level 1 Be based on TCFD requirements As a minimum requirement Level	Important variables identified but not fully discussed and explained their importance	In multiple scenarios, Simply cite existing scientific scenarios/only bivariate scenario branching	Qualitative and partial quantitative assessments of the business impact of each scenario	Present countermeasures are shown, but linkage with future scenarios is unclear.
This time Details of implementation	• **Communications solutions** • **Energy infrastructure** Identify high-priority risks in the 2 businesses	• **4° C (business as usual)** • **2° C (strict measures)** Define 2 scenarios	• **Estimated impact on net sales and operating income** • **Estimated Impact of Carbon Tax and Copper Price Rise**	• **Insurance, etc.** • **Consider conversion to other materials**

Assess materiality of climate-related risks (Communications Solutions Business)

②Assess materiality of climate-related risks

- **Increase in production costs due to the introduction of carbon prices, an increase in procurement costs due to the increase in copper demand, and the effects of physical risks**
- **On the other hand, opportunities such as market expansion due to the spread of smart cities have a major financial impact.**

Risk Item		Business impact		Assessment
Major classification	Small classification	Index	Discussion (Example)	
Toward a Low-Carbon Economy • Carbon tax • New Technology • Raw material cost • Reputation	Carbon Emissions Targets/Policies in Each Country	Spending Assets	➢ Depending on the amount of CO_2 discharged by the plant, the conversion to renewable energy is required, and the corresponding costs for purchasing facilities and green power, etc. are increasing.	Large
	Dissemination of renewable energy and energy-saving technologies	Revenue Assets	➢ Acceleration of introduction of renewable energy, etc. and increase of renewable energy ratio of electricity supplied to manufacturing plants	
	Carbon price	Spending	➢ When a carbon tax is introduced, taxes are levied on fuel procurement costs.	
	Energy conservation, regulations in each country	Spending	➢ If the energy conservation policy is not achieved, the company's environmental image will be damaged by the announcement of the company name.	
	Changes in the energy mix	Spending	➢ In order to achieve CO_2 reduction target, the introduction of renewable energy will be accelerated, and the ratio of electricity supplied to manufacturing plants will increase. Risks associated with the introduction of emissions trading, etc.	
	Developing next-generation technologies	Revenue Spending Assets	➢ Demand for optical fibers is increasing due to demands for increased communication volume and speed due to the spread of next-generation infrastructures utilizing AI and IoT, electrification of transportation systems (autonomous driving, EV, etc.), micro/digital grid, and smart cities.	
	Changes in Important Products/Prices (Intensification of resource competition)	Revenue Spending Assets	➢ Demand for copper and plastics, the main raw materials for electric wire and cable, has increased due to the spread of EV and renewable energy, and procurement costs have increased due to changes in the supply-demand balance.	
Physical Risk	Rising sea level	Spending	➢ The operation of coastal plants was shut down due to natural disasters such as floods and a sharp increase in tides. Increasing investment in the installation of breakwater.	
	Drought: changes in rainfall and weather patterns	Spending	➢ Drought, increased production costs due to water restrictions, additional investments for system development, etc.	
	Typhoon: Increasingly severe extreme weather conditions	Spending Assets	➢ Due to plant damage caused by typhoons, additional investments were made to shut down operations, reduce production, and restore facilities. Increase in the premium	
Other	Customer reputation changes, Increase in the average temperature Changes in the investor's reputation	Revenue Spending Assets	➢ Due to the increasing interest of business partners, preference has emerged for SBT and other companies that have made progress in environmental measures. ➢ Die Best moves faster and more winds into the enterprise. Worsening of the mining working environment due to the hot weather.	Medium

Examples of definitions based on scientific grounds such as IEA

③ Identify and define range of scenario

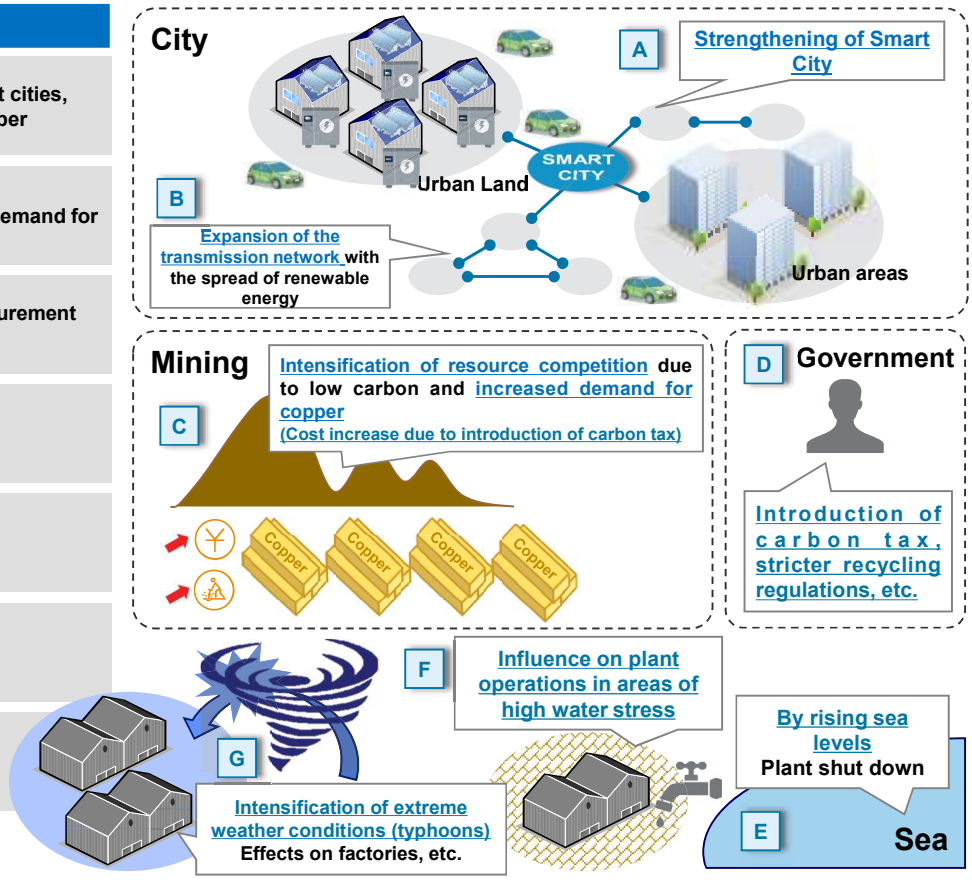
		At present	2030* 1		Source
			4° C world	2° C world	
Carbon Emissions Targets/Policies in Each Country	In the industrial sector GHG emissions	413 Million tCO_2 (2017)	401 Million tCO_2	401 Million tCO_2	• Ministry of the Environment, "Japan's draft promise" and "Toward a drastic reduction of greenhouse gases in anticipation of 2050"
Carbon price	Carbon tax	-	(Not installed at 4° C)	$88/t	• Estimated from IEA WEO 2018
In energy conservation and other countries Regulation of organic compounds	Recycled plastics Utilization rate	12.5% (2017)	(No restriction at 4° C)	14.0%	• European plastics strategy, Plastics Recycling Association
Renewable energy, etc. Subsidy policy	FIT's purchase price (yen/kWh)	Solar: 14 (bidding system) Wind: 2019-36 (2019)	(From FIT at 4° C Assuming that independence is difficult)	Solar: JPY7/kWh (2025) Wind: JPY8-9/kWh	• Agency for Natural Resources and Energy
	Unit price of renewable energy generation (yen/kWh)	Solar: 21.8 Land Wind: 21.5 (2017)	Solar: 13.5 Land wind: 20.6	Solar: 12.4 Land wind: 20.6	• IEA WEO2017 (450 scenarios)
Re-energy and Energy Conservation Dissemination of technology	Capacity to augment the transmission network	-	Increase of more than 6.65 million kW (until 2027)	Increase of more than 6.65 million kW (until 2027)	• Agency for Natural Resources and Energy
	ZEV ratio	58 thousand units (EV, PHV, FCV) (2017)	PHV/ZEV:5% (72.38 million units)	PHV/ZEV:39% (536.85 million units)	• IEAs and JETORO reports • Global Calculator
	World's storage capacity	4.67 TWh (2017)	6.62~7.82 TWh	11.89~15.27 TWh	• IRENA Report
Changes in the energy mix	Power Source Composition (Japan) (TWh)	Coal: 360 Nuclear: 33 Re-energy: 186 (2017)	Coal: 264 Nuclear: 216 Renewable energy: 250	Coal: 83 Nuclear: 247 Renewable energy: 347	• IEA WEO2018 (NPS,SDS)
Next-generation technology Progress of	Smart City Market Size and M2M Communications Volume	Smart City Market Size: JPY38 trillion M2M communication volume: 4 exerbites (10^{18})/month (2018)	(market at 4° C)	Smart City: 4 thousand trillion yen M2M: 745 Exabyte/month	• Cisco Report • Frost & Sullivan Japan • SMART CITY PROJECT
Increase/Decrease in Prices of Heavy-Use Products/Products	Predicted value of copper demand	5,000 thousand tons (2015)	9,000 thousand tons	10,500 thousand tons	• Than Sebastiaan Deetman and others Estimate
Sea level rise	Magnitude of sea level rise	-	0.25m (2050)	0. 2m (2050)	• Ministry of the Environment, Japan Meteorological Agency Report
Drought	Water stress	-	Extracting values from each country from tools (2040 *2)	-	• WRI "Aqueduct," Our CDPs
Typhoon	Number of occurrences	26 (2016)	The number of typhoons approaching is forecast to decrease, but uncertainty remains.		• Ministry of the Environment, Japan Meteorological Agency Report

*1: The time horizon to be examined for physical risks is set at 2050. * 2: Figures for 2050 are not available, and figures for 2040 are used.

③ Identify and define range of scenario

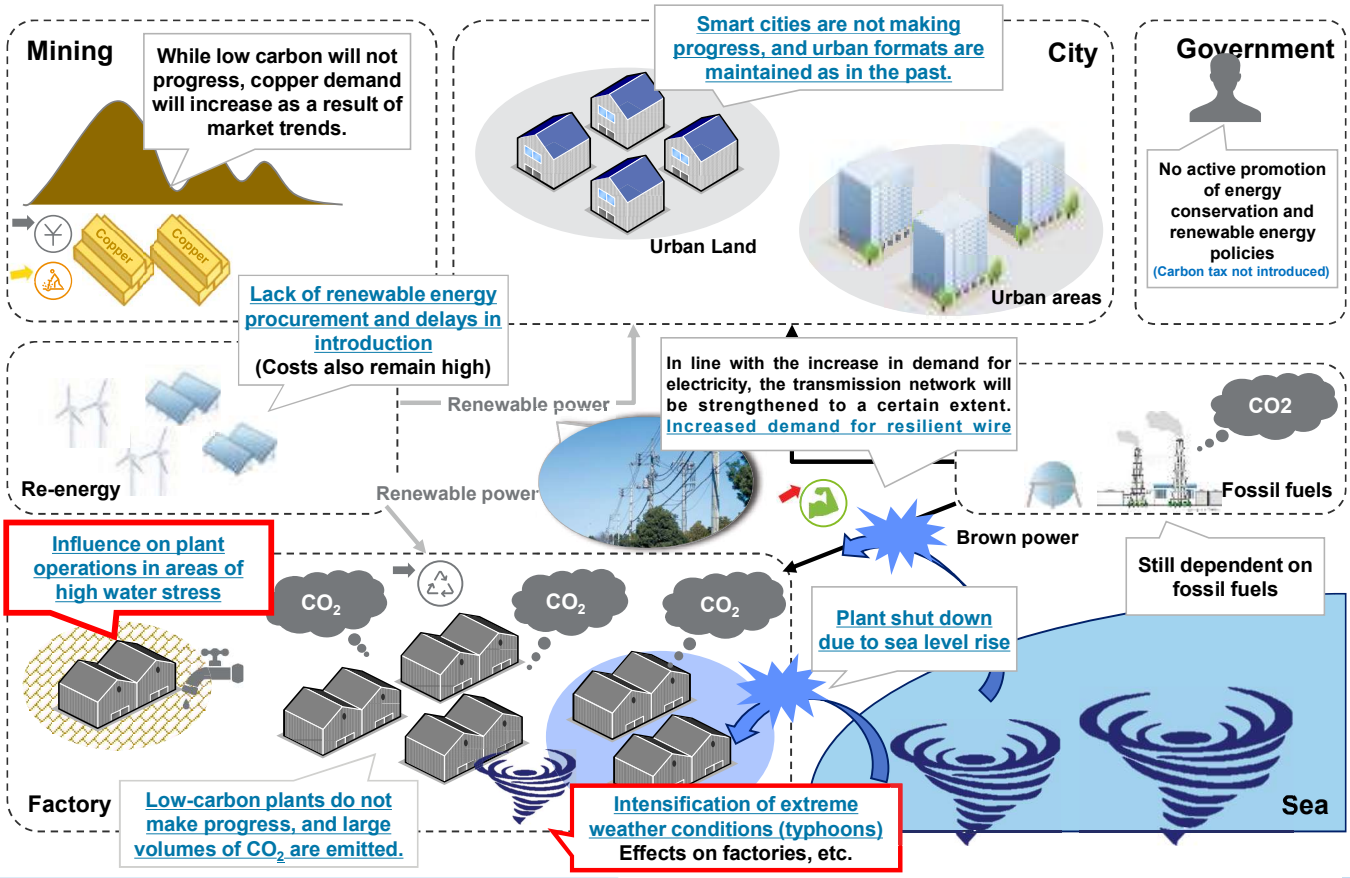
Select the evaluation items for business impact

		Item
Transition risk	A	With the spread of smart cities, increased demand for fiber
	B	In the expansion of the transmission network, demand for power cable increase
	C	Increase in copper procurement costs
	D	Carbon tax
Physical risk	E	Sea level rise
	F	Drought
	G	Typhoon (Increased Storm and Flood Damage)



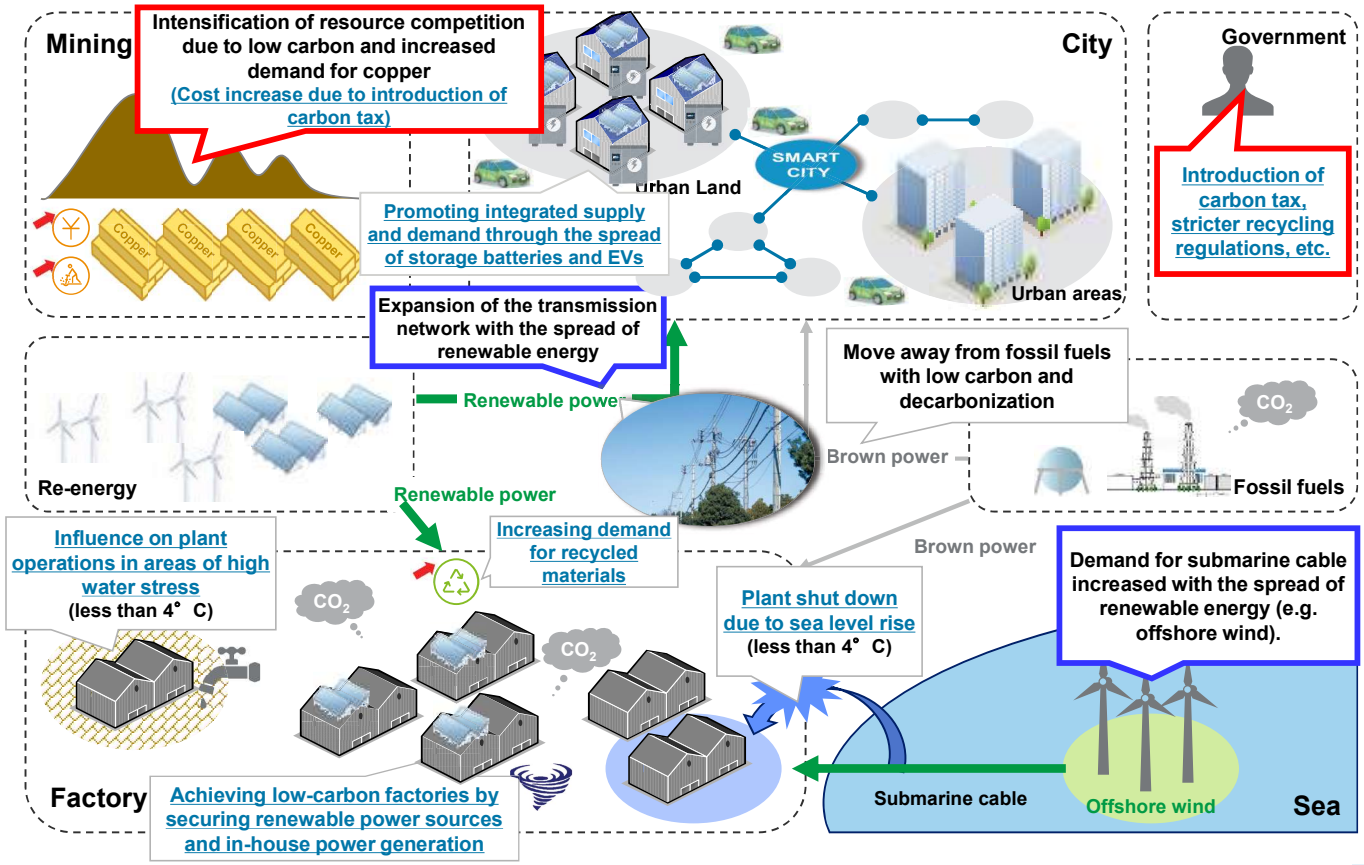
In the 4° C world, low carbon/decarbonization is not promoted, Increased physical risk (business as usual)

③ Identify and define range of scenario



In the world of 2° C, low carbon is being promoted, renewable energy consumption and smart cities become popular (severe measures)

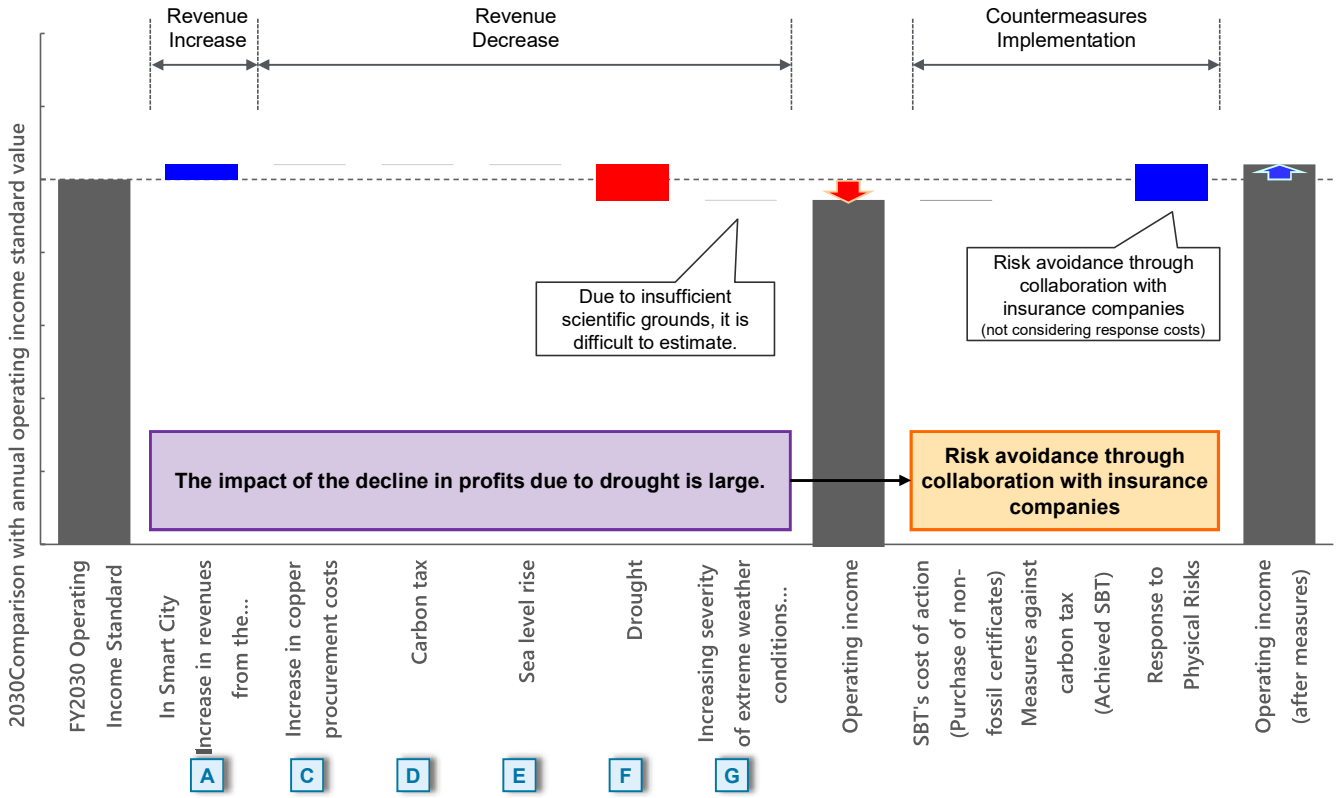
③ Identify and define range of scenario



④ Evaluate business impacts
⑤ Identify potential responses

Communications Solutions Business: 4° C (business as usual)

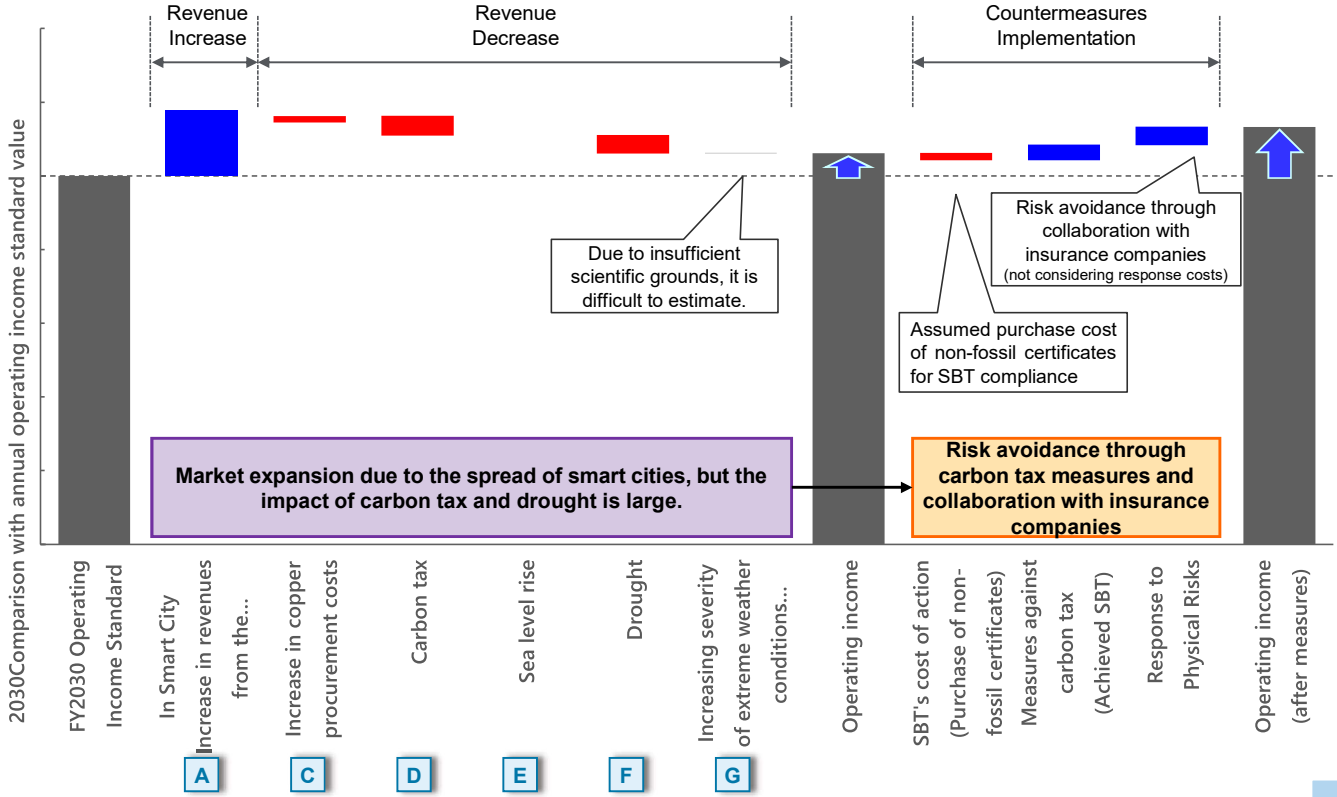
- Working with insurance companies to avoid risks and secure increased profits.



④ Evaluate business impacts
⑤ Identify potential responses

Communications Solutions Business: 2° C (strict response)

- Reduce greenhouse gas emissions and collaborate with insurance companies to avoid risks and recover the increase in revenues.



⑤ Identify potential responses

Countermeasures

☐ Carbon tax and physical risks need to be addressed in a timely manner.

	Item	Risk response measures
Transition risk	C Cost of procuring copper Increase	➢ Consider passing on cost increases, etc. In order to minimize the risk, we will partially consider the possibility of shifting from copper to aluminum, which is expected to see a steep rise in prices.
Transition risk	D Carbon tax	➢ Re-energy introduced at headquarters, factories and value chains ➢ Implementation of ambitious target setting (SBT, etc.)
Physical risk	E Sea level rise	➢ Consider collaboration with insurance companies that have in-house tools to minimize risk ➢ Strengthen preventive measures against existing assets (breakwater, etc.)
Physical risk	F Drought	➢ Consider collaboration with insurance companies that have in-house tools to minimize risk ➢ Implementation of preventive measures for existing assets (water supply towers and reservoirs) ➢ Relocation of some bases
Physical risk	G Typhoon	➢ Be scientifically examined in the future, including the quantification of risks

Materials

✓ Practice Case①：Shin-Etsu Chemical Co., Ltd.

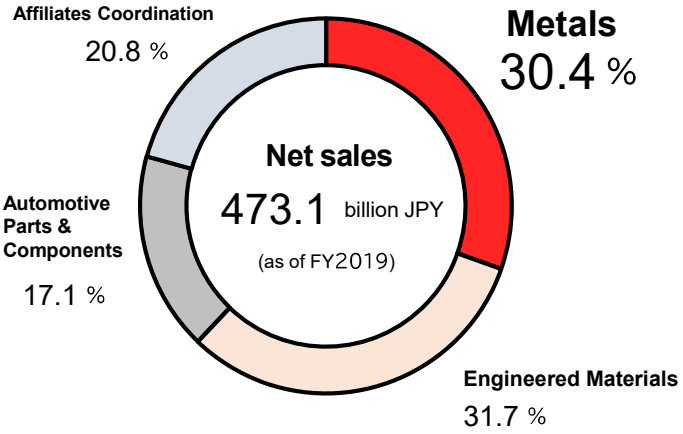
✓ Practice Case②：FUJIFILM Holdings Corporation

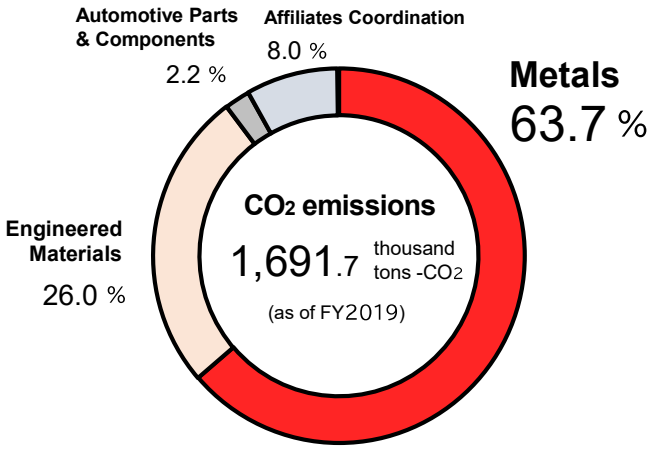
✓ Practice Case③：Furukawa Electric Co., Ltd.

✓ **Practice Case④：Mitsui Mining & Smelting Co., Ltd.**

[Business covered in this analysis]

We cover the company's metal business, which accounts for approximately 30% of all sales



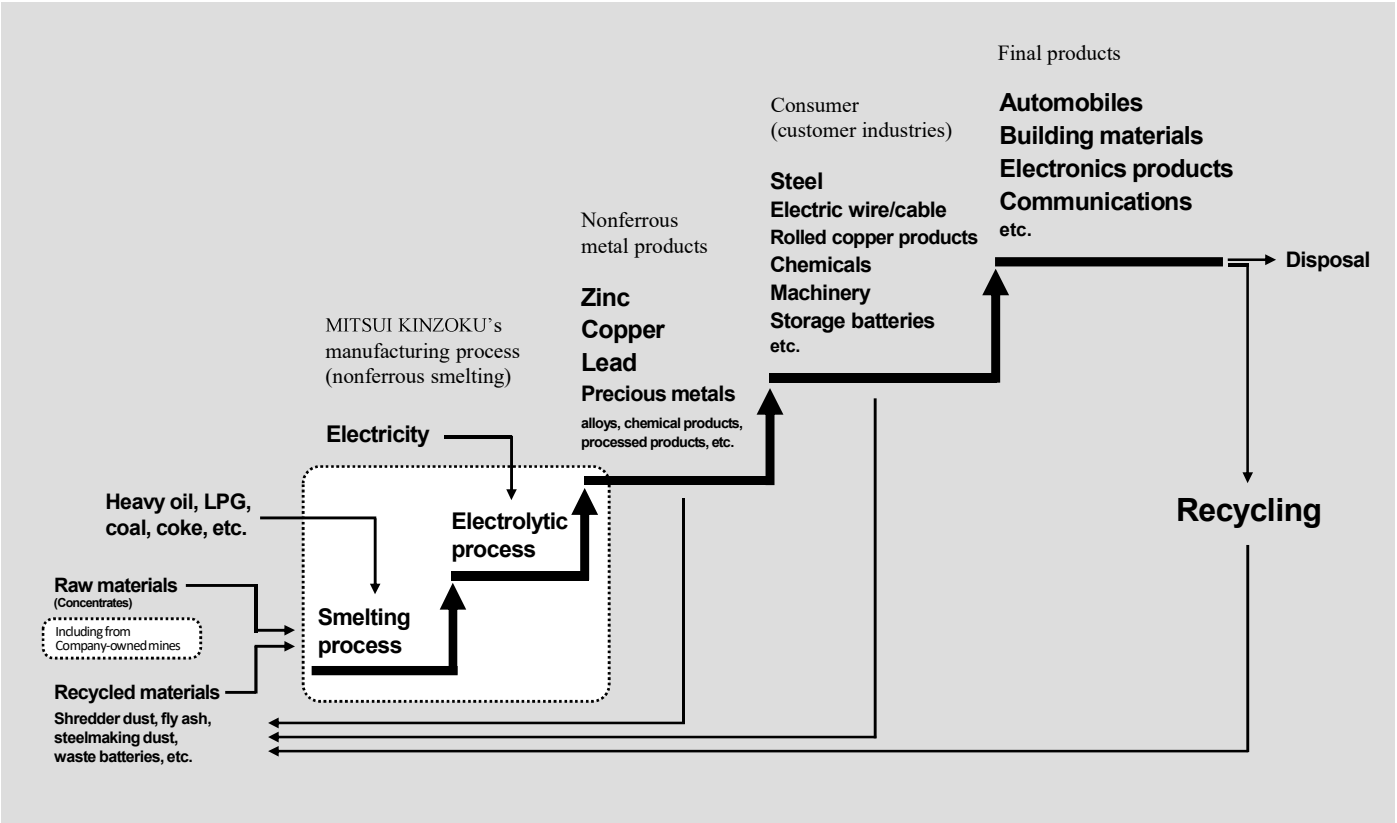


Metal business: Business structure and products

Metal Sector	Lead & Zinc Division	Zinc / Zinc-based alloys / Lead / Tin / Antimony trioxide / Bismuth
	Copper & Precious Metals Division	Copper / Gold / Silver / Sulfuric acid
	Mineral Resources Division	Zinc concentrate / Copper concentrate / Geothermal steam

[Business covered in this analysis]

Metal business supply chain and material flow



[Business covered in this analysis]

Metal business: Core business locations

Miike

Miike Smelting Co., Ltd.
Shinkaimachi, Omuta-shi, Fukuoka

Hikoshima

Hikoshima Smelting Co., Ltd.
Hikoshima-nishiyamacho, Shimonoseki-shi, Yamaguchi

Takehara

Takehara Refinery
Shiomachi, Takehara-shi, Hiroshima

Hibi

Hibi Smelter
Hibi, Tamano-shi, Okayama

Kamioka

Kamioka Mining and Smelting Co., Ltd.
Shikama, Kamiokacho, Hida-shi, Gifu

Hachinohe

Hachinohe Smelting Co., Ltd.
Hamanayachi, Kawaragi, Hachinohe-shi, Aomori

[Assessment of risk significance]

Future climate changes will bring significant risks and opportunities to the metal business

∗ Only items with a "high" impact rating have been listed

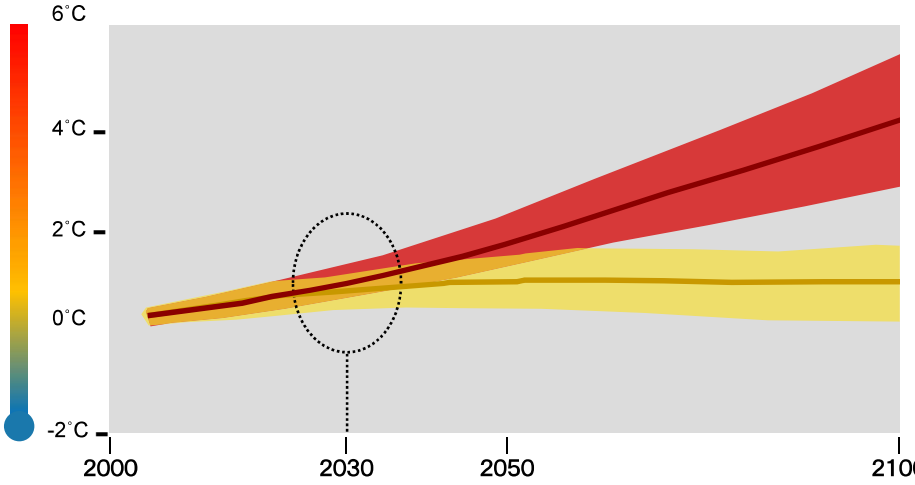
Item <Main category>	<Subcategory>	Predicted impact on business <Risks>	Predicted impact on business <Opportunities>
Transition risks	**Increase in carbon pricing**	● The introduction of carbon taxes or increases in the coal tax rate could increase costs for raw material procurement, product manufacturing, and logistics ● The nonferrous metal industry is at risk of incurring a larger cost burden than other industries as it consumes a large amount of energy for mining, ore processing, and melting	● We can establish low-coke smelting technology through methods such as developing beneficiation techniques to improve metal grades
	Changes in energy costs	● Electricity prices and energy prices from crude oil and similar are predicted to increase due to changes in the supply-demand balance ● It will be necessary to make investments toward increasing energy efficiency in the manufacturing process for nonferrous metals which have particularly high energy consumption	● The company can gain an advantage in terms of total energy output level by increasing the ratio of recycled materials and eliminating the process from mining to concentration (beneficiation) ● We can reduce the price of energy by strengthening the demand response of the electrolytic process as a means to level out the large fluctuations in renewable energy
	Changes in product prices/ demand	● Tighter regulations on mining for metals with increased demand due to trends toward electrification and renewable energy may lead to increases in response costs ● Higher market prices due to increased costs for mining raw materials will accelerate the substitution of other products in place of MITSUI KINZOKU's, resulting in lower sales	● Demand for zinc, platinum, copper, nickel, lithium, and cobalt may increase due to progress in electrification, etc. ● Demand will increase for the following materials in the following areas: zinc/platinum for automobiles, copper for energy-related facilities and equipment, lithium/cobalt/nickel for battery materials ● Demand for copper used in renewable energy-related facilities and equipment will grow with the spread of renewable energy over society as a whole
	Changes in reputation with customers	● Increased interest from client companies in environmental measures such as RE100 will lead to a preference for companies who have made advances in such measures. Because of this, additional response costs will be incurred due to the need to make manufacturing processes low-carbon, and PL/BS will be impacted as a result	● Proactive efforts to address ESG issues can be expected to lead to enhanced competitiveness and a stronger advantage for the company ● We can strengthen competitiveness from increased collection and use of environmentally friendly raw materials and switching to a product lineup with high added value from an environmental perspective
Physical risks	**Extreme weather conditions**	● Extreme weather could have a significant impact on production sites and supply chains, leading to shutdowns, suspension of logistics functions, and increased response costs ● Extreme weather may affect slag storage sites and lead to violations of laws and regulations due to spillage of hazardous substances ● Insurance premiums for weather insurance will increase	● Other sites may be substituted into BCP plans for other plants even if a certain site has been damaged by leveraging the strengths of having multiple sites (zinc/lead) ● We can use permits for industrial waste treatment to contribute toward local communities and the company's revenue through active initiatives toward disposing waste from natural disasters ● Processing costs may be reduced if demand is secured for slag as a construction material for seawalls and breakwaters
	Increase in average temperatures	● Increased heat stress and an increase in infectious diseases may lead to lower productivity for workers, as well as accidents ● Higher temperatures may cause forest fires that damage infrastructure, etc.	● We could differentiate itself from domestic and overseas competitors by using IOT and Digital Transformation initiatives to improve working environments, enhance productivity, and maintain stable operations

[Scenario group definition]

For climate change, which has a high degree of uncertainty, we will use two scenarios to study society in 2030

[Projected average global surface temperature change]

(compared with the average from 1986-2005)



Definition of 4˚C (2.7˚C+) scenarios

4˚C scenario:
3.2-5.4 ˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken.

Over 2˚C (2.7˚C-4˚C) scenario:
2.7-4.0˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken.

2˚C scenario:
0.9-2.3˚C higher than pre-Industrial Revolution levels if strict measures are taken

(Source) Simplified form of AR5 SYR Table SPM.6

The TCFD recommendations for scenario analysis suggest that multiple temperature range scenarios be selected, including those below 2˚C

[Scenario group definition]

The 4˚C worldview in 2030 (temperatures of 2.7˚C and higher)

Physical risk increases as low-carbon/decarbonization trends weaken

: Actions for responding to risks
: Actions for seizing opportunities

Nonferrous metals industry

Sellers (raw material suppliers)

- Carbon regulations are not introduced
- The shift toward environmentally friendly products does not progress as much as in the 2˚C scenario
- Physical risks on operations become tangible for certain mining sites, factories, and resource suppliers

Conduct assessments toward suppliers with high physical risk

Sellers (energy, etc.)

- There is no significant change from the current status, and there is no energy cost burden capable of affecting operations

Maintain existing initiatives toward energy conservation, etc.

New entrants

- The potential for new entrants is low
- There is increased competition due to expansion into developing countries

Industry

- Renewable energy/energy efficiency initiatives and investments toward smelting technology are carried out as they had been previously
- Physical risks to MITSUI KINZOKU sites become tangible (flooding, property damage)
- Decreased worker production due to heat stress

Promote investment related to disaster preparedness, review labor regulations, etc., and increase investment toward decreasing manpower and similar

(Substitutes)

- Market prices rise and substitution of alternative products progresses to a certain degree due to increased raw material costs from catastrophic weather events

Deal with diverse countries, improve the product recycling rate

Buyers (customers)

- Demand for copper/lead/zinc and other materials increases due to increased demand for electrification and EVs, and for storage batteries
- Trends toward low-carbonization/decarbonization weaken, and preference toward companies with advanced environmental measures does not increase to the extent seen in the 2˚C scenario
- There is a trend toward substituting metal products with products from China or other countries with low environmental costs
- There is a certain increase in the substitution of other materials (e.g. aluminum in place of iron) due to rising market prices

Maintain existing portfolios

Create dependable initiatives toward increased metal demand

Government

- Carbon taxes and emission credit trading are not widely introduced due to weakening trends for low-carbonization/decarbonization and weakened external pressure from the international community
- Mining regulations are tightened in certain regions as a result of increased demand in line with trends for increased electrification and use of renewable energy
- Disaster prevention/mitigation plans are reviewed, and there is a government-led increase in disaster responsive architecture
- The government establishes incentives such as subsidies for the development of technologies for observation and forecasting of torrential rains/typhoons/tornadoes
- Legislation is created to prohibit outdoor work during the summer months (more pronounced than in the 2˚C scenario)

Promptly obtain policy information and secure subsidies (work actively with the government, particularly concerning physical risks)

[Scenario group definition]

The 2˚C worldview in 2030

Expansion of carbon regulations and other policies result in the need for introduction of renewable energy and investment in low-carbon technologies

: Actions for responding to risks
: Actions for seizing opportunities

Nonferrous metals industry

Sellers (raw material suppliers)

- Procurement costs soar due to carbon regulations
- Renewable energy continues to become mainstream, and further renewable energy-related capital investment becomes necessary
- There are accidents at mining sites and reduced shipments due to disasters from extreme weather (Risk is lower than in the 4˚C scenario)

Conduct reviews toward low-carbon procurement methods, etc., and respond to physical risks (Risk is lower than in the 4˚C scenario)

Sellers (energy, etc.)

- Retail prices for electricity increase due to rising carbon prices

Move forward with introduction of energy efficient and renewable energy practices

New entrants

- The potential for new entrants is low
- There is increased competition due to expansion into developing countries

Industry

- Manufacturing costs and operating costs for facilities such as plants increase due to rising electricity prices
- Competition for resources becomes more intense. There is increased activity in investments toward smelting technology aimed toward energy conservation/decarbonization
- Heat stress reduces worker productivity

Move forward with introduction of energy efficient and renewable energy practices
Increase investments toward improving quality
Execute suitable and timely pricing strategies

(Substitutes)

- Substitution of alternative products accelerates due to rising market prices resulting from increased demand and rising raw material costs
- MITSUI KINZOKU 's competitiveness can be enhanced by changing to a product lineup with high added value from an environmental perspective

Improve the product recycling rate
Develop environmentally friendly products

Buyers (customers)

- There are increased needs for energy-efficient manufacturing processes (including methods such as recycling) due to low-carbonization
- Demand for copper/zinc/lead increases due to increased needs in areas such as energy conservation, EV demand, and storage battery demand
- Increased interest in client companies leads to a preference toward companies that have made advances in environmental initiatives such as RE100.
- There is a trend toward substituting metal products with products from China or other countries with low environmental costs
- There is a certain increase in the substitution of other materials (e.g. aluminum in place of iron) due to rising market prices

Promote investment toward low-carbon technologies
Create dependable initiatives toward increased metal demand
Participate in initiatives such as RE100

Government

- The government considers a carbon tax hike and emissions credit trading. There are expanded efforts related to emissions credits and similar measures on a global scale
- The government promotes policies related to introducing renewable energy, including the promotion of electrification
- Metal recycling regulations and mining regulations are further tightened out of concern regarding the depletion of metal resources
- Disaster prevention/mitigation plans are reviewed, and there is a government-led increase in disaster responsive architecture
- The government establishes incentives such as subsidies for the development of technologies for observation and forecasting of torrential rains/typhoons/tornadoes

Promptly obtain policy information and secure subsidies
Promote investments toward recycling technology in response to regulations

[Visual representation of a 4˚C scenario future society]

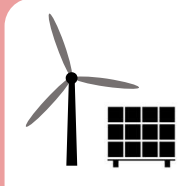
Physical risk increases as low-carbonization/decarbonization does not progress

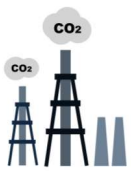
Government — Energy conservation / renewable energy policies are not actively promoted **(Carbon taxes have not been introduced)**

Mining

Mining site operations are suspended due to **extreme weather**

Worker productivity decreases due to increased heat stress and an increase in infectious diseases

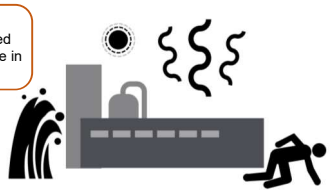




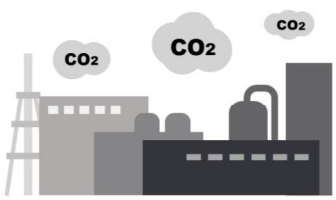
There are limited means for procuring renewable energy (costs remain high, as well), and dependence on fossil fuels continues

Manufacturing

Factory operations are suspended due to **extreme weather and storm surges**



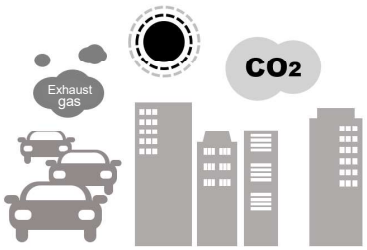
Low-carbonization of plants does not progress, and large amounts of CO_2 are emitted

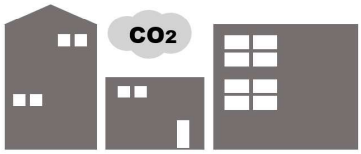


The product recycling rate improves due to increased demand

City

Conversion to smart cities does not progress, and the existing form of cities is maintained

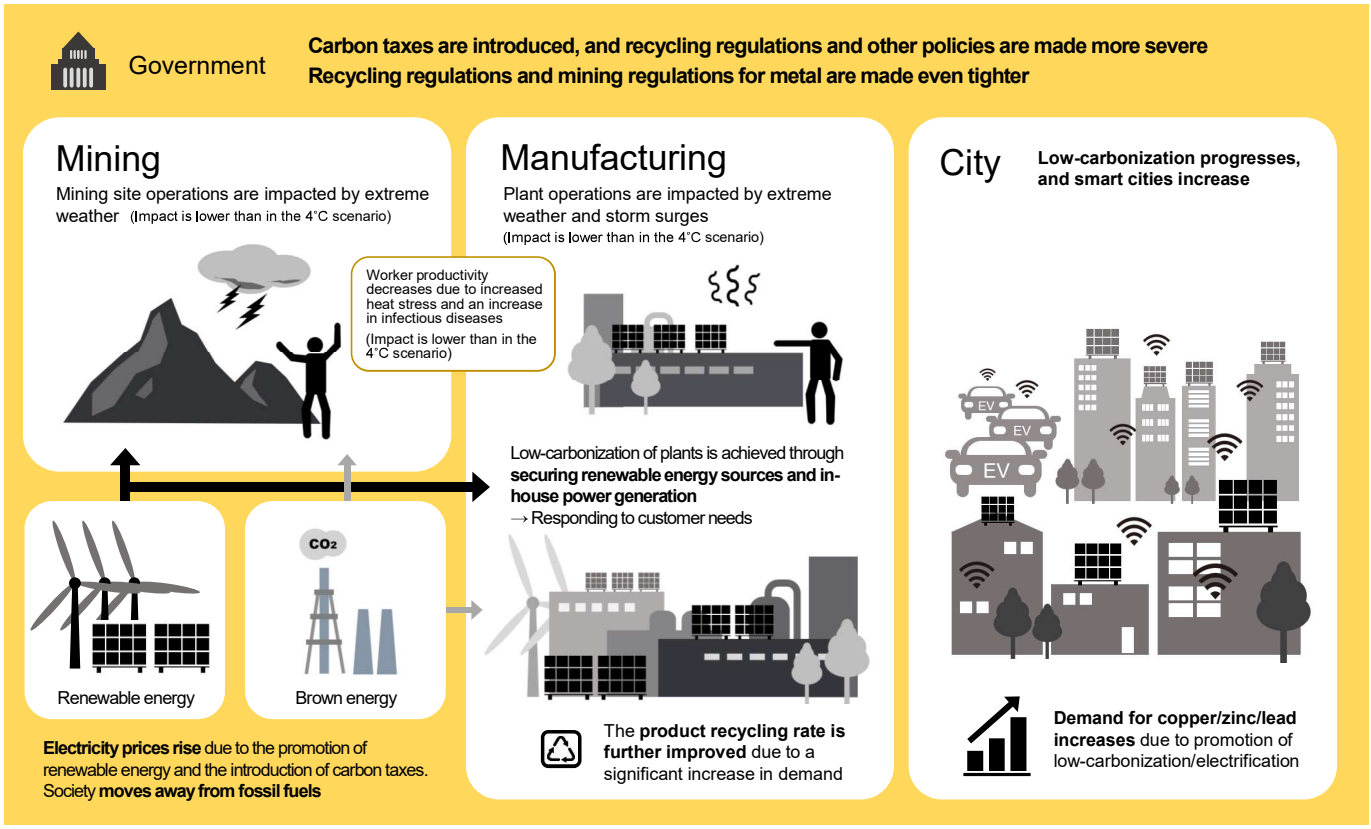




Demand for materials such as copper/zinc/lead **increases** in line with current trends

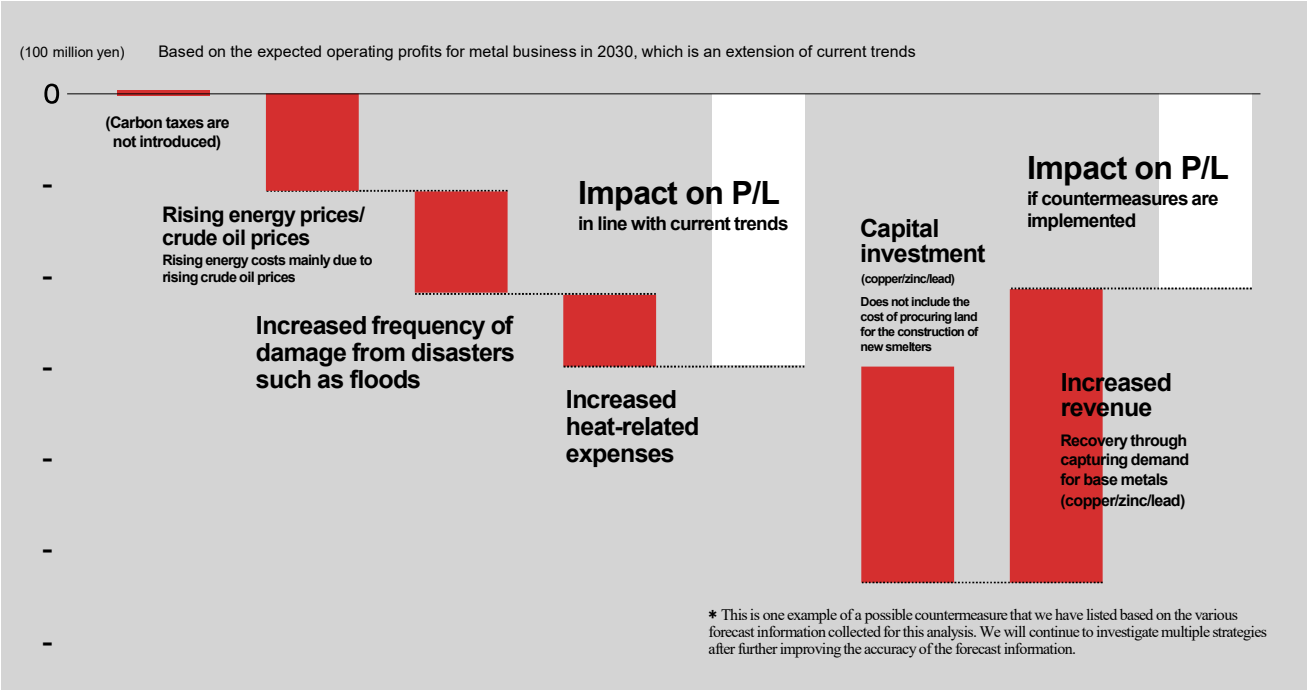
[Visual representation of a 2˚C scenario future society]

Demand for nonferrous metals increases due to the global promotion of low-carbonization initiatives



[Assessment of impact on business: 4˚C scenario]

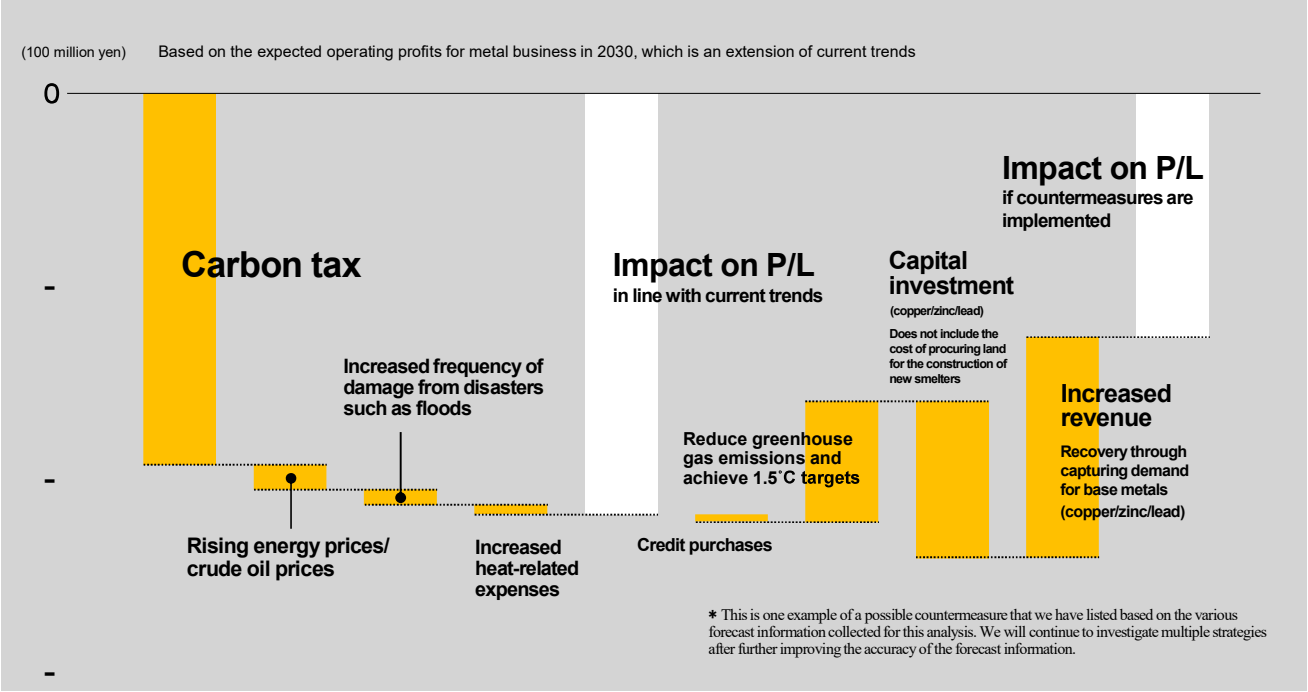
In the 4˚C scenario, while the impact of physical risks increases, demand for base metals also increases



In the 4˚C scenario, it will be necessary to focus particular attention on investigating countermeasures for physical risks in addition to responding to the expected increase in demand for base metals

[Assessment of impact on business: 2˚C scenario]

In the 2˚C scenario, carbon tax becomes a significant factor for reduced revenue, and strategies toward minimization are essential



In the 2˚C scenario, approximately half of the impact of carbon tax can be made up for by weighting energy conservation and similar efforts to curb CO_2 emissions and capturing growing demand

[Definition of countermeasures]

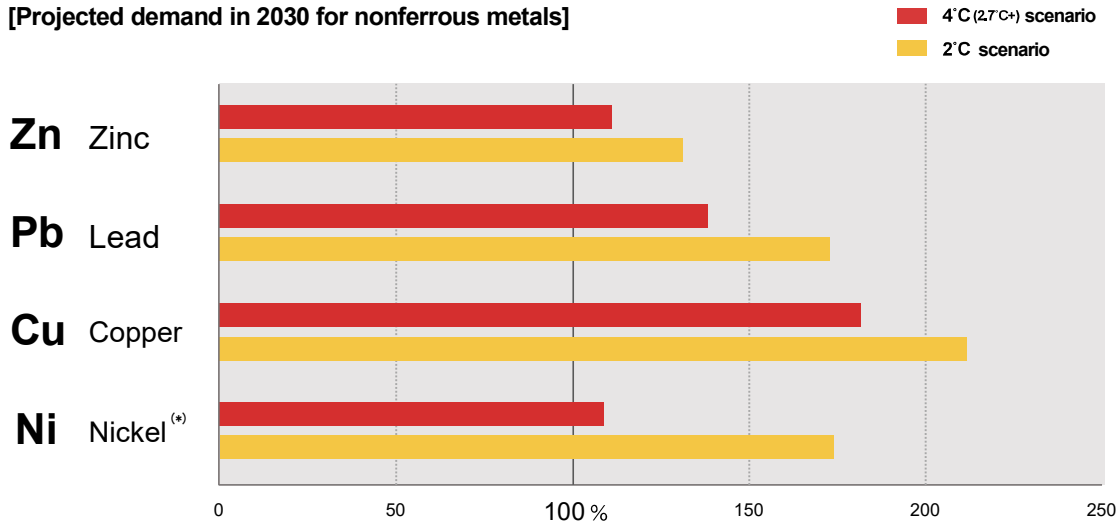
We investigate the direction for countermeasures toward responding to risks and seizing opportunities

Impact estimation items	4˚C scenario	2˚C scenario		Countermeasures corresponding to risks and opportunities
Increases in carbon pricing	Carbon tax is not introduced in the 4˚C scenario	▼▼▼	Risk	Implementation of ambitious target settings (e.g. SBT targets)
			Risk	Introduction of internal carbon pricing
			Risk	Development of low-coke, carbon-free smelting technology and creation of industry rules
			Opportunity	Development of carbon-absorbing technology such as blue carbon
Changes in energy cost	Loss ▼▼	▼	Risk	Establishment of target figures for renewable energy introduction rates
			Risk	Establishment of long-term targets for the reduction of energy used
			Opportunity	Improvement of the rate of recycled materials (energy conservation)
			Opportunity	Strengthening of demand response measures
			Opportunity	Introduction of renewable energy generation equipment to the roofs of plant buildings and unused company land
			Opportunity	Development toward off-grid buildings with hydrogen storage alloys
Changes in demand for copper, lead and zinc	▲ Profit	▲▲	Opportunity	Investment toward developing products using copper and other metals
			Opportunity	Recycling of metal scrap collected from customers
			Opportunity	Improvement of the rate of recycled materials (collection of lithium and other valuable metals)
			Op. / Risk	Reevaluation of portfolios in consideration of multiple scenarios
Extreme weather conditions	▼▼	▼	Risk	Company-wide systemization of spare parts management aimed toward swift recovery after incurring damages
			Risk	Construction work toward disaster preparedness at closed mines
			Risk	Development of low-environmental burden/low-cost processing technologies at closed mines
			Risk	BCP sophistication, including verification of the cost-effectiveness of disaster prevention measures
			Opportunity	Strengthened processing of waste from natural disasters
			Opportunity	Formulation of product sales strategies tailored to national land resilience needs
Increased average temperatures	▼	▼	Risk	Implementation of FA operations at high-temperature work sites in the smelters
			Risk	(Development of a system for remote control of mining machinery)

[Future initiatives]

For metal business, we performed regular monitoring in order to increase the certainty of the scenarios

[Projected demand in 2030 for nonferrous metals]

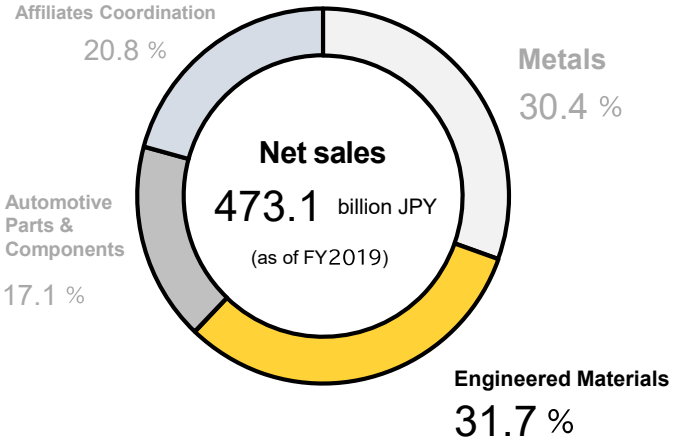


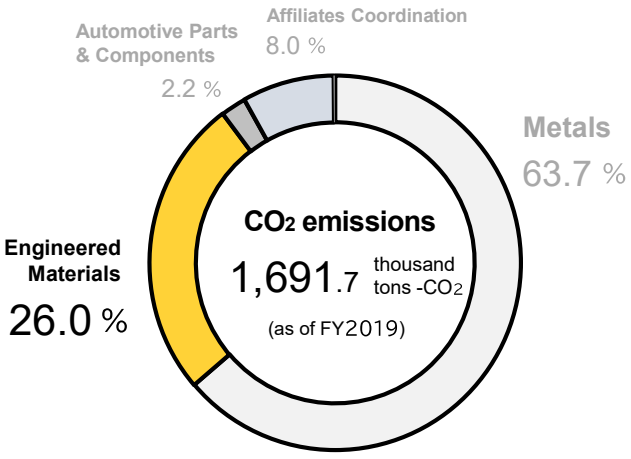
(Source, reference) Sebastiaan Deetman, World Bank et al.
For copper, we used the average demand from 2010 to 2015; for other metals, the projected figures are based on using the demand for 2013 as 100%

(*) Nickel is not currently a main product in the company's metal business, but we covered it here as a reference for metals used as raw materials by other divisions, together with cobalt and platinum.

[Future initiatives]

We will move on to analyze other business divisions after ending scenario analysis for metal business with the support of this project





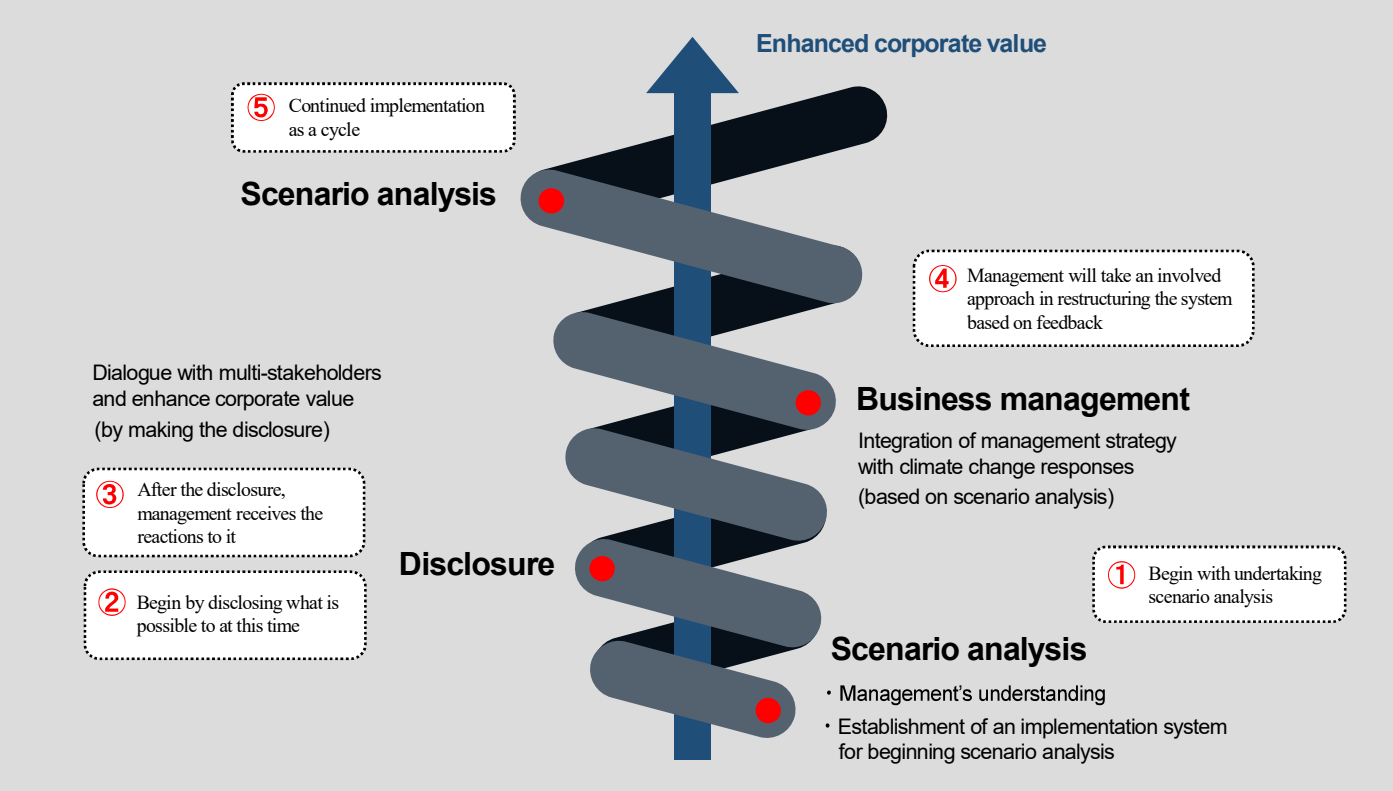
Engineered Materials: Business structure and products

Engineered Materials Sector	Engineered Powders Division	Engineered powders / Rare metals / Battery materials
	Catalysts Division	Catalysts used in exhaust gas purification (for automobiles, for motorcycles, general purpose)
	Copper Foil Division	Electro-deposited copper foil for printed wiring boards / Copper foil with carrier film
	PVD Materials Division	Sputtering targets
	Ceramics Division	Refractories / Fine ceramics / Molten aluminum filtration devices

[Future initiatives]

The goal is to integrate climate change with management and enhance corporate value

With the scenario analysis as a starter, we will go on to implement a continuous cycle of disclosure and system restructuring (integration with management strategy)



Food

- ✓ **Practice Case①：Kagome CO., LTD.**
- ✓ **Practice Case②：Calbee. Inc.**
- ✓ **Practice Case③：Meiji Holdings Co., Ltd.**

Introduction of Kagome

▸ Company Overview

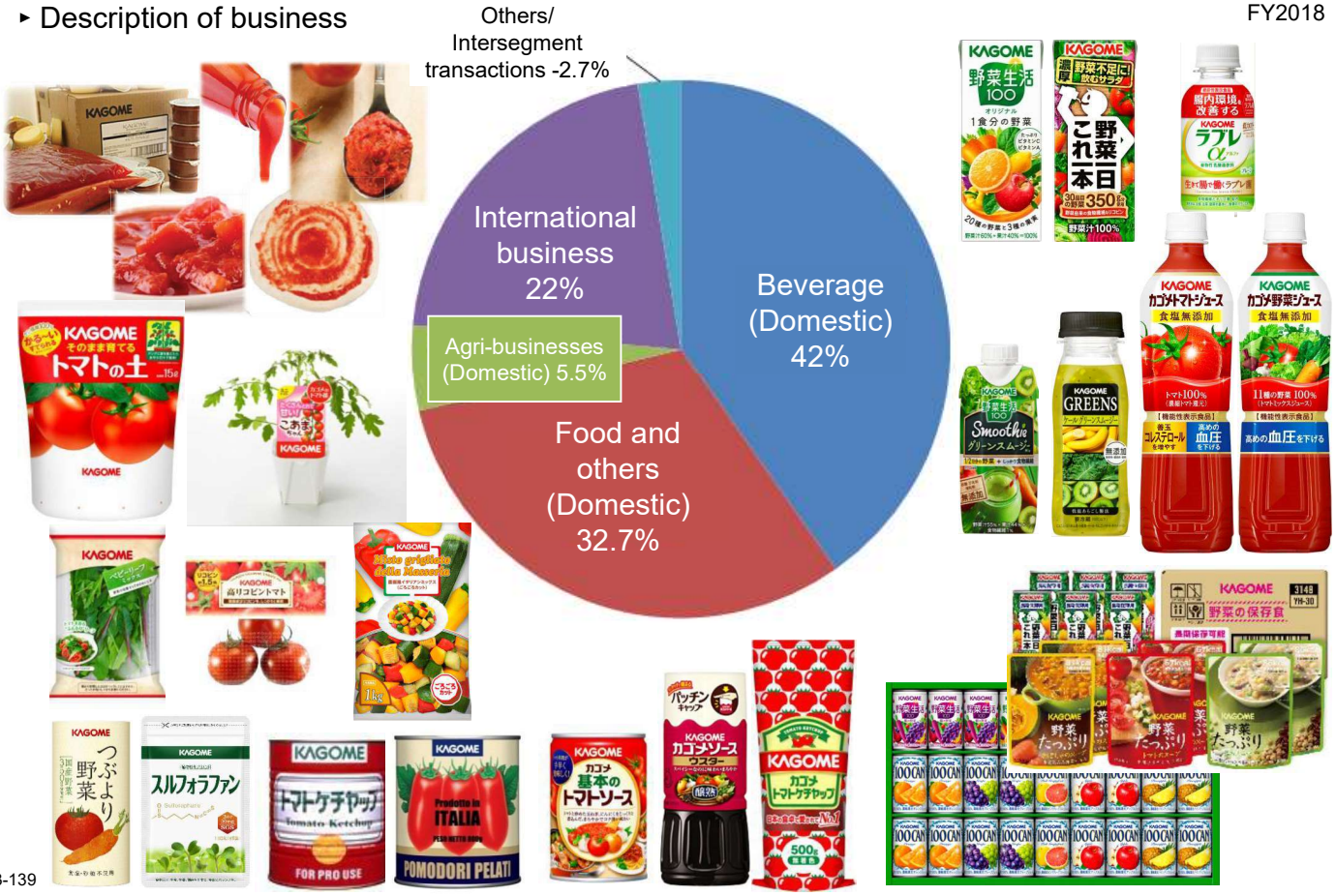
As of the end of December 2018

Head Office	Nagoya-shi, Aichi
Founded	**1899**
Common stock	**JPY19,985 million**
No. of individual investors	**186,095**
Sales consolidated)	**JPY209,865 million**
Number of employees(Consolidated)	**2,504**
Business Offices	Head Office, Tokyo Head Office, 1 division office, 8 branches, 6 plants, Innovation Division (Research Institute)
Group Companies	Hibikinada Green Farm Co,. Ltd. Iwaki Onahama Green Farm Co., Ltd. Kagome Axis Corporation KAGOME LOGISTICS SERVICE CO., LTD. **Kagome Inc.** **United Genetics Holdings LLC** **Vegitalia S.p.A.** **Holding da Industria Transformadora DoTomate, SGPS S.A. (HIT)** **Kagome Australia Pty Ltd.** Taiwan Kagome Co., Ltd. and others (40 subsidiaries and 5 affiliates)

Introduction of Kagome (Manufacture and sale of beverages and foodstuffs, development of vegetable varieties, and cultivation)

▸ Description of business

FY2018



[Step 2: Assess materiality of climate-related risks]

Step 2 3 4 5 Scenario 4℃ 2℃

Extract the risk of Kagome, evaluate the impact on a large, medium, or small scale, and identify those with the greatest impact.

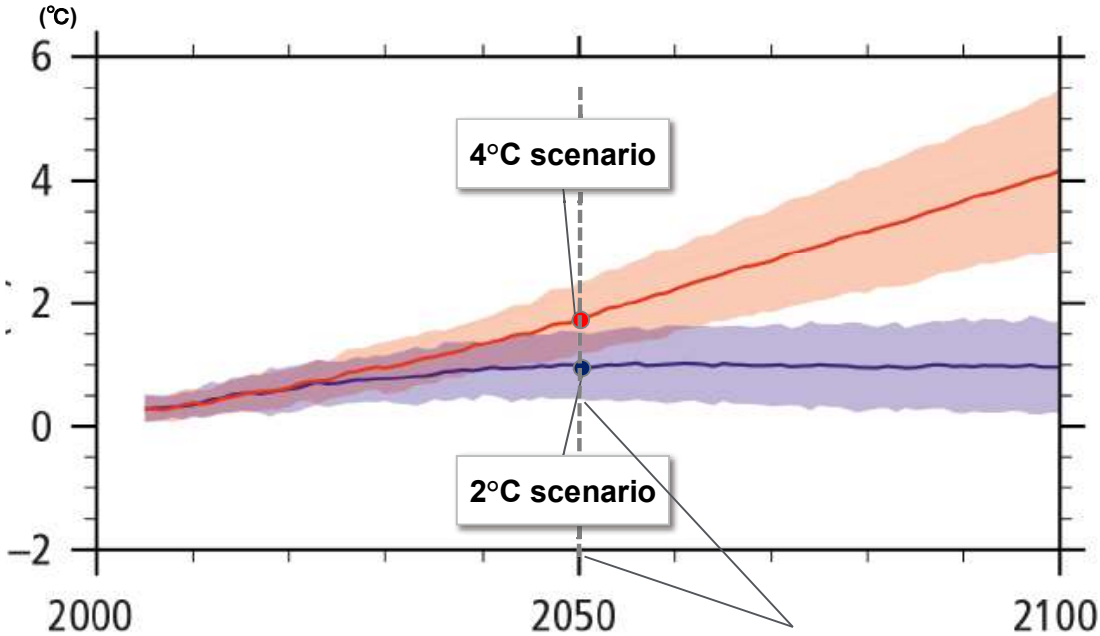
Risk Item			Business impact		
Classification	Major classification	Small classification	Index	Discussion (Example)	Assessment
Transition risk	Policies/ Regulation	Increase in carbon tax	Spending	・With the introduction of a carbon tax having a broad impact on raw materials, containers, and packaging materials Cost increases	Large
		CO2 emissions in each country Strengthening Reduction Policies	Expenditures and assets	・Energy-saving policies are strengthened and high-efficiency machines for manufacturing facilities are developed. Need to be renewed	Medium
	Reputation	Changes in consumer behavior	Revenue	・Expansion of purchasing behavior considering environmental impact due to climate change	Large
		Changes in the investor's reputation	Capital	・Investor reputation if climate change response is inadequate Deterioration and difficulty in raising funds	Small
Physical risk	Chronic	Increase in the average temperature	Expenditures and revenues	・Crop quality and yield deterioration occur.	Large
		Changes in rainfall and weather patterns	Expenditures and revenues	・Increased rainfall and drought adversely affect crop areas Reflecting high raw material prices	Large
		Reduction of biodiversity	Spending	・Procurement due to difficulty of plant pollination due to decrease in insects Generation of raw materials that are impossible	Large
		From the generation of pests Declines in production	Expenditures and revenues	・With the expansion of pests and pests lowering the production and quality of crops Difficulty of stable procurement	Medium
		Farmers Lower productivity	Expenditures and revenues	・By lowering the labor productivity of agricultural workers due to higher temperature Higher funding costs	Small
	Acute	Due to water stress Declines in production	Expenditures and revenues	・Water shortage makes it difficult to secure water and prices soar.	Large
		Increasing severity of extreme weather conditions	Expenditures and revenues	・Damage due to frequent extreme weather events such as storms Frequent production areas	Large

[Step 3: Identify and define range of scenarios]

Step 2 3 4 5 Scenario 4℃ 2℃

Consider a 2050 society under 2 scenarios (4°C, 2°C) for highly uncertain climate change (4°C: If the temperature rises without taking any measures, 2°C: If a variety of measures are taken)

[Global Average Terrestrial Temperature Change (Difference from the 1986-2005 Average)]



The temperature will rise 3.2-5.4°C above pre-industrial levels, unless more rigorous measures are taken.

The temperature will rise 0.9-2.3°C above pre-industrial levels, if strict measures are taken.

Source: AR5 SYR Diagram SPM.6

Set 2050-year time horizon for transition risk and physical risk

[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 | Scenario **4℃** **2℃**

Collect scientific evidence on the situation for 2050 (use in calculating the future impact amount)

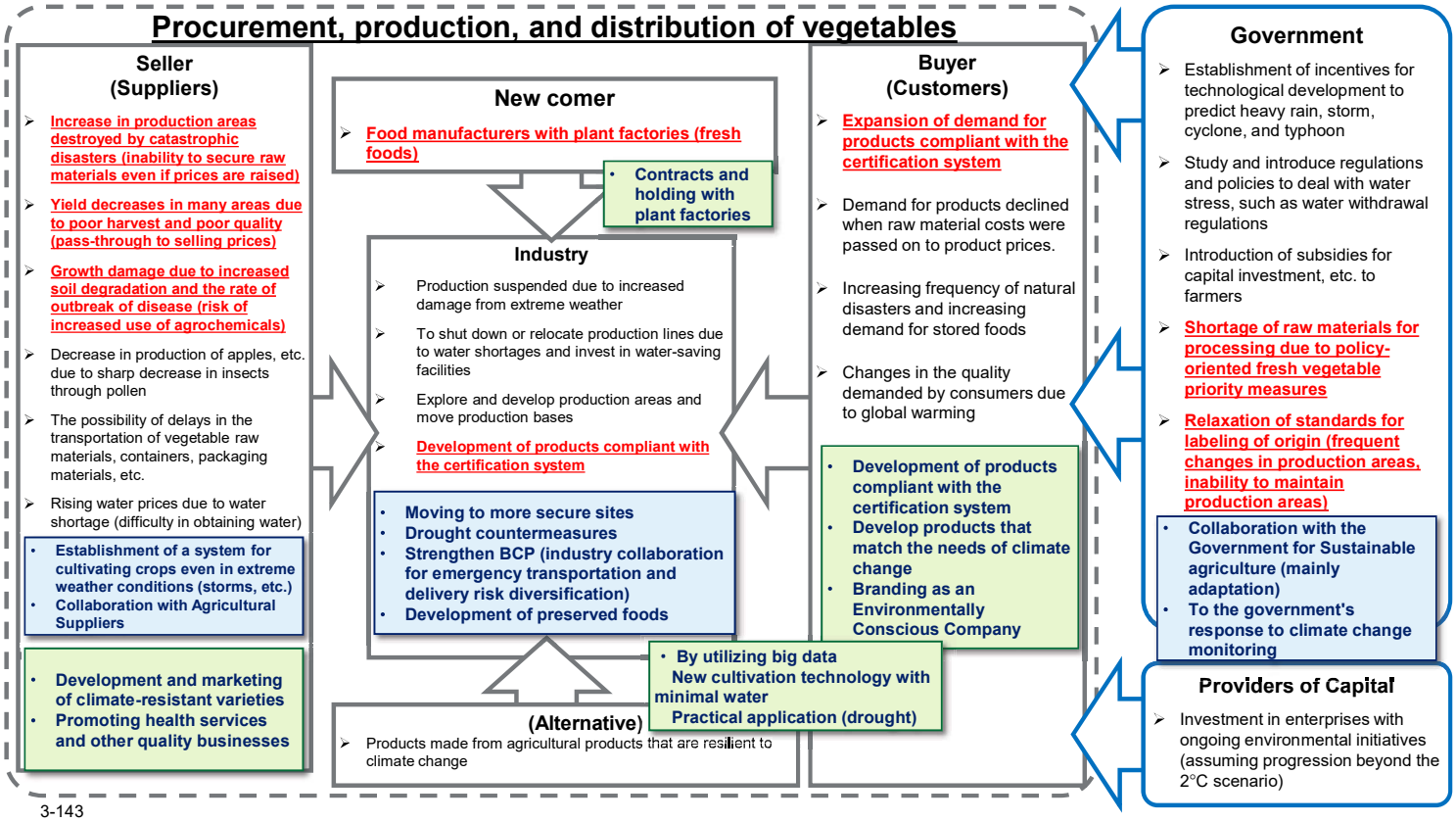
		At present	2050		Source
			4°C world	2°C world	
Carbon price	Carbon tax	-	**53USD/tCO2 (EU)**	**180 USD per tCO2 (developed countries)**	• IEA WEO 2019
Changes in consumer behavior	Purchasing behavior choices, Sales of Sustainable Certification Products (U.S.)	128.5 billion USD	397.5 billion USD (3.1 times the current level)	397.5 billion USD (3.1 times the current level)	• The Deloitte Global Millennial Survey 2019 • Nielsen "product Insider"
Increase in the average temperature **Changes in rainfall and weather patterns**	Changes in tomato yields	-	**-17~7%**	**-2~10%**	• GAEZ (yield per hectare)
	Change in carrot yield	-	**-0.1~2%**	**-2~1%**	
	Orange yield change	-	**4%**	**5%**	
	Changes in apple yield	No data			
Reduction of biodiversity	Reduction of pollen-borne organisms	No data			
Decrease in production due to water stress	Production bases in water-stressed areas	No. of production bases with water stress of Extremely high: 1	Number of manufacturing sites that are Extremely high to water stress: 7	No. of manufacturing sites with Extremely high water stress: **7**	• WIRI Aqueduct
Increasing severity of extreme weather conditions	Annual occurrence of heavy rain Incremental days	2.5 days	**4.3 days**	**2.9 days**	• "Japan's Climate at the End of the 21st Century," Ministry of the Environment and the Japan Meteorological Agency, "Observations and Forecasts of Climate Change and Integrated Report on Impact Assessments 2018-Climate Change and Its Impact in Japan."
	Amount of rainfall	-	**+8~+15%**	**+8~+15%**	
	Flood damage increase rate	-	**5.9 times**	**2.2 times**	• Supplemental to WRI 2030 annual data

[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 | Scenario **4℃** 2℃

Using Michael Porter's 5Forces to forecast the 2050 worldview

4°C worldview @2050s (Example)



[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 | Scenario 4℃ **2℃**

Using Michael Porter's 5Forces to forecast the 2050 worldview

2°C worldview @2050s (Example)

Procurement, production, and distribution of vegetables

Seller (Suppliers)

- Some areas where raw material cultivation is difficult
- Yield decreases in some areas due to poor harvest or poor quality (pass-through to sales prices)
- The possibility of delays in the transportation of vegetable raw materials, containers, packaging materials, etc.
- Carbon price burden for logistics, containers and packaging (passed on to sales prices)
- Rising water prices due to water

- Review of Procurement Strategy(Exploration and development of new production areas)
- Strengthening the procurement network (Strengthening the alternative procurement structure)
- Collaboration with agricultural suppliers

- Development and marketing of climate-resistant varieties
- Promotion of health services and other quality businesses

New comer

- Active entry into new businesses through low-carbon and non-carbon products and low-carbon business models (certified products, etc.)

To consider an aggressive business model for decarbonizing

Industry

- Partial suspension of production due to increased damage from extreme weather
- To shut down or relocate production lines due to water shortages and invest in water-saving facilities
- Enterprises with contract farms bail out part of the damage
- Shift to low-carbon production, use of low-carbon substitutes, and low-carbon transportation
- Development of products compliant with the certification system
- CO2 carbon offsets that cannot be reduced

- Drought countermeasures
- Strengthen BCP
- To expand into high-profit, low-carbon businesses

(Alternative)

- Products made from agricultural products that are resilient to climate change

Buyer (Customers)

- Expansion of demand for products compliant with the certification system
- Selection of products with a high price advantage that do not pass through carbon price increases
- Demand for products declined when raw material costs were passed on to product

- Shifting costs to carbon prices and low/decarbonizing

- Development of products compatible with certified products
- To the needs of climate change product development that matches
- As an environmentally conscious company branding

Government

- Consider, implement and strengthen carbon taxes on a national and local level to implement national commitments, such as NDCs.
- Establishment of incentives for technological development to predict heavy rain, storm, cyclone, and typhoon
- Study and introduce regulations and policies to deal with water stress, such as water withdrawal regulations
- Considering relief in the event of frequent agricultural damage
- Limited amount of water available for 1 product
- Introduction of a government system for certification of low-carbon labeled agricultural products

- Cooperation with Government for Sustainable Agriculture (mainly Mitigation)
- Government's monitoring of climate change countermeasures
- Introduction of Internal Carbon Pricing

Providers of Capital

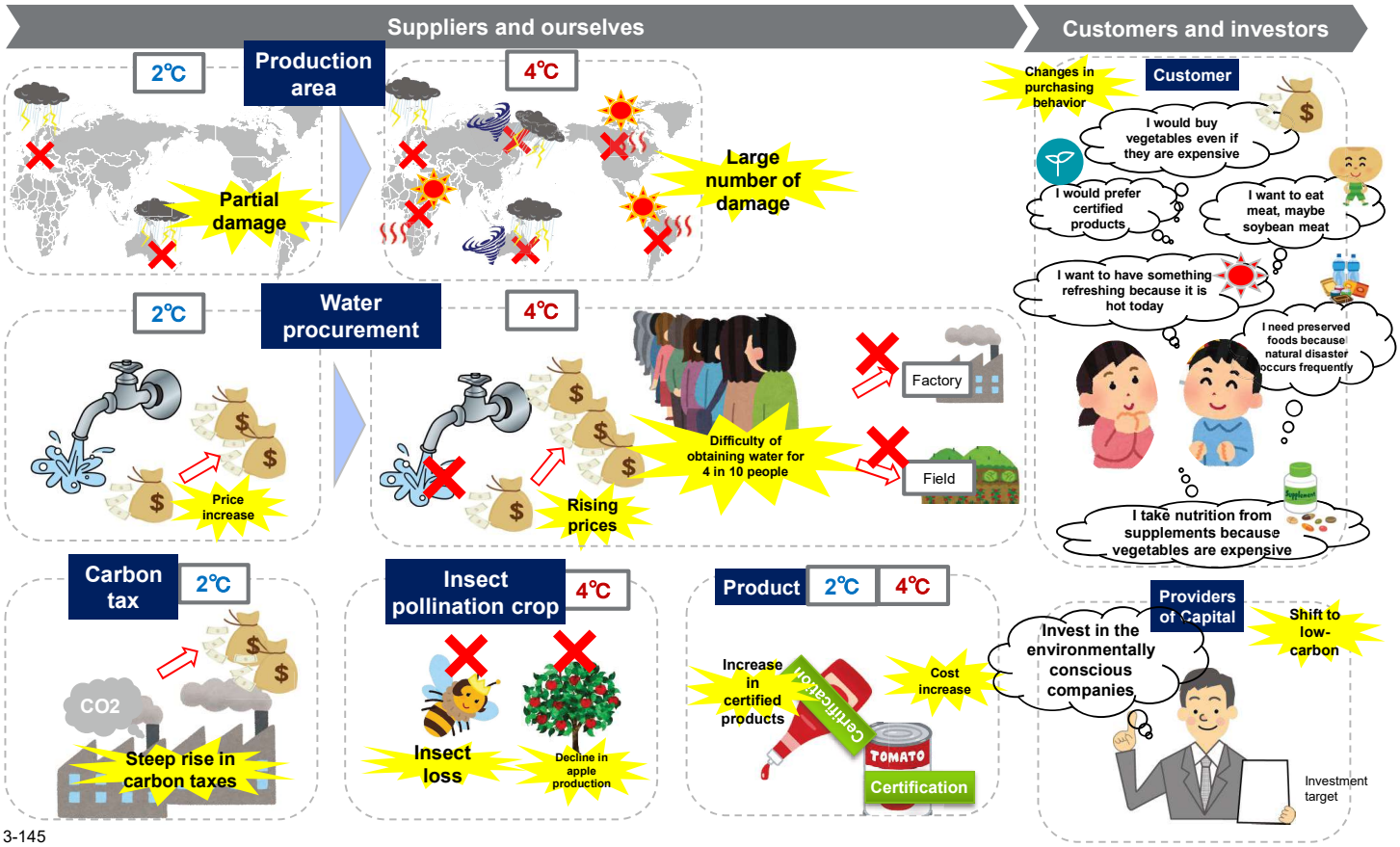
- Progress in investment in companies that are making progress in environmental initiatives

[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 | Scenario **4℃** 2℃

In the 2°C world, several production areas will be damaged by storms, and many production will not be able to harvest in the 4°C world. Water shortage will worsen due to global warming.

Major Worldwide Views in 2050



[Step 4: Evaluate business impacts]

Step 2 3 **4** 5 Scenario **4℃** **2℃**

Summary of estimated risk items

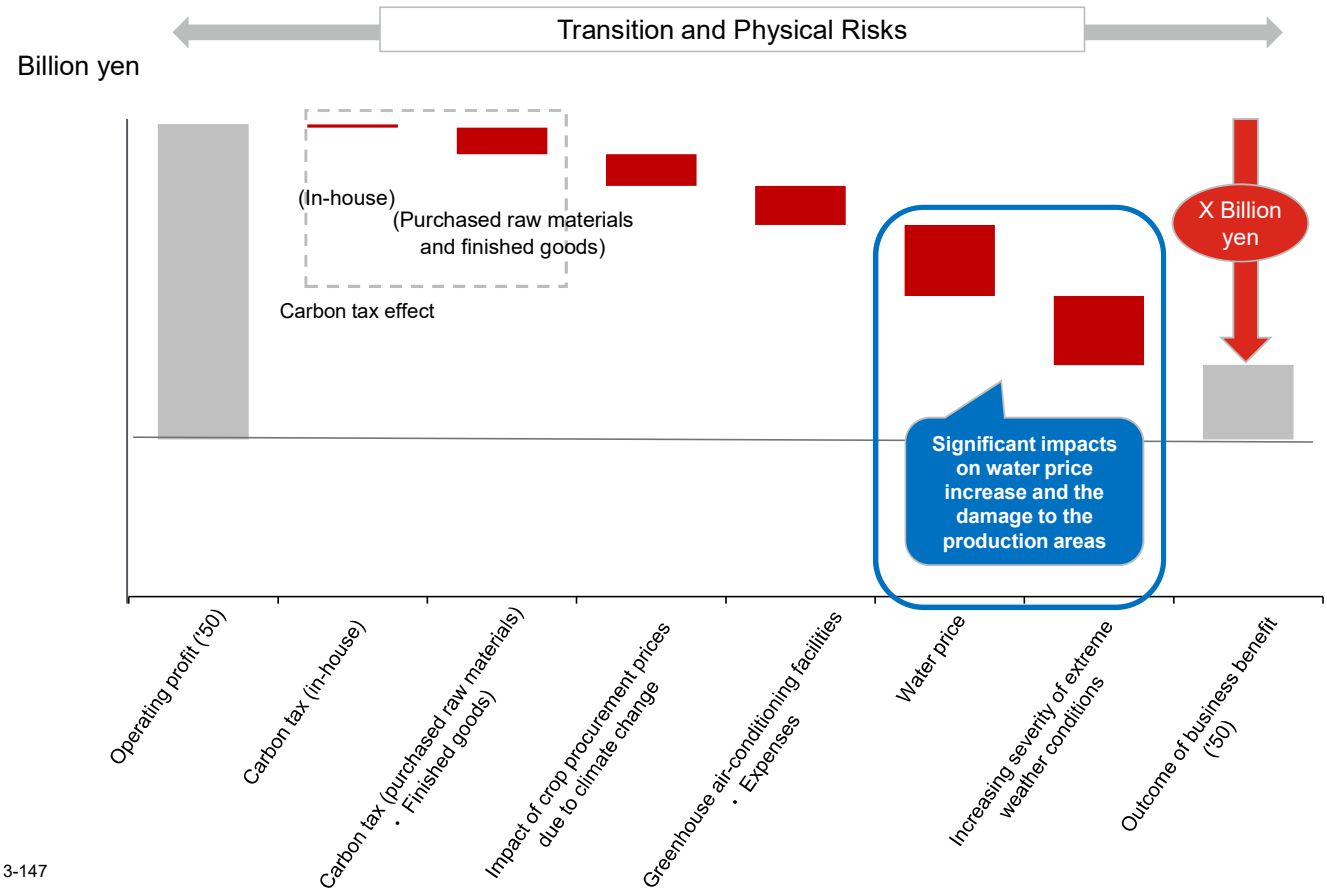
Determine the calculation logic for risk items and calculate the impact on business.

Risk Item	Assumed parameter		Overview of Impact and Assumptions	Effect factor	Impact (Billions of yen)		Pricing logic
					4℃	2℃	
Carbon price	①	Carbon tax	Scope 1 and 2 (in-house) emissions: CO2 emissions in the process of processing and manufacturing raw materials are subject to a carbon tax.	Sales Cost			CO2 emissions from manufacturing countries × business growth rate × carbon prices
			Scope 3 (Supplier) emissions: CO2 emissions from purchased raw materials and products are subject to a carbon tax.	Sales Cost			CO2 emissions of purchased raw materials and products (excluding N2O) × business growth rate × carbon prices
Increase in the average temperature Changes in rainfall and weather patterns	②	-	Rising raw material prices, including those in undesired areas, due to changes in weather patterns and rising average temperatures	Sales Cost			Amount procured × degree of price increase
	③	-	Increased temperatures in summer in Japan require air-conditioning in greenhouses resulting in capital expenditures and expenses.	Sales Cost			Estimated Cost of Cooling (Equipment + Expenses)
Rising water prices	④	Water stress data	Water shortage increases water prices and puts pressure on profits.	Business Profit			Actual increase in costs during drought × Rate of increase in water-stressed production sites
Increasing severity of extreme weather conditions	⑤	Flood damage increase rate data	Damage to production sites and production sites due to heavy rain, typhoons, and cyclones	Damage Cost			Results of damage in the event of a disaster × Flood damage increase rate
Total							

[Step 4: Evaluate business impacts]

Step 2 3 **4** 5 Scenario **4℃** 2℃

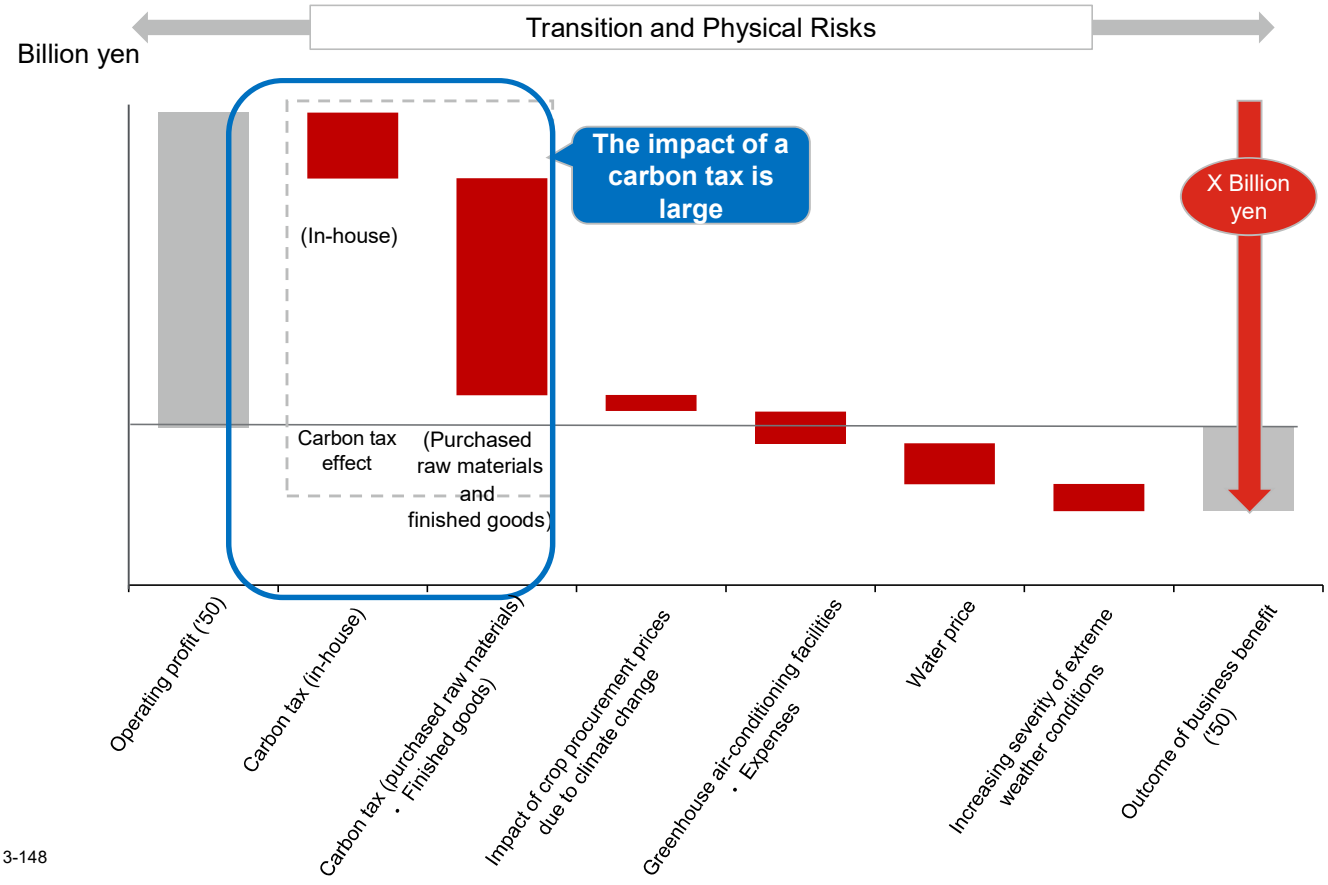
In the 4°C world, business profit will decrease by X billion yen due to water price increase and damage to production areas.



[Step 4: Evaluate business impacts]

Step 2 3 **4** 5 Scenario 4℃ **2℃**

In the world of 2°C, the impact of a carbon tax is large, and the business profit will decrease by X billion yen.



[Step 5: Identify potential responses]

Step 2 3 4 **5** Scenario **4℃** **2℃**

Summary of estimated countermeasures

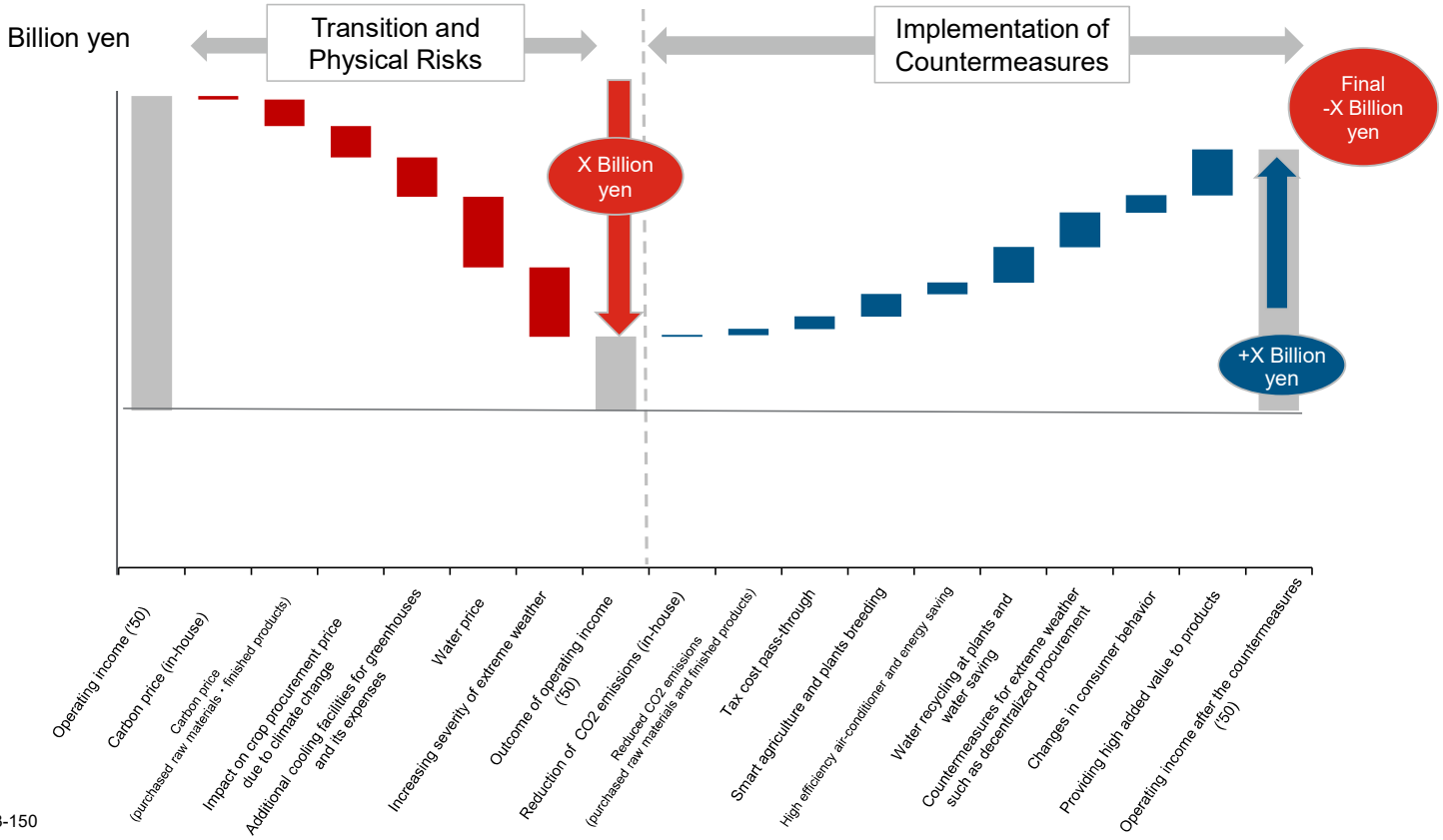
The following measures are necessary in order to recover the business impact that decreasing operating profits

Risk Item	Assumed parameter		Means of recovering the business impact	Effect factor	Impact (Billions of yen)		Pricing logic
					4℃	2℃	
Reduced CO2 emissions	⑥	Carbon tax	Achieve the 2050 CO2 reduction target for Scope 1 and 2 (in-house) (50% reduction)	Cost of sales			Estimate the avoided costs of a carbon tax if CO2 target of 2050 CO2 emissions is at the current 50% level.
		Carbon tax	CO2 reductions at Scope 3 (suppliers)	Cost of sales			Assuming a 25% reduction on a basic unit basis
		Pass-through of tax burdens accompanied by CO2 reductions	Passing on cost increases for carbon taxes that meet reduction targets and remain	Cost of sales			Shifts over 60% of the carbon tax costs that cannot be avoided by reducing CO2 above to products.
Smart Agriculture and Climate Change Resilience	⑦	—	Climate Change Responses in Agriculture	Cost of sales			Avoidance of about 70% of cost increase
For summer air-conditioning High efficiency	⑧	—	Reduction of Costs for Cooling of Greenhouses	Cost of sales			Avoid about 30% of the increase in costs (assuming an annual level of about 1% based on the Energy Conservation Law, etc.)
Water recycling Water saving	⑨	—	Reduction of rising water costs due to drought	Cost of sales			Reducing and Assuming a 50-Fraction of Elevated Water Costs During Drought.
Resistance to abnormal weather	⑩	—	Establishment of a system that can be procured even during extreme weather conditions	Cost of sales			Assumed to be about 50% of the amount of damage
Consumer Behavioral change	⑪	Choice of buying behavior Sales of certified products	Follow-up to and sales expansion of environmentally conscious purchasing behavior of consumers	Operating profit			Sales of certified products × Business growth rate × Projected Increase in Sales of Certified Products
High added value of products Valuing	⑫	—	Environmentally conscious products with high added value	Operating profit			Assumed to be about 50% of the cost that cannot be absorbed by the above-mentioned method at 4°C. (Temporary assumption of 4°C for 2°C)
Total of measures							

Scenario 4℃ 2℃

Business impact of risks and its recovery through countermeasures

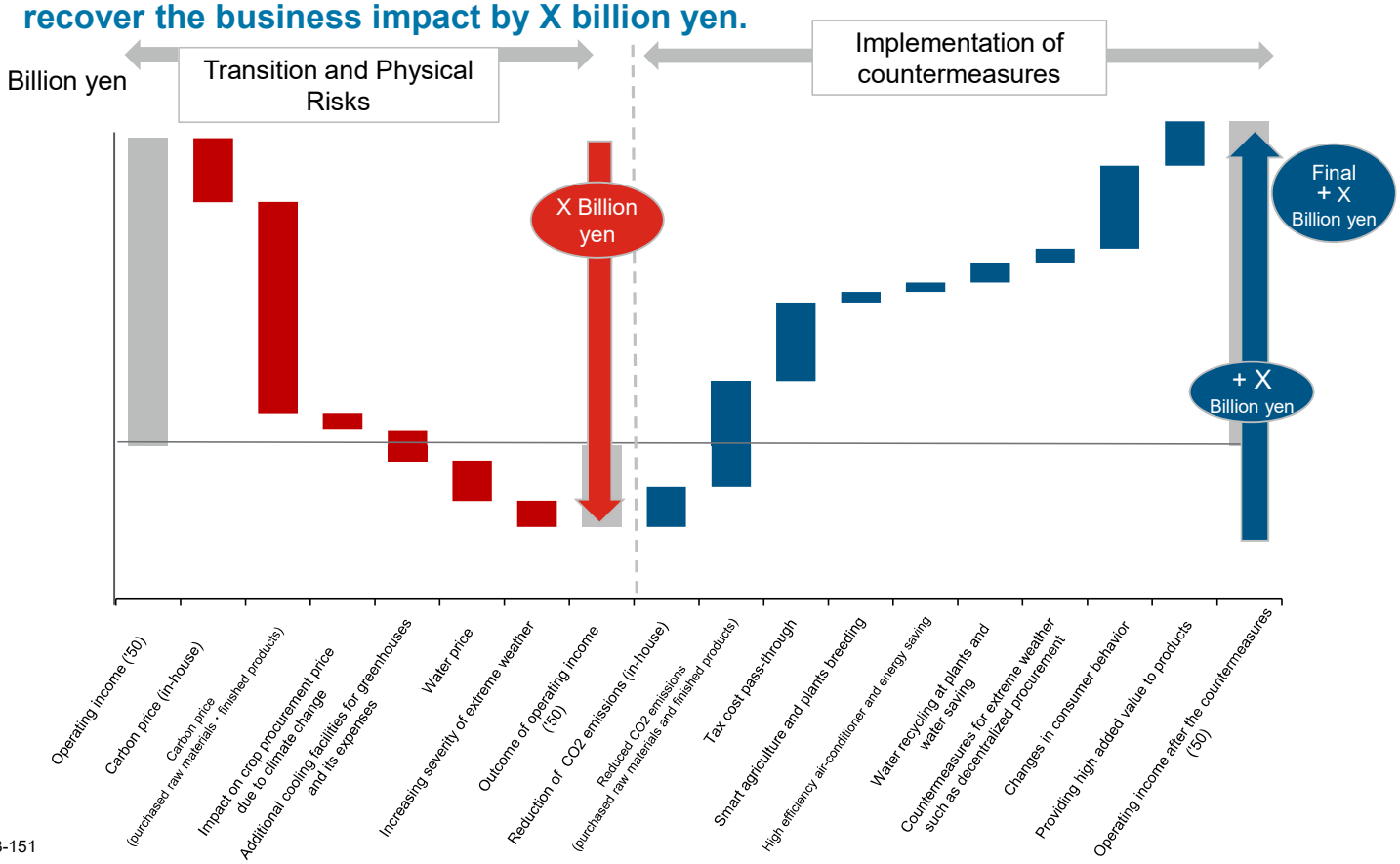
In the world of 4°C, operating profits decline by X billion yen, and countermeasures recover the business impact by X billion yen



Scenario 4℃ 2℃

Business impact of risks and its recovery through countermeasures

In the world of 2°C, operating profits decline by X billion yen, and countermeasures recover the business impact by X billion yen.



[Step 5: Identify potential responses]

Step 2 3 4 **5** Scenario **4℃** **2℃**

Practical measures at Kagome to restore business impact

	Item	Specific risk countermeasures	Opportunity
A	**Carbon price Increase**	✓ Achieve the goal of reducing CO2 emissions by 50% by 2050 through energy conservation, energy creation, and energy purchase within the Kagome Group ✓ Reduce CO2 through collaborating with suppliers ✓ Formulate and implement cost-shifting measures for each product ✓ Raise in-house CO2 reduction target (emissions 50% → 0%)	
B	**Consumer Behavioral change**	✓ Understanding of consumers' purchasing behavior and accurate sales activities ✓ Development of environmentally conscious products and certified products proactively	✓ Develop and sell products that meet the needs of customers under extreme weather conditions
C	**Average temperature Increase** **Rainfall and weather conditions Shifts in patterns**	✓ Respond to climate change through smart agriculture, such as data utilization ✓ Acquire vegetable varieties that can cope with climate change (such as high temperature resistance and pest resistance)	✓ Global expansion of sales of vegetable varieties that can cope with climate change
D	**Biodiversity decrease**	✓ Propose and disseminate agriculture that coexists with all living things	✓ Promote a tomato cultivation that does not use bees in greenhouses
E	**To water stress production by decrease**	✓ Promote water recycling and water conservation efforts at plants (membrane treatment, etc.) ✓ Develop and use a tomato cultivation system that can be produced with minimal water ✓ Promote recycling-oriented agriculture (use of factory wastewater and rainwater in agricultural land)	✓ Global expansion of a tomato cultivation system capable of producing with minimal water
F	**In extreme weather conditions, increasing severity**	✓ Upgrade procurement strategies (reviewing and diversifying production areas) ✓ Create a system that can be cultivated even during storms ✓ Upgrade BCP measures (assuming climate change)	✓ Transition to Koto Businesses (To be a service business that is not susceptible to cost fluctuations)

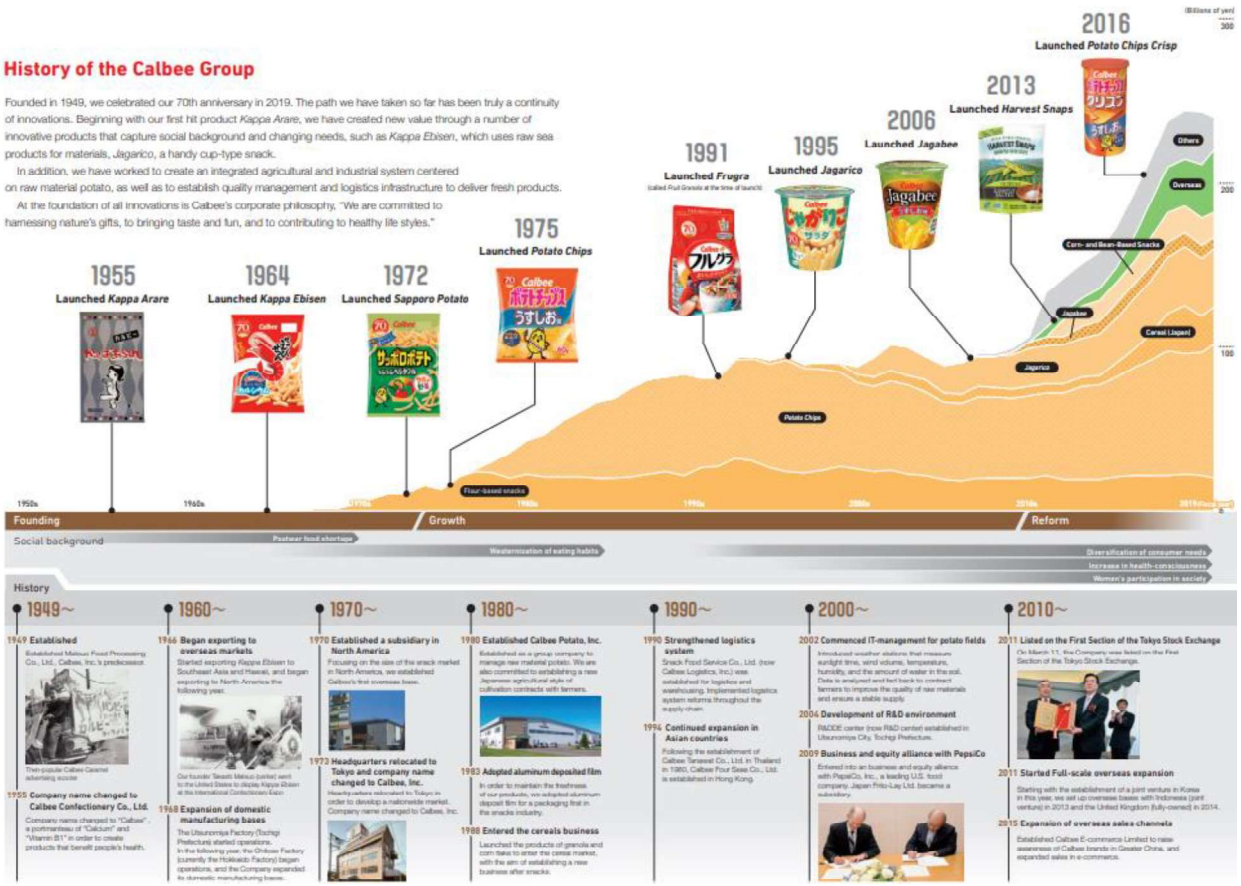
Food

✓ Practice Case①：Kagome CO., LTD.

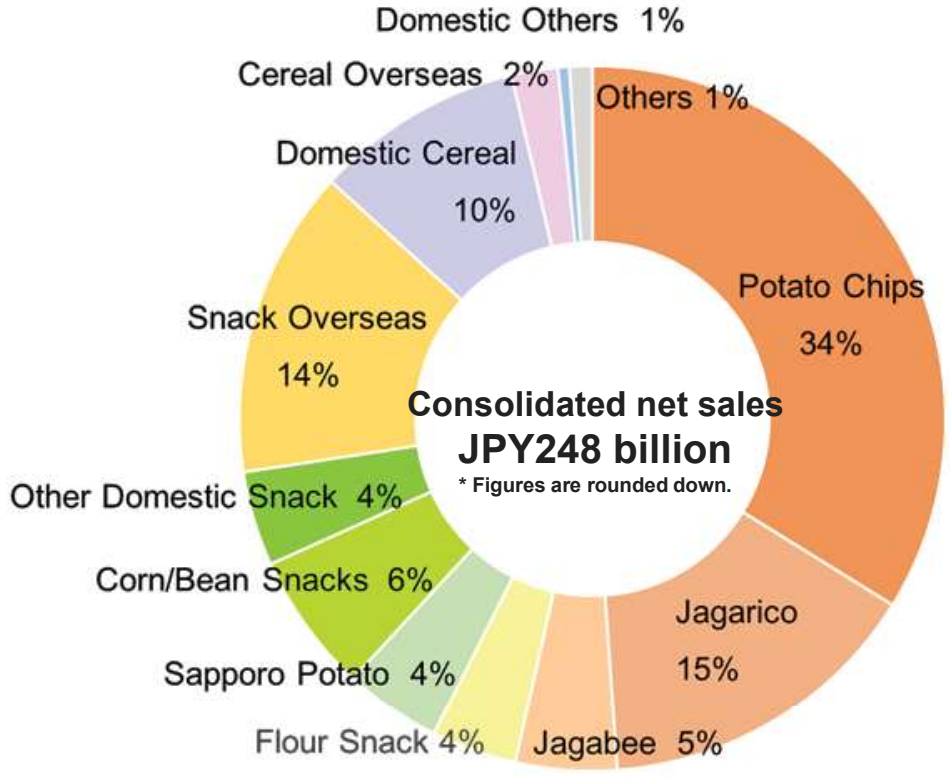
✓ **Practice Case②：Calbee. Inc.**

✓ Practice Case③：Meiji Holdings Co., Ltd.

History of the Calbee Group



Product Mix (Fiscal year ended March 2019)

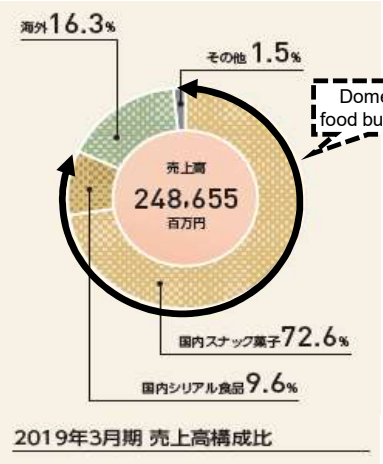


More than 50% of total sales consist of products made from potato.

Assessed Material Risks in Major Value Chain of Domestic Food Business

① Selected domestic food business for materiality assessment because it consists of more than 80% of total business

Business Portfolio



② Selected procurement, production, logistics and sales as key value chains for materiality assessment

R&D → Procurement → Production → Distribution → Sales → Consume / Disposal

- Procurement
  - Main raw materials include potato and oat
  - Specialty raw materials include shrimp
- Production
  - Facilities
- Distribution
  - Distribution
  - Inventory
- Sales
  - Shift in demand orientation

Main raw materials and specialty raw materials are taken into consideration.

Not only production but also distribution, package and sales activities are taken into consideration.

Referenced to the list of important parameters of each value chain

Procurement	Production	Distribution	Sales
✓ Carbon price ✓ Precipitation change ✓ Exetreme weather occurrence ✓ Rise in temperature	✓ Carbon price ✓ Energy-saving policy	✓ Carbon price	✓ Changes in customer behaviours

Listed Material Risks Related to Climate Change

Risks		Financial impact		
		Metrics	Impact	Assessment
1	Carbon price	Cost	• GHG emissions: Scope 1&2+ packaging material +supply chain	Large
2	Precipitation changes	Cost Revenue	• Decreased yield of potato • Decreased yield of Oats	Large
3	Extreme weather occurrence e.g. heat wave, tropical cyclone, flood	Cost Revenue Assets	• Decreased yield of potato • Decreased yield of Oats • Suspended production • Damage on facilities	Large
4	Rise in temperature	Cost Revenue	• Decreased yield of potato • Decreased yield of Oats	Large
5	Changes in ocean environment (e.g. temperature rise, acidification)	Cost Revenue	• Decreased yield of prawn	Large
6	Changes in consumer behavior	Revenue	• Decreased sales of anti-environmental products	Large

[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 Scenario **4℃** **2℃**

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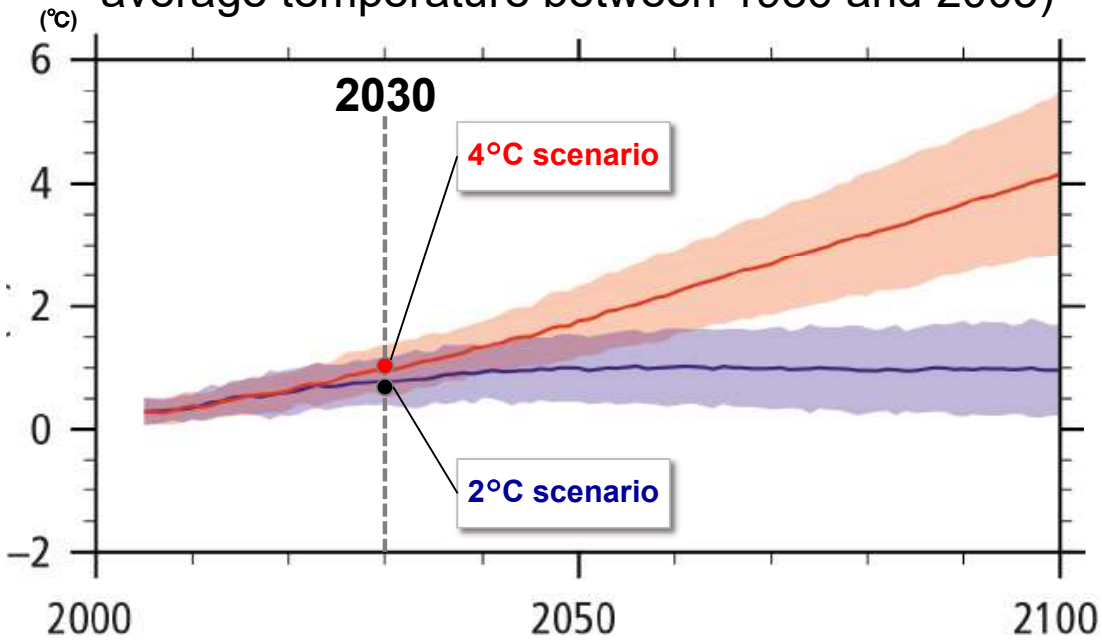
Considered 2030 Societal Impact of 2 Scenarios as to Climate Change

Changes in Global Ground Temperature from average temperature between 1986 and 2005)



The temperature will rise 3.2-5.4°C above pre-industrial levels, unless more rigorous measures are taken.

The temperature will rise 0.9-2.3°C above pre-industrial levels, if strict measures are taken.

Source: AR5 SYR Diagram SPM.6

[Step 3: Identify and define range of scenarios]

Step 2 **3** 4 5 Scenario **4℃** **2℃**

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Defined Worldview of 2 Scenarios Based on Scientific Grounds of IEA

		At present	2030		Source
			2°C world	4°C world	
Carbon price	Carbon tax	※ Average successful bid in the European EU-ETS: Approx. $8 per tonne	For the developed countries 88 USD per tonne CO2	Assumed no carbon tax in Japan	IEA WEO 2016 (450, NPS Scenario
Changes in customer behaviours	Response to certification	No procurement	Certification price +●●%	Assuming no certification	Private research firm (No scenario)
Raw material impacts due to precipitation changes caused by rise in temperature	Changes in potato yields	(Base year)	Domestic yield -●●% U.S. yield -●●%	Domestic yield -●●% U.S. yield -●●%	Academic literature (RCP8. 5, RCP4. 5, SI92a scenarios)
	Changes in oat yields	(Base year)	Australian yield +●● %	Australian yield +●● %	GAEZ (United Nations) (Scenarios A2 and B1)
Change in ocean environment	Changes in fishery	(Base year)	Assume no change	Japan -●% U.S. import -●% China import - ●%	Academic literature (A2 scenario)
Occurrence of extreme weather events such as heat waves, tropical cyclones, floods, etc.	Increase in the number of days of heavy rain	2.5 days a year on average in Japan	2.5 days a year on average in Japan	3.0 days a year on average in Japan	The Ministry of the Environment and other government offices, Academic literature (RCP2.6、RCP8.5 Scenario)
	Severe typhoons and cyclones	(Base year)	Damage +120%	Damage +200%	Temporarily based on IPCC Report

The parameters were set at 2°C and 4°C for each transition risk and physical risk.

[Step 3: Identify and define range of scenarios] Step 2 **3** 4 5 Scenario 4℃ **2℃**

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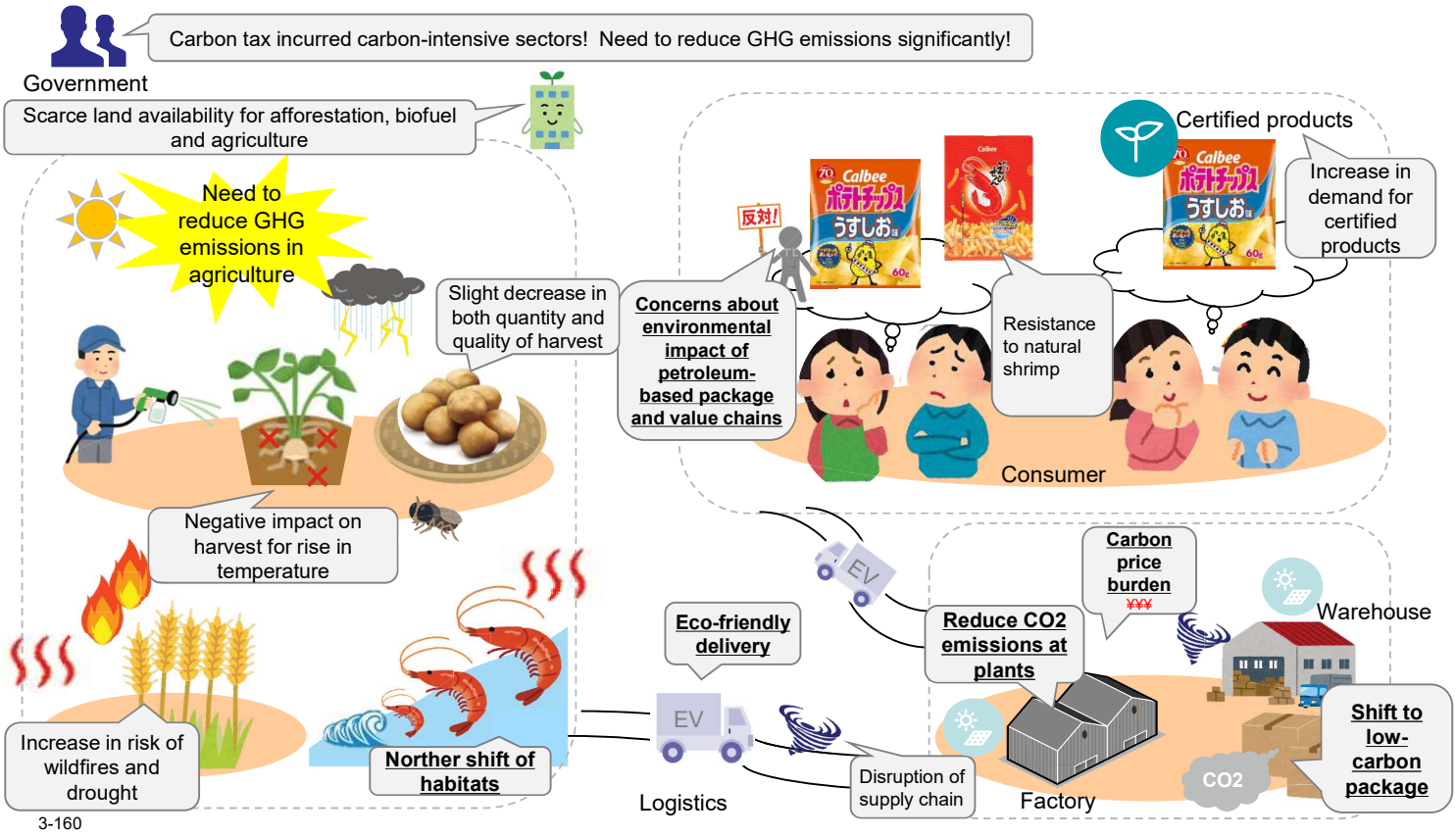
Demand for sustainable products increases as low-carbon and de-carbon

2°C scenario



[Step 3: Identify and define range of scenarios] Step 2 **3** 4 5 Scenario **4℃** 2℃

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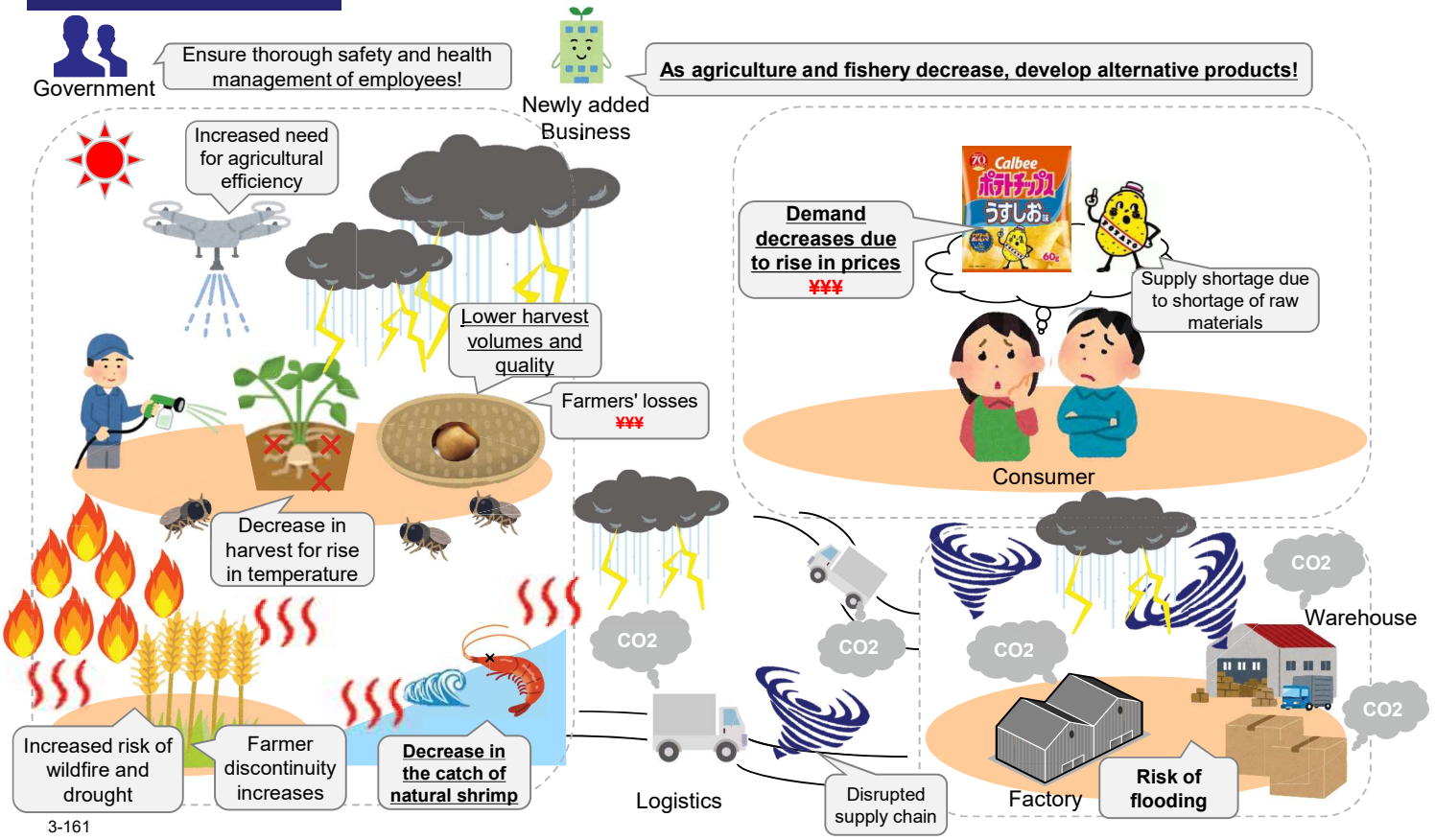
Potato harvest and shrimp fishery reduce and extreme weather damage increases

4°C scenario



[Step 4: Evaluate business impacts]

Step 2 3 **4** 5 Scenario **4℃** **2℃**

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Evaluate the impact of transition and physical risks based on sales, market size, etc. in 2030.

Risk Item			Parameter		Impact 2℃	Impact 4℃	Estimated assumptions (common for 2°C and 4°C)
Transition risk	Policy	Carbon price	①	Carbon tax			・CO2 Emissions from Manufacturing Sites × Carbon-Prices ・CO2 emissions from use of cardboard and packaging materials × carbon prices ・CO2 emissions on logistics × carbon prices → Calculated on the assumption that 100% of the carbon price will be passed on.
	Market	Changes in customer behaviours	②	Selective purchasing and need for the certified sustainable products in US			・Decrease in sales of products not certified for sustainability × sales
Physical risk	Chronic	Changes in precipitation, Impact on raw material harvest	③	Changes in potato yields			・Shift harvest area to make up for potential decline in yields
			④	Changes in oat yields			・Other factors would allegedly exist to hinder the correlation between the increase in yields and the price increase in the market principle,
		Changes in ocean environment	⑤	Changes in fishery			・Estimated changes in procurement from each area by referring to the fluctuations of fishery in Japan, the U.S., and China.
	Acute	Frequency of extreme weather events (tropical waves, tropical cyclones, floods, etc.)	⑥	Response to drought and wildfires			・Insufficient parameters of palms and oats (not estimated)
			⑦	Increasing number of days of heavy rain per year			・Damage from past heavy rain × Increase rate of heavy rain
							・Damage due to past heavy rainfall × Increase rate of heavy rainfall ・Production suspension due to inability of employees to come to work (including suspension of operations due to high tides)
			⑧	The number of typhoons and cyclones			・Damage from past typhoons × Rate of increase in typhoons

Impact assessments are performed using parameters of 2°C and 4°C.

[Step 5: Identify potential responses]

Step 2 3 4 **5** Scenario **4℃** **2℃**

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Consider initiatives for multiple scenarios

Item	Existing Initiatives	Additional counter measures against risks
Carbon price increase	✓ CO_2 Reduction Target (30% Reduction by 2030) ✓ Conversion to liquefied natural gas (LNG) ✓ Implementation of high-efficiency operation of biomass boilers ✓ Aggressive introduction of energy-saving equipment and energy-saving activities at offices Improve load factor by standardizing cases ✓ Low and decarbonized logistics – Promoting joint delivery and modal shifts	✓ Integration of production lines and factories to improve energy efficiency ✓ Implementation of carbon offset by credit, tree-planting and blue-carbon offsetting ✓ Achieve 100% renewable energy
Sales decrease for shifting consumer behavior	✓ Reducing packaging materials and eliminating plastics ✓ Assessing and obtaining certification ✓ Expansion of best before date to reduce food losses	✓ Actively participating in the initiative ✓ Obtaining sustainability certification and establishing voluntary certification system
Harvest change due to rise in temperature **Change in precipitation** **Increase in extreme weather events** **In the marine environment Change**	✓ Diversification of farming areas for potato and other raw materials ✓ Promotion of field storage management system ✓ Development of varieties resilient to climate change and environmental change ✓ Product development using materials other than potato	✓ Utilization of development tools of and collaboration with research institutions, etc. to mitigate risks ✓ Promotion of consortia and initiatives in Japan and participate in working groups to consider countermeasures ✓ Lobbying to deregulations on agriculture ✓ Diversification of product portfolio and raw materials ✓ Storage of carbon in soil, innovation in cultivation methods and enhancement of variety cultivation ✓ Strengthening BCP with alignment among production and logistics sites globally

Food

✓ Practice Case①：Kagome CO., LTD.

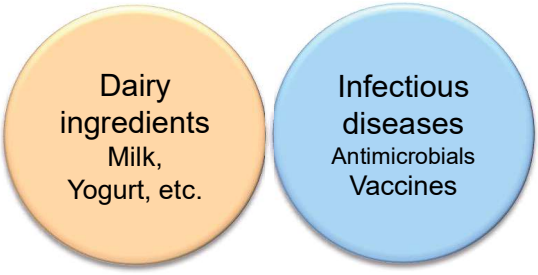
✓ Practice Case②：Calbee. Inc.

✓ **Practice Case③：Meiji Holdings Co., Ltd.**

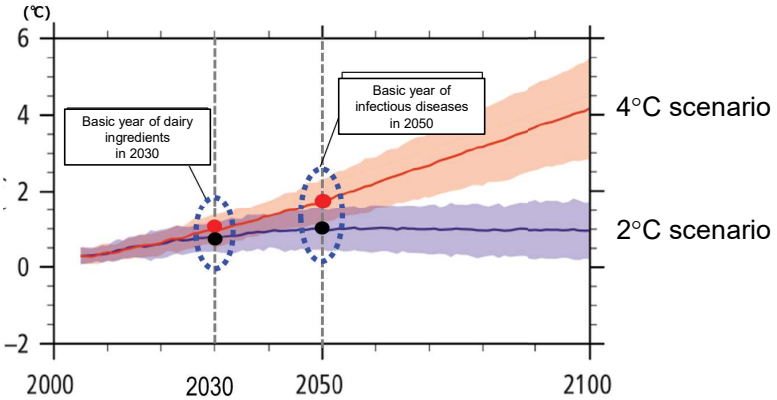
TCFD scenarios (summary)

meiji

Themes to be analyzed

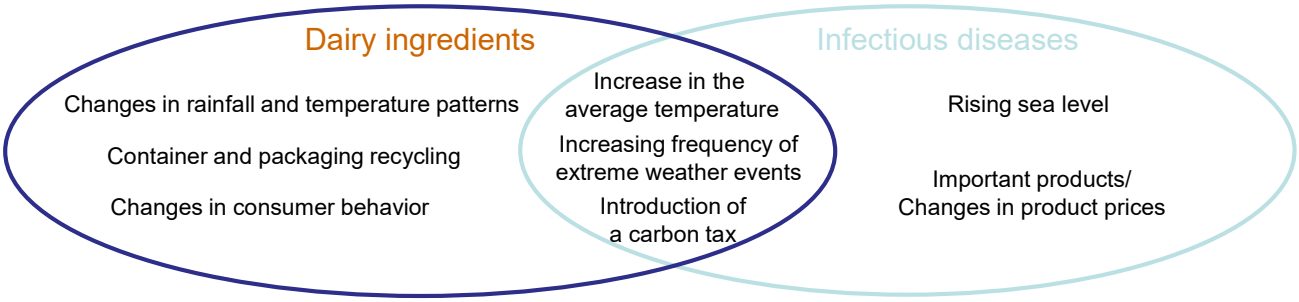


Scenario setting at 2°C and 4°C



Source: AR5 SYR (image) SPM.6

Important risk items



Risk assessment for dairy ingredients

Risk Item	Business impact		
Small classification	Index	Discussion	Assessment
Increase in the average temperature	Expenditures and revenues	Decrease in production of raw milk. Measures to cope with heat (feeding management, cattle barn environment) are required, and the cost of procuring raw materials is increasing. Increased interest in environmentally conscious consumption (ethical consumption) and increased costs associated with conscious procurement of raw materials.	◎
Changes in rainfall and temperature patterns	Expenditures and revenues	Risks associated with changes in rainfall and temperature patterns (e.g., deterioration of water quality, drought) increase. Costs of securing adequate water will increase.	
Increasing frequency of extreme weather events (typhoons, floods, etc.)	Expenditures, revenues, and assets	Natural disasters (e.g. heavy rain, floods, droughts) have resulted in suspension of operations or suspension of distribution of manufacturing bases and distribution routes. Cost increase for recovery. Yields of biological resources may decrease and procurement costs may increase due to higher feed costs.	
Carbon price	Expenditures	Increased production and transportation costs due to the introduction of a carbon tax, and higher production costs due to higher fossil fuel-derived electricity prices, as well as higher operating costs for data centers, etc.	
Container and packaging recycling	Revenues and expenditures	Costs incurred for raw materials, such as the use of environmentally friendly raw materials (certified paper, biomass plastics, etc.) and the introduction of recyclable raw materials.	
Changes in consumer behavior	Revenues	Consumers are increasingly interested in the use of natural materials, recycling of packaging materials, and CO_2 emissions, and they are increasingly purchasing products from companies that are proactive in addressing climate change (increased ethical consumption).	
Changes in Important Products/Prices	Expenditures and assets	Rising operational costs and the threat of collapse of the entire value chain.	
Food loss	Expenditures and assets	Increased procurement costs due to stricter regulations on the disposal of milk and GHG emissions, and higher equipment costs due to the introduction of cooling facilities.	
Carbon emissions targets/policies in each country	Expenditures and assets	Dairy ingredients emit large amounts of GHG in the process. The unit price of raw milk rises if it becomes regulated in each country.	
Soil degradation	Expenditures and revenues	Dairy farms are subject to tighter regulations, which may increase the cost of operating equipment and restrict business expansion, thereby affecting raw material availability and procurement costs.	○
Energy-saving policy	Expenditures and assets	Expenses for changing manufacturing processes, procuring alternative materials, and installing energy-saving equipment and highly efficient equipment increased.	
Rising sea level	Revenues, assets and expenditures	Water disasters such as floods and a sudden increase in droughts have an impact on production, such as the shutdown of plants located in coastal areas vulnerable to disasters and areas with low sea levels.	
Changes in the investor's reputation	Revenues and assets	Investors' increased interest in climate change and other environmental issues and sustainability, and inadequate countermeasures, will adversely affect PL/BS and reputation of investors.	

Risk Assessment in Infectious Diseases

Risk Item	Business impact		
Small classification	Index	Discussion (Example)	Assessment
Rising sea level	Revenue Assets and expenditures	Influence from floods, etc., that shut down the operations of plants located in coastal and other areas. Also affects the reproduction of infectious agents and changes the supply and demand of products.	◎
Increase in the average temperature	Revenue	The frequency, spread timing and area of infectious diseases may change, and demand for each product may fluctuate significantly.	
Increasing frequency of extreme weather events (heat waves, typhoons, floods, etc.)	Revenue Assets and expenditures	Frequent heavy guerrilla rains, typhoons, etc., cause major damage to inventories and facilities, resulting in an increase in facility restoration costs, etc.	
Changes in important products/prices	Expenditures and assets	Product prices fluctuate due to the risk of sharp rises in raw material prices and decreases in the amount that can be secured.	
Carbon price	Expenditures and assets	The introduction of a carbon tax will impose taxes on transportation fuel for raw materials and commodities and increase transport costs. Production costs at plants in countries with high carbon taxes also increased.	
Carbon emissions targets/policies in each country	Expenditures and assets	New technologies and equipment installation costs are incurred due to the tightening of regulations on carbon emission policies in each country.	○
Investments in low carbon technology	Expenditures and assets	Capital expenditures in the entire value chain, including raw material procurement and transportation, were incurred in order to transition to low-carbon technologies.	
Investment in temperature adjustment equipment	Expenditures and assets	Additional temperature control equipment is required for product processing and transportation, resulting in an increase in equipment costs.	
Changes in the investor's reputation	Revenue	There is growing interest in sustainability, so investors' reputation will deteriorate if insufficient measures are taken.	

Forecasts of various factors in the base year

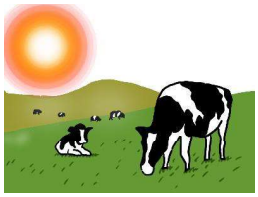
		At present	Dairy ingredients (food)		Infectious diseases (pharmaceuticals)		Source
			2030		2050		
			4°C world	2°C world	4°C world	2°C world	
Carbon price	Carbon tax	-	EU $23 per tonne China $23 per tonne Japan not yet introduced	Japan and Europe $100 per tonne China $75/ton	China $29/ton Japan not yet introduced	Japan and Europe $191 per tonne China $180 per tonne	• IEA WEO 2018
Recycling of containers and packaging	Recycled plastics Utilization rate	Not introduced	Not introduced	30%	-	-	• EU government
Change in customer behavior	Rate of decline in sales due to failure to comply with sustainability certification	-	Down 2%	Down 3%	-	-	• Private research firm
Changes in rainfall and weather patterns	Rate of increase in the frequency of floods	1 times	Japan 1.5 times China 2.1 times	No change	Japan 1.5 times China 2.1 times Indonesia 2.9 times India 5.8 times Spain 1.1 times	No change	• AQUADUCT
Increase in the average temperature	Increase ratio of cost for operating the barn	-	Up 4.02%	No increase	-	-	• USDA (U.S. government agency)
	Mosquito-borne infectious diseases Population at Risk (Asia)	Approx. 3.82 billion	-	-	Approx. 4.36 billion	Approx. 3.86 billion	• Academic literature
	Number of outbreaks of waterborne infections (diagnostics) (Asia)	Approx. 2.53 billion	-	-	Approx. 2.92 billion	Approx. 2.72 billion	• Academic literature
Rising sea level	Magnitude of sea level rise	-	-	-	0.25m	0.2m	• Ministry of the Environment and Japan Meteorological Agency Report

・ International Energy Agency: An advisory body to 29 member countries to provide reliable, affordable and clean energy to their citizens.
・ AQUEDUCT (in the Japanese language, "pipelines and pipelines"): A tool that provides free global maps and other information about the latest water risks released by the World Resources Laboratory (WRI)
・ USDA(United States Department of Agriculture): Government Offices governing U.S. agricultural policies

Conceptual diagram: 4°C scenario

While low carbon/decarbonization is not promoted (business as usual) and the physical risk increases, the possibility of the market expansion of infectious diseases is considered.

Dairy ingredients (food)



Productivity decline in dairy cows due to heat stress
Cost increase for air-conditioning and other measures

Increase in facility operation and transportation costs due to natural disasters

✓ Support for dairy farmers due to declining production of raw milk
✓ Support for countermeasures against physical risks such as water stress and natural disasters

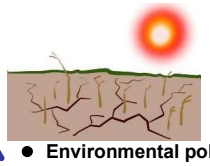
Government

Increase in facility operation and transportation costs due to natural disasters

Influence on plant operations in areas of high water stress

Infectious diseases (pharmaceuticals)

- Increased risk of mosquito-borne infectious diseases
- Diarrhea due to water contamination (enteritis, cholera, etc.)

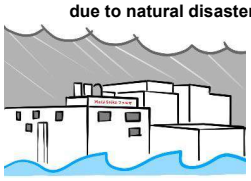


- Environmental pollution
- Effects of food shortages

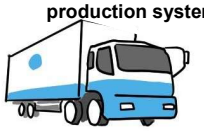
Government

☐ Collaboration with Asian countries based on Industry-Government-Academia collaboration
☐ Support for countermeasures against physical risks such as natural disasters

Possibility of plant shutdown due to natural disasters

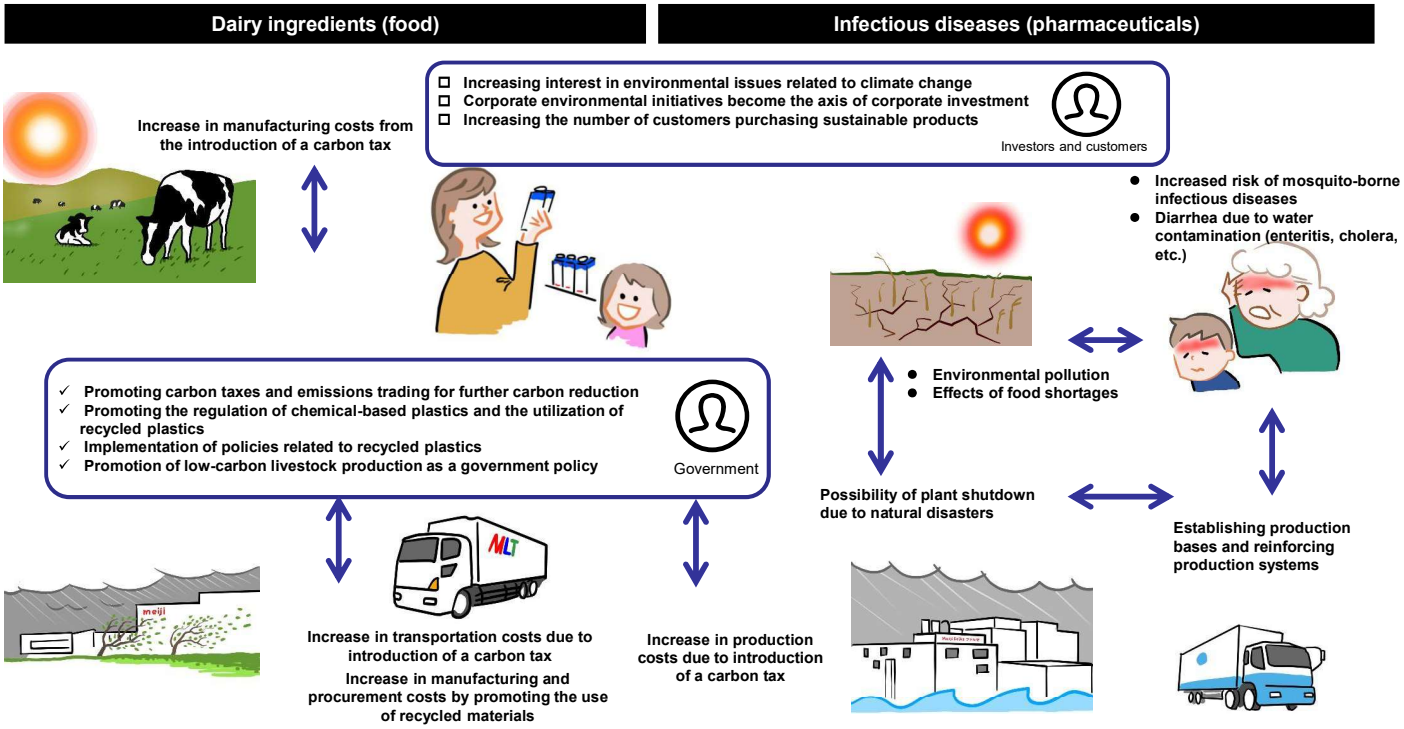


Establishing production bases and reinforcing production systems



Conceptual Diagram: 2°C scenario

Measures to reduce carbon emissions will be promoted, and investors and customers will be more interested in environmental issues.
While various cost increases may occur, there is a possibility that the customer's ethical orientation will increase.

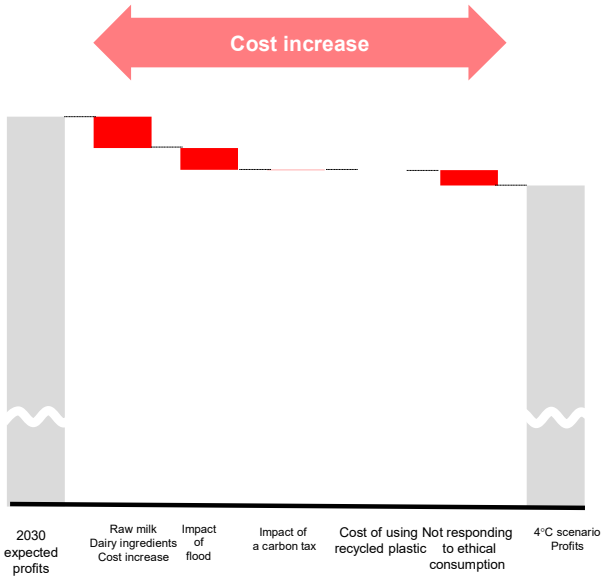


Important risk items and evaluation of business impacts on dairy ingredients

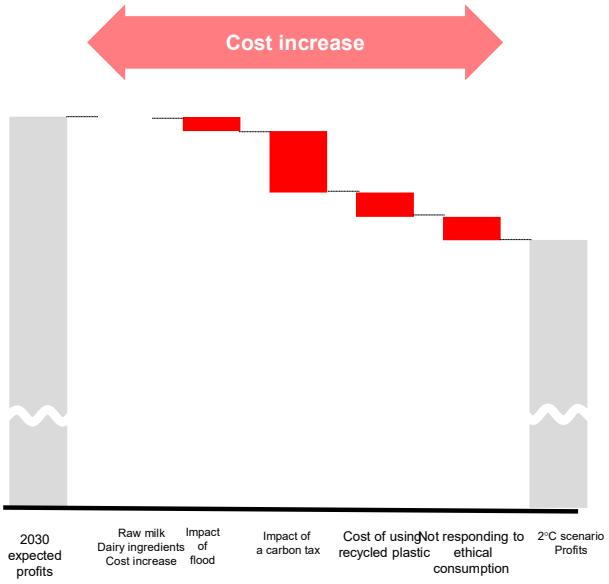
Risk item	Expected business impact		Impact value
Changes in average temperature	Nurturing cows by preventing hot weather (feeding management, cattle barn environment)	Increased cost of raw milk, dairy raw materials	4℃ : XX billion USD 2℃ : No impact
	Increase in the price of cattle feed ingredients due to a decrease in crop yield		
	Increased demand for products to prevent thirst due to temperature increase, and increased heatstroke due to temperature increase	Increased demand for products for prevention of thirst and heatstroke	-
Changes in precipitation patterns	Need to improve quality of water in manufacturing and rearing due to water quality deterioration*not in 2030	Increased cost due to water risk responses	-
	Increase in the unit price for water supply in animal-rearing areas due to drought		
Frequency of extreme weather events (typhoons, floods, etc.)	Lost opportunities due to suspension of production and logistics	Decreased opportunity because of stopped supply chain	4℃ : XX billion USD 2℃ : XX billion USD
	Restoration of damaged facilities for production and logistics due to flood		
Carbon price	Introduced a carbon tax in manufacturing sites (plants)	Increased cost due to a carbon tax	4℃ : XX billion USD(only in China) 2℃ : XX billion USD
	Introduced a carbon tax in logistics		
Recycling of packages	Introducing recycled plastics due to plastics ban	Increased cost due to replacement with recycled plastics	4℃ : No plastics ban 2℃ : XX billion USD
Changes in customer behaviors	Growing environmental consciousness (reduction of environmental burden・environmentally-friendly) due to increased frequency of extreme weather and environmental regulation (such as CO2 and plastics).	Increased ethical consumption	4℃ : XX billion USD 2℃ : XX billion USD

Profit simulation in Dairy Ingredients by Scenario

Simulation under the 4°C Scenario



Simulation under the 2°C Scenario



Outline of measures to deal with business risks and opportunities in dairy ingredients

	Existing Initiatives	Future Initiatives
Seize opportunities Expansion of ethical consumption ・ Expansion of demand for responding to temperature increases, etc.	☐ Requirements for anti-thirst and heat stroke countermeasures are increasing. In response to these needs, products for anti-thirst drinks and heat stroke countermeasures are launched ☐ Shift to environmentally conscious raw materials FSC-certified paper and recycled paper: FY2018 Result 55.3% Certified palm oil: FY2019 Plan Use approx. 10% 	☐ Examination of products that meet the possibility of expanding demand for products with minimal environmental impact ☐ Considering expansion of anti-thirst and anti-heat stroke products ☐ Aggressive use of environmentally friendly raw materials in response to heightened environmental awareness due to extreme weather and various regulations
Risk mitigation Raw material price increase ・ Plastic regulations ・ Increased water risk ・ Introduction of a carbon tax	☐ Reduction in plastic consumption due to thinning, etc. ☐ Introduce solar power facilities for renewable energy  Completion drawing (image) the solar facilities of Meiji Co., Ltd. Kyushu Plant	☐ Significant reduction in plastic consumption due to thinner-walled plastics and shift to paper, and replacement with recycled plastics. ☐ Considering the use of raw materials with minimal logistics impact ☐ Efficiency of water consumption in production and flood countermeasures ☐ Further promotion of energy conservation and shift to renewable energy ☐ Considering support for heat countermeasures to maintain milk production for dairy farmers

Infectious diseases particularly affected by temperature increases

The vaccine for Japanese encephalitis and dengue fever, and antimicrobials for diarrhea (cholera, etc.) are assumed to be affected by temperature rise.

Various infectious diseases and routes

	Routes of transmission	Vectors/ Vehicles	Infection
Direct transmission		Bite Feces	Rabies Toxoplasmosis, Ascaris
Indirect transmission	Vector-borne	Mosquito Tick Rodens Flea Snails	**Japanese encephalitis,** malaria**, dengue fever,** West Nile fever, and Rift Valley fever Tick-borne Encephalitis Hantavirus Pulmonary Syndrome Plague Schistosomiasis japonica
	Water/ Soil-borne	Water Soil contamination	**Diarrhea (cholera, etc.)** Anthrax
	Food (animal derived) - borne	Meat Fish meat	Enterohemorragic E. coli O157 infection, salmonellosis Anisakiasis

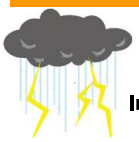
Infectious Diseases assumed to be impacted by global warming

Source: What is known about global warming and infectious diseases today? (Ministry of the Environment)

Relationship with Global Warming in Infectious Diseases

It has been suggested that the risk of infectious diseases is generally increased by global warming.

Climate change affects rainfall volumes and patterns



Increase rainfall volumes during a specific period

Increase **the number of mosquitos and the number of natural hosts**

Climate change raises temperature

Raises the highest temperatures in summer

Raises the lowest temperature in winter

Mosquitoes that had been dead during the winter **live over the winter**

Expansion of living areas where the number of mosquitos and the number of natural hosts increase

Changes in human clothing and living environments
(Increase in short-sleeve and field activities, etc.)

Agents intrude into the body
Number of agents and opportunities that penetrate the human body

Existence of vector And natural host
Vector (mosquitoes, etc.)
Natural hosts (mice, livestock, etc.)

Social environment where agents can easily intrude
Building patterns, economic activities, cultural lifestyles, and other environments that facilitate contact with vectors and natural hosts

Human health
Nutritional and hygiene conditions that are easily affected

Climate change has also been reported to increase diarrhea by 3%, malaria by 5%, and malnutrition by 10%, assuming that the risk of infections other than Japanese encephalitis, dengue fever, and diarrhea has also increased.

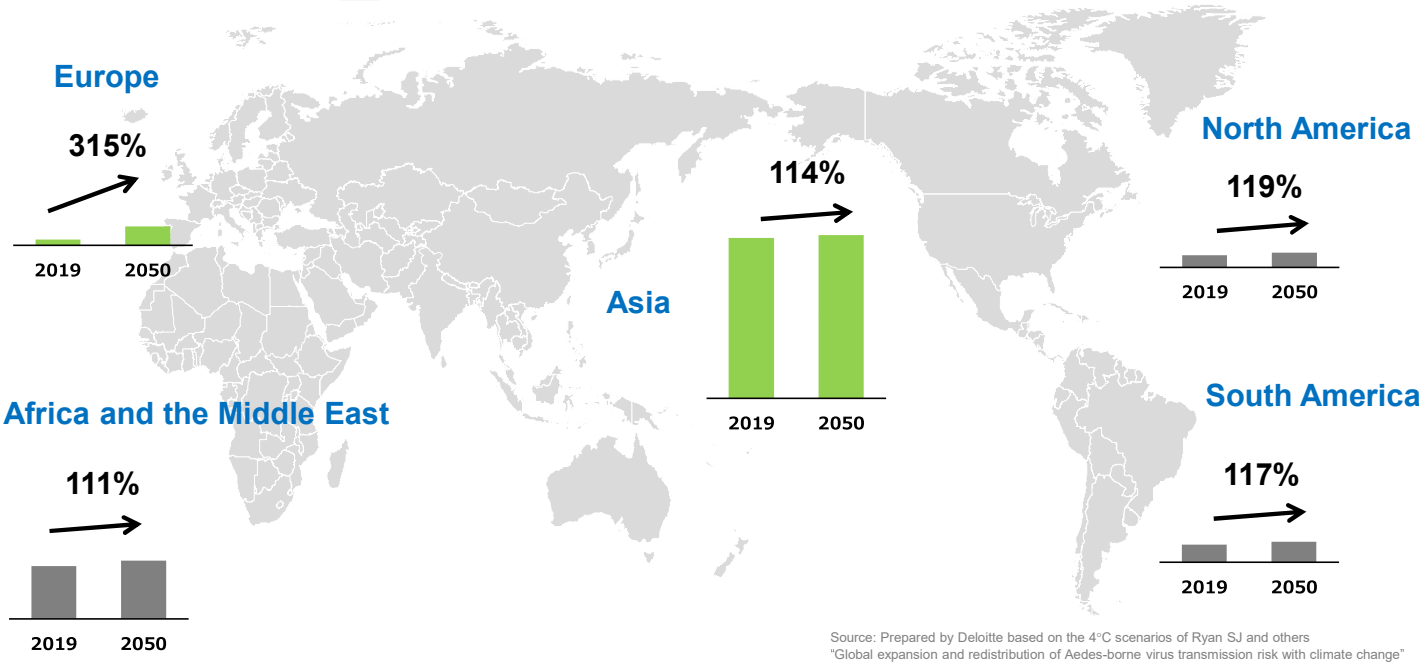
Source: What is known about global warming and infectious diseases today? (Ministry of the Environment)

Population growth rate at risk due to increased temperature of mosquito-borne infectious diseases (4°C scenario)

The population at risk for mosquito-borne infections is predominantly in Asia.

※ Market size: Population at risk for mosquito-borne infectious diseases (100 millions of people)

Pharma sales bases (subsidiaries) No pharma sales base (subsidiary)



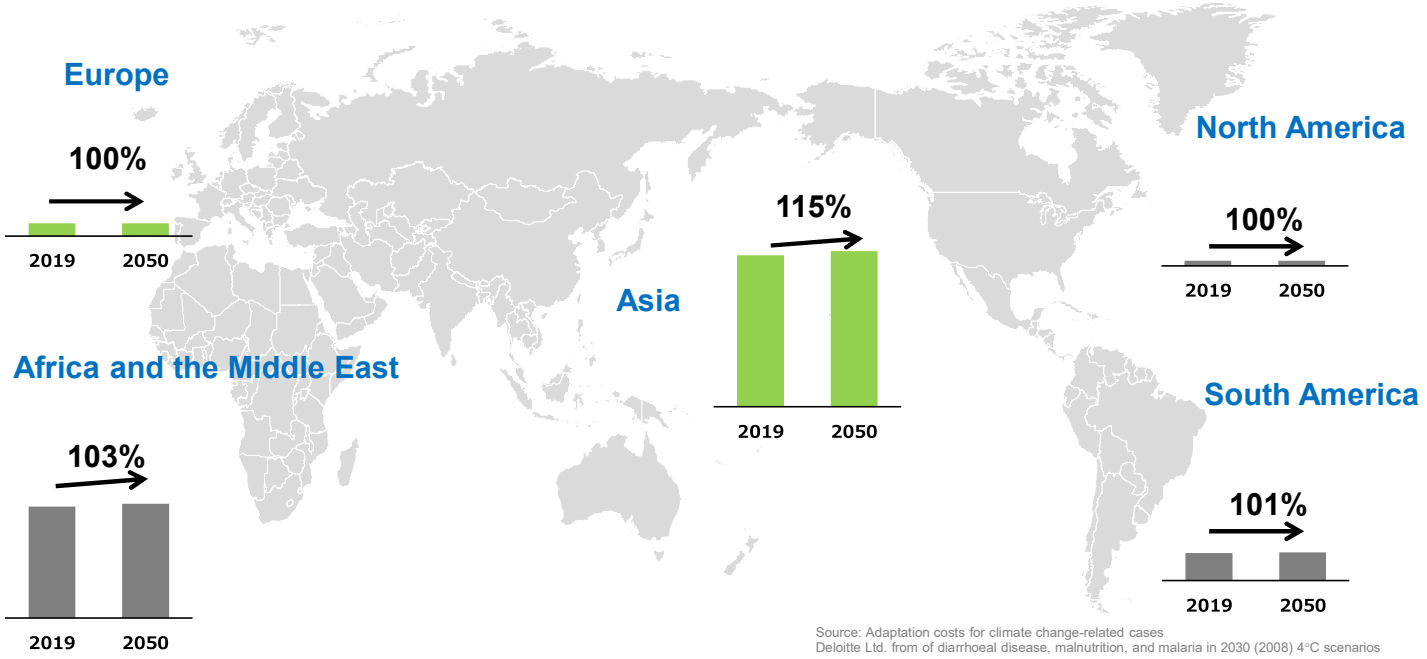
Source: Prepared by Deloitte based on the 4°C scenarios of Ryan SJ and others
"Global expansion and redistribution of Aedes-borne virus transmission risk with climate change"

Increasing rate due to number of diarrhea and temperature increases (4°C scenario)

The number and increase rate of diarrhea are high in Asia and Africa.

※ Market size: Number of diarrhea occurring (100 millions of incidents)

Pharma sales bases (subsidiaries) No Pharma sales bases (subsidiaries)



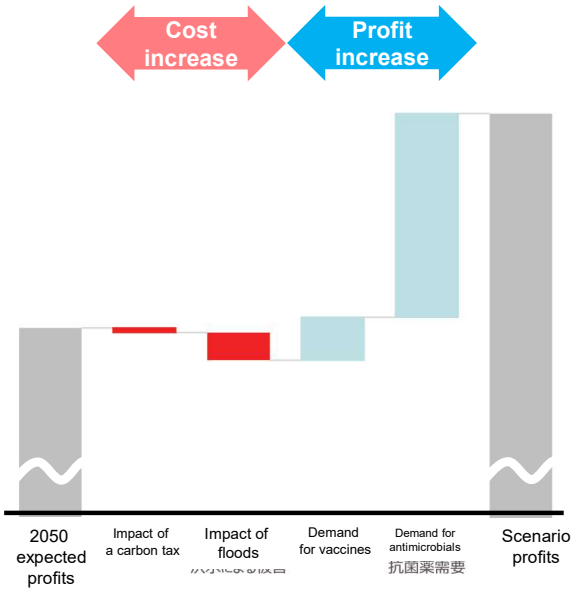
Source: Adaptation costs for climate change-related cases
Deloitte Ltd. from of diarrhoeal disease, malnutrition, and malaria in 2030 (2008) 4°C scenarios

Important risk items and evaluation of business impacts on Infectious Diseases

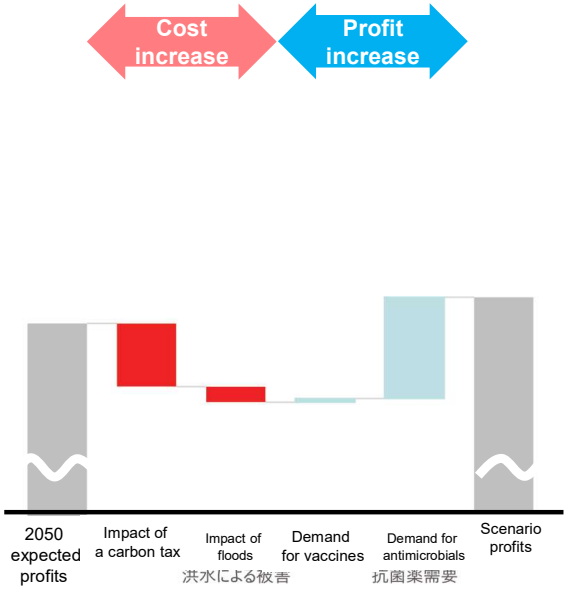
Risk item	Expected business impact		Impact value
Changes in average temperature	Increased risk for Mosquito-borne infection	Increased demand for vaccine and antimicrobials	4℃：XX billion USD 2℃：XX billion USD
	Increased cases of diarrhea		
Frequency of extreme weather events (typhoons, floods, etc.)	Lost opportunities due to suspension of production and logistics	Decreased opportunity because of stopped supply chain	4℃：XX billion USD 2℃：XX billion USD
	Restoration of damaged facilities for production and logistics due to flood		
Carbon price	Introduced a carbon tax in manufacturing bases (plants)	Increased cost due to a carbon tax	4℃：XX billion USD (only in China) 2℃：XX billion USD
	Introduced a carbon tax in logistics		
Rising sea level	Increased flood damage due to the sea level rise	Increase cost due to cancelled manufacturing	4℃：Assume no damage due to rising sea level 2℃：Assume no damage due to rising sea level

Profit simulation in Infectious diseases by Scenario

Simulation under the 4°C Scenario



Simulation under the 2°C Scenario



Outline of Business Risks and Opportunities for Infectious Diseases

	Existing Initiatives	Future Initiatives
Seize opportunities Growing demand for infectious disease drugs and vaccines	☐ Increase in sales volume of products due to the expansion of infectious diseases ☐ Upgrading of production bases in Asian countries ☐ Reinforcement of product lineup 	☐ Strengthen business development in Asian countries with subsidiaries as bases. ☐ Contributing to the Asian market through industry-government-academia-medical collaboration 
Risk mitigation Increased water risk ・ Introduction of a carbon tax	☐ Strengthening of stable procurement system ☐ Building a Production System to Ensure Stable Supply ☐ Periodic maintenance of equipment ☐ Energy conservation promotion ☐ Ensuring the safety of plant employees ☐ Proper management of equipment using fluorocarbons 	☐ Implement measures to increase the efficiency of water consumption in production and to prevent plant shutdowns due to natural disasters ☐ Promotion of energy conservation and shift to renewable energy ☐ Reinforcement of management for chemical resistance in factory wastewater ☐ Appropriate management of plant waste and total material input ☐ Reduction of plastic consumption by considering use of thinner-walled and biodegradable plastics

Other Sector

- ✓ **Practice Case①：KYOCERA Corporation (Electronic Equipment)**
- ✓ **Practice Case②：YASKAWA Electric Corporation (Electronic Equipment)**
- ✓ **Practice Case③：ASKUL Corporation(Retailing)**
- ✓ **Practice Case④：Seven & i Holdings Co., Ltd. (Retailing)**
- ✓ **Practice Case⑤：Lion Corporation (Consumer Products)**

Step 2 3 4 5 Scenario 4℃ 2℃

Assessing the impact of climate change on the energy sector

Analyzed mainly in the energy field of the Kyocera Group

Item		Major Impact	Assessment
Technological Development	Response to decarbonized society	Developments in VPP※ technologies (e.g., power generation forecasting technologies, power generation stabilization technologies), power generation and storage efficiencies, high-volume storage batteries production technologies, environmentally friendly technologies to introduce renewable energy (e.g., offshore and water-based photovoltaics), and alternative energies (e.g., hydrogen technologies) can have a significant impact on decarbonized society and sales.	Large
Transition Risk (Policy Risk)	Carbon emissions targets for each country /Energy policy	National targets/energy policies have a major impact on societal decarbonisation and sales.	Large
	Carbon tax	When a carbon tax is introduced, manufacturing costs increase.	Medium
	Recycling regulations	When recycling regulations are introduced, businesses may bear the recycling fee, which affects sales.	Medium
Physical Risk (Natural Disaster Risk)	Increasing severity of extreme weather conditions	Natural disasters cause costs such as shutdowns, production declines, and equipment restoration. Costs for natural disaster countermeasures and insurance premiums increase.	Medium

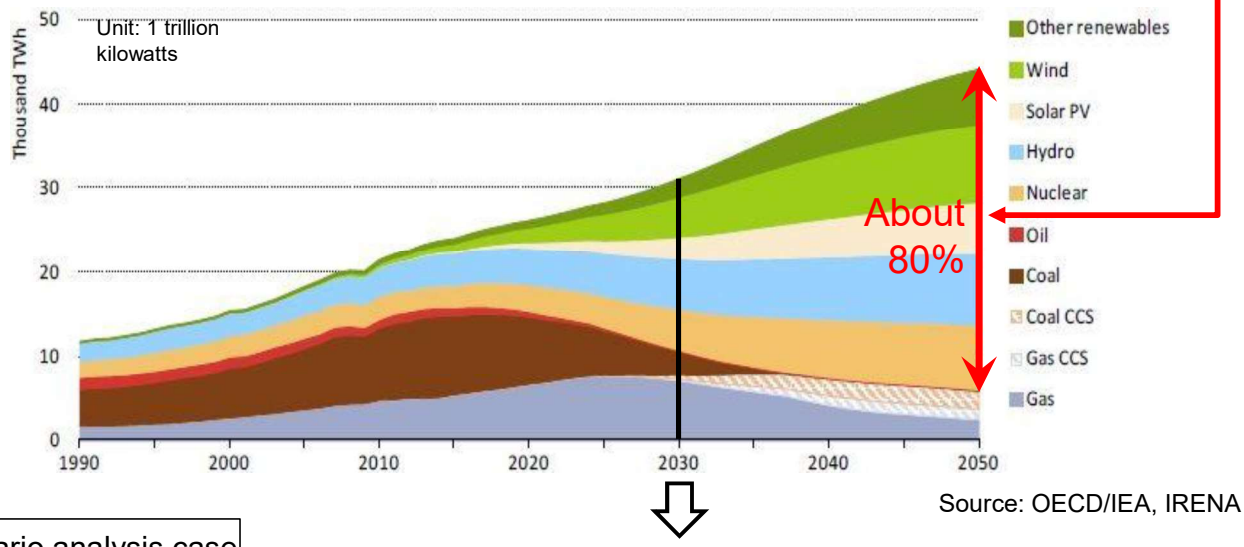
※ VPP (Virtual Power Plant): Technologies that can be used to balance power supply and demand by combining distributed energy resources possessed by factories, households, etc., and then controlling these resources remotely and in an integrated fashion.
Since it functions like a single power plant, it is called a “virtual power plant.”

Assumptions for Scenario Analysis

Step 2 3 4 5 Scenario 4℃ 2℃

To keep temperature increases below 2° C

Temperature increases can be limited to less than 2℃ by increasing the proportion of non-fossil fuels in the world



Source: OECD/IEA, IRENA

Scenario analysis case

2° C Scenario: The Future of Decarbonized society
4° C Scenario: A Current Extended Future

Scenario analysis is conducted with 2030 as the target year.

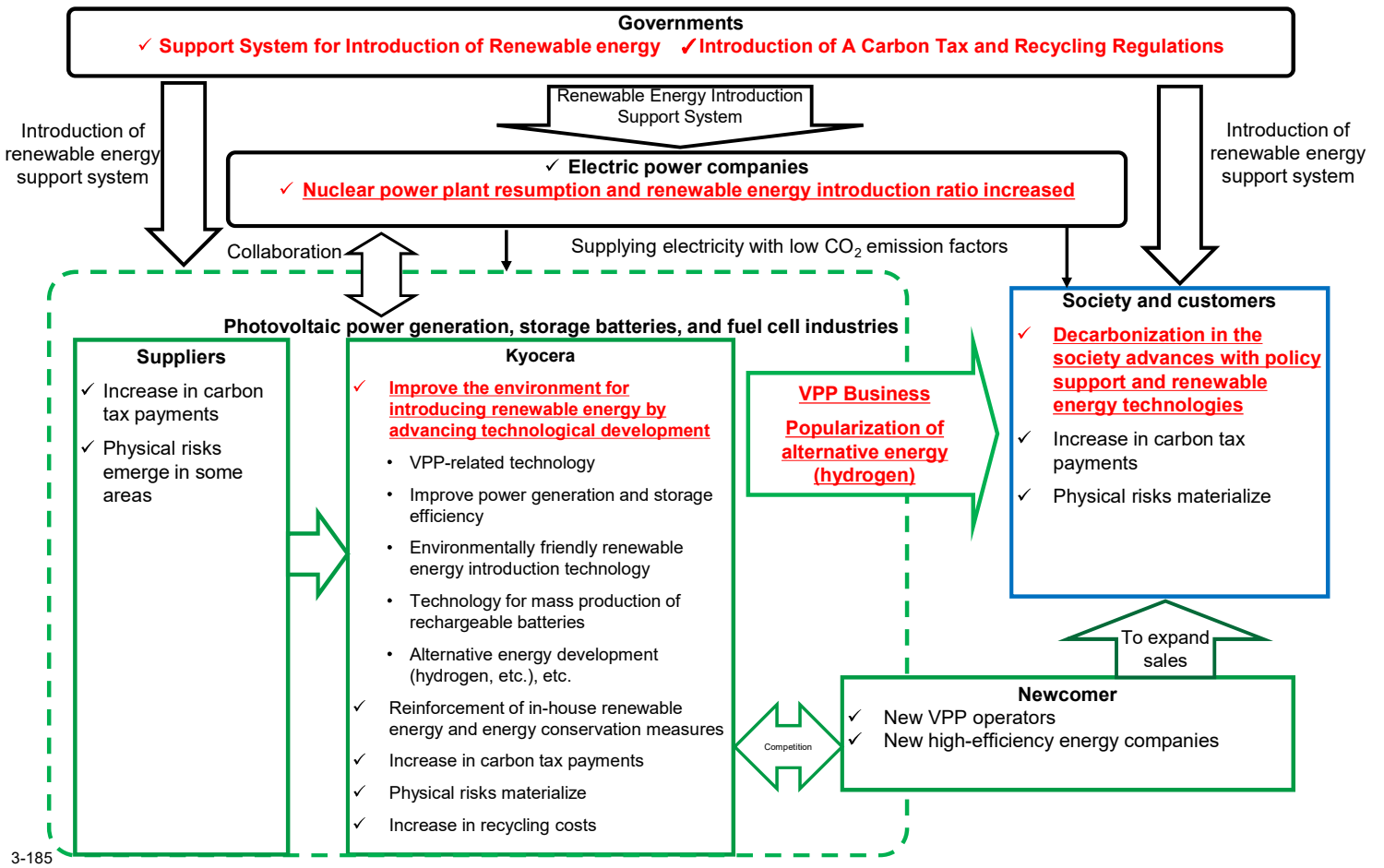
Assumptions for Scenario Analysis

Step 2 3 4 5 Scenario 4℃ 2℃

			At present	2030		Source
				4° C world	2° C world	
Economic Efficiency	Renewable energy, etc. Subsidies Policy	FIT's purchase price (yen/kWh)	Solar: 14 (bidding system) Wind: 19-36 (2019)	(Assumed to have difficulty in become self-reliant from FIT at 4° C)	Solar: 7 (2025) Wind: 8-9	• Agency for Natural Resources and Energy
		Unit price of renewable energy generation (yen/kWh)	Solar: 21.8 Land wind: 21.5 (2017)	Solar: 13.5 Land wind: 20.6	Solar: 12.4 Land wind: 20.6	• IEA WEO2017 (450 scenarios)
Natural Disaster	Increasing severity in extreme weather conditions	Frequency of floods	1 times	3 times	1.7 times	• Technical Review Committee on Flood Control Plans Based on Climate Change "Recommendations on Water Control Plans Based on Climate Change"
Other		Battery cost (USD/kWh)	280 (2015)	(business as usual)	150 (0.54 times)	• Estimated from IEA ETP 2017 • 2014 Advanced Battery Society of Europe Target Value
		Demand for solar power Amount of electricity (TWh)	190 (2014)	1,402 (7.38 times)	1,757 (9.25 times)	• Estimated from IEA ETP 2017 • 2014 Advanced Battery Society of Europe Target Value
		Demand for batteries Reserves of power (GW)	159 (2015) EV application 98.8%	219 (1.38 times)	172 (1.08 times) EV application: 99.8%	• Estimated from IEA ETP 2017
		Demand response capacity (GW)	11 (2015)	25 (2.3 times)	39 (3.5 times)	• Estimated from IEA ETP 2017

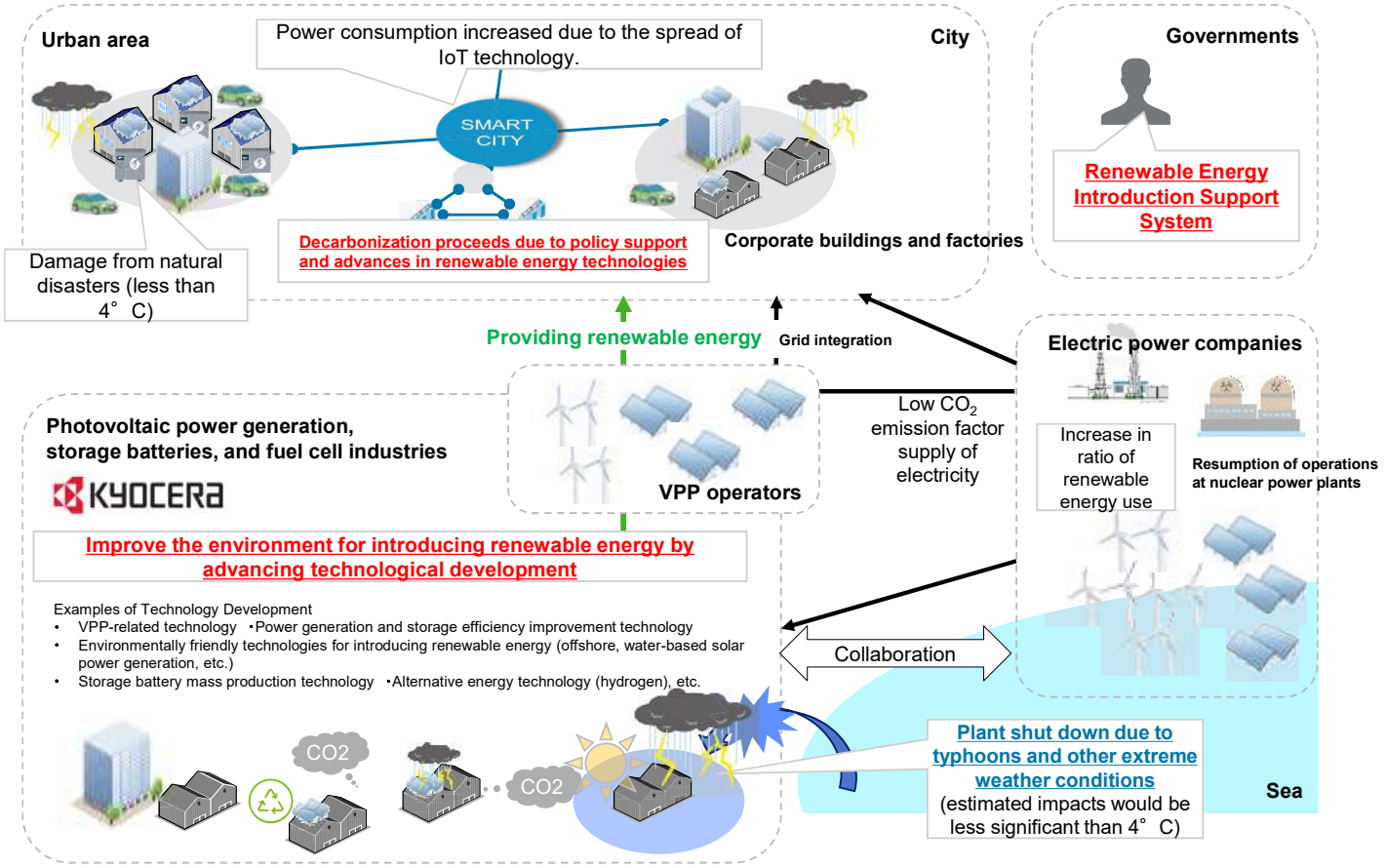
The 2° C World: Shift toward decarbonized society

Step 2 3 4 5 Scenario 4℃ 2℃



The 2° C World: Shift toward decarbonized society

Step 2 **3** 4 5 Scenario 4℃ **2℃**



The 4° C World: Current Extension

Step 2 **3** 4 5 Scenario **4℃** 2℃

Governments
✓ Policies will remain unchanged
✓ A carbon tax will not be introduced

Electric power companies
✓ Generation continues using fossil fuels and CO_2 emission factor of electricity does not decrease
✓ Energy prices of fossil fuels fluctuate depending on social conditions in oil-producing countries.

Supplying electricity with higher CO_2 emission factors

Photovoltaic power generation, storage batteries, and fuel cell industries

Suppliers
✓ Increase in costs for responding to changes in energy prices
✓ Physical risks materialize

Kyocera
✓ Technology development for the introduction of renewable energy has been delayed, and the spread of renewable energy in the market has not progressed
- VPP-related technology
- Technologies for Improving the Efficiency of Power Generation and Storage
- Environmentally friendly renewable energy introduction technology
- Technology for mass production of rechargeable batteries
- Alternative energy technologies, etc.

✓ Reinforcement of in-house renewable energy and energy conservation measures
✓ Physical risks materialize
✓ Increase in costs for responding to changes in energy prices

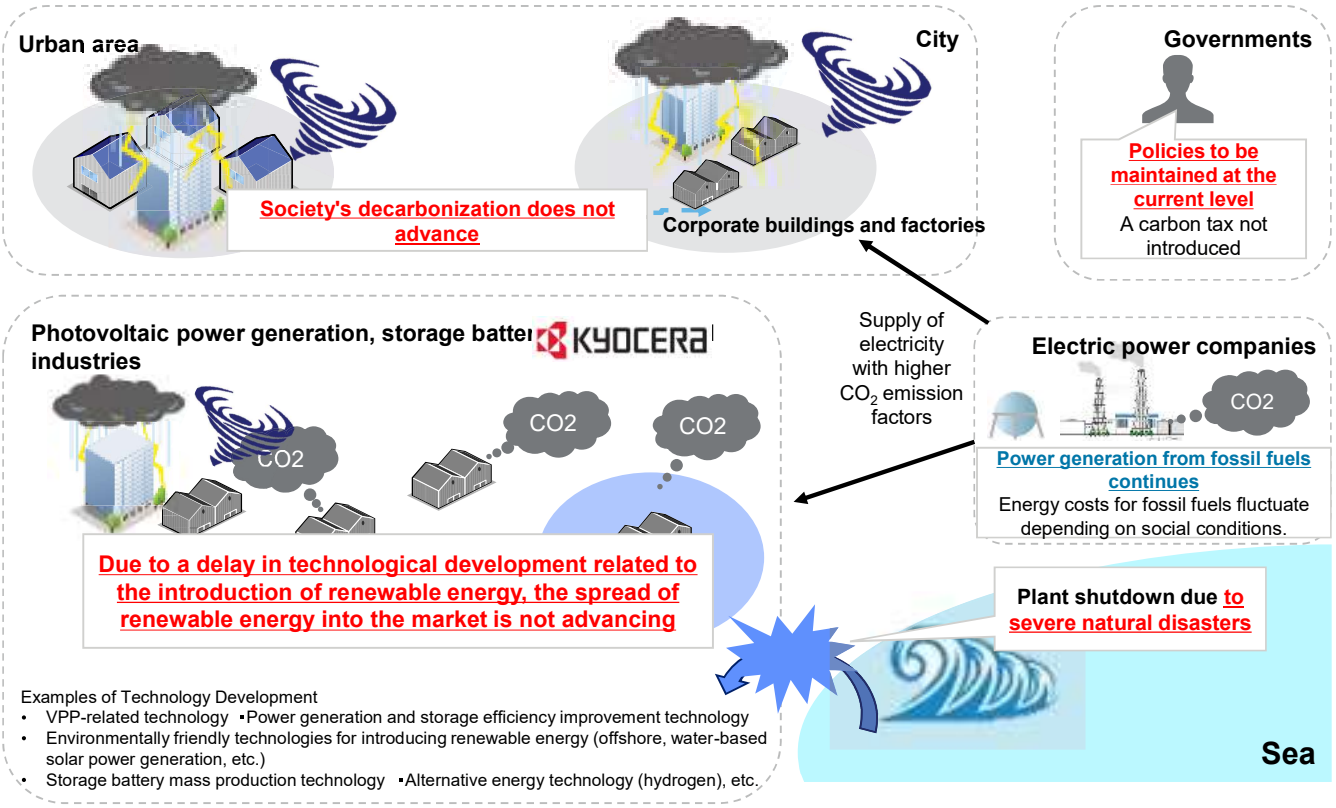
No progress in penetration of renewable energy

Society and customers
✓ Decarbonization fails to evolve due to weak policy support and fewer renewable energy technology options
✓ Physical risks materialize
✓ Increase in costs for responding to changes in energy prices

In many companies, most businesses are stagnant and they would be in crisis. Don't make it the 4° C world

The 4° C World: Current Extension

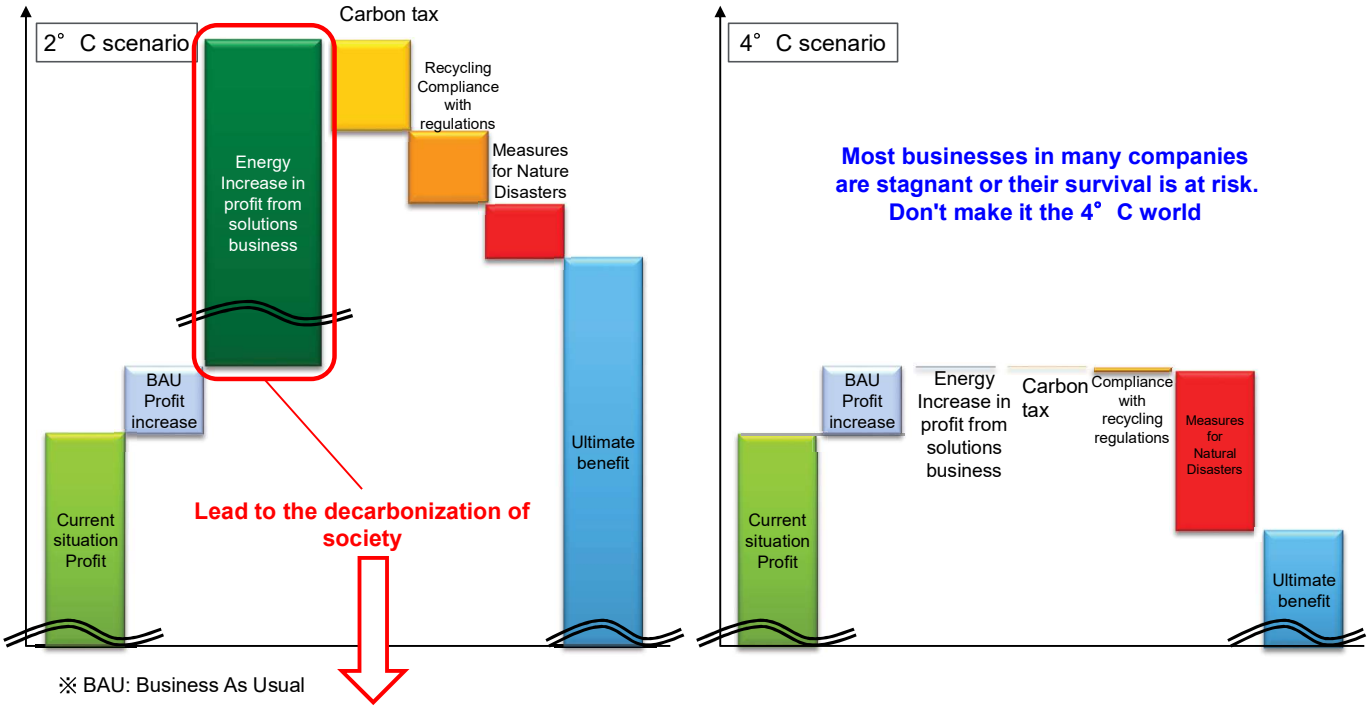
Step 2 3 4 5 Scenario 4℃ 2℃



Most businesses in many companies are stagnant or their survival is at risk.
Don't make it the 4° C world

Evaluate business impacts

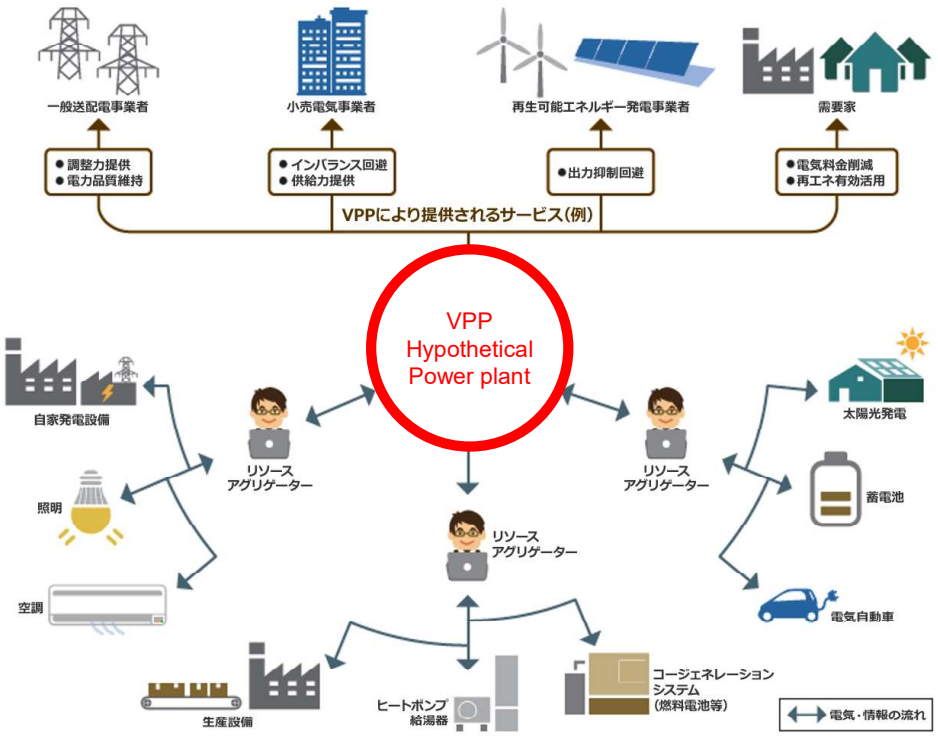
Step 2 3 4 5 Scenario 4℃ 2℃



1. "Technical issues" related to the introduction of renewable energy
2. Economic challenges for renewable energy introduction
Attempt to solve these problems

Countermeasure 1: Solving Technical Challenges

Step 2 3 4 **5** Scenario **4℃** **2℃**



Technical Challenges for VPP

- Power generation forecasting technology
- Power stabilization technology to connect to the power system
- Capacity improvement of storage batteries to achieve power stabilization, etc.

Rapid diffusion of distributed resources

Source: Ministry of Economy, Trade and Industries Agency for Natural Resources and Energy

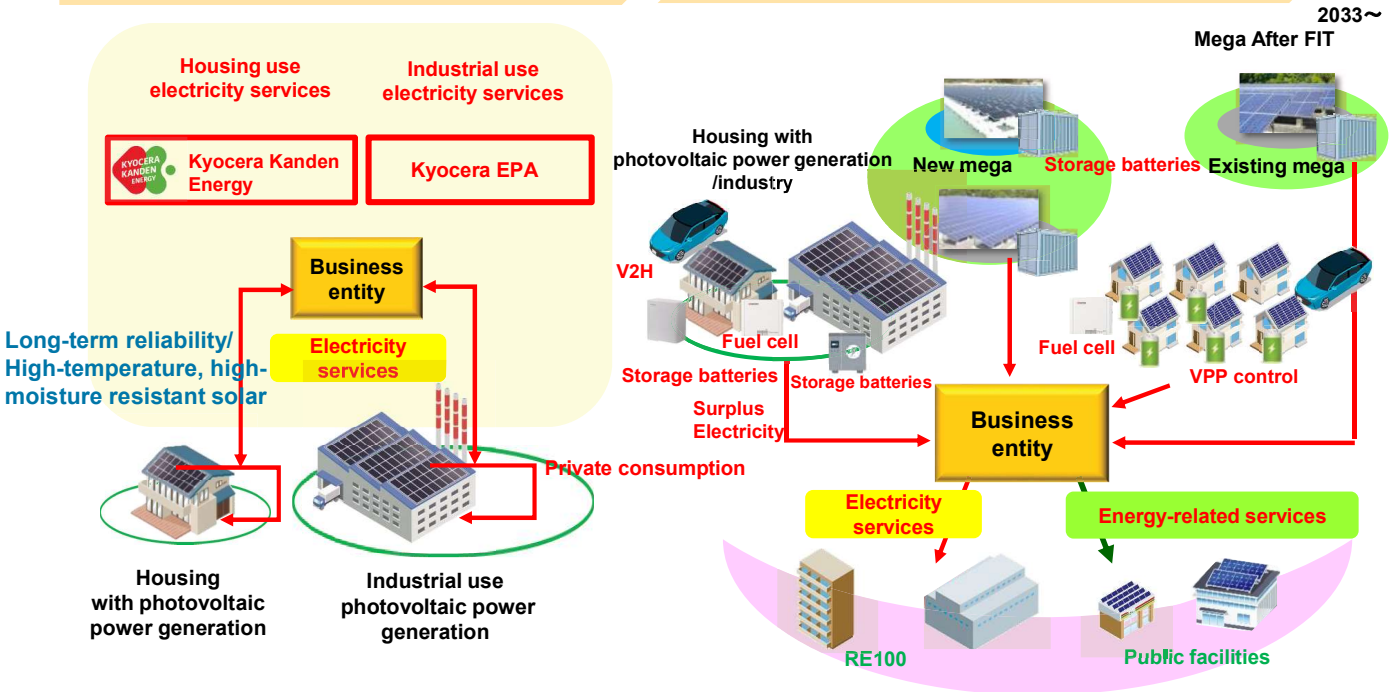
Solve technical issues related to VPP and increase the rate of renewable energy use

Countermeasure 2: Solving Economic Issues and Future Energy Utilization

Step 2 3 4 **5** Scenario **4℃** **2℃**

Power supply by photovoltaic power generation on the roof (Private consumption)

Optimization of intra-regional energy (local production for local consumption)

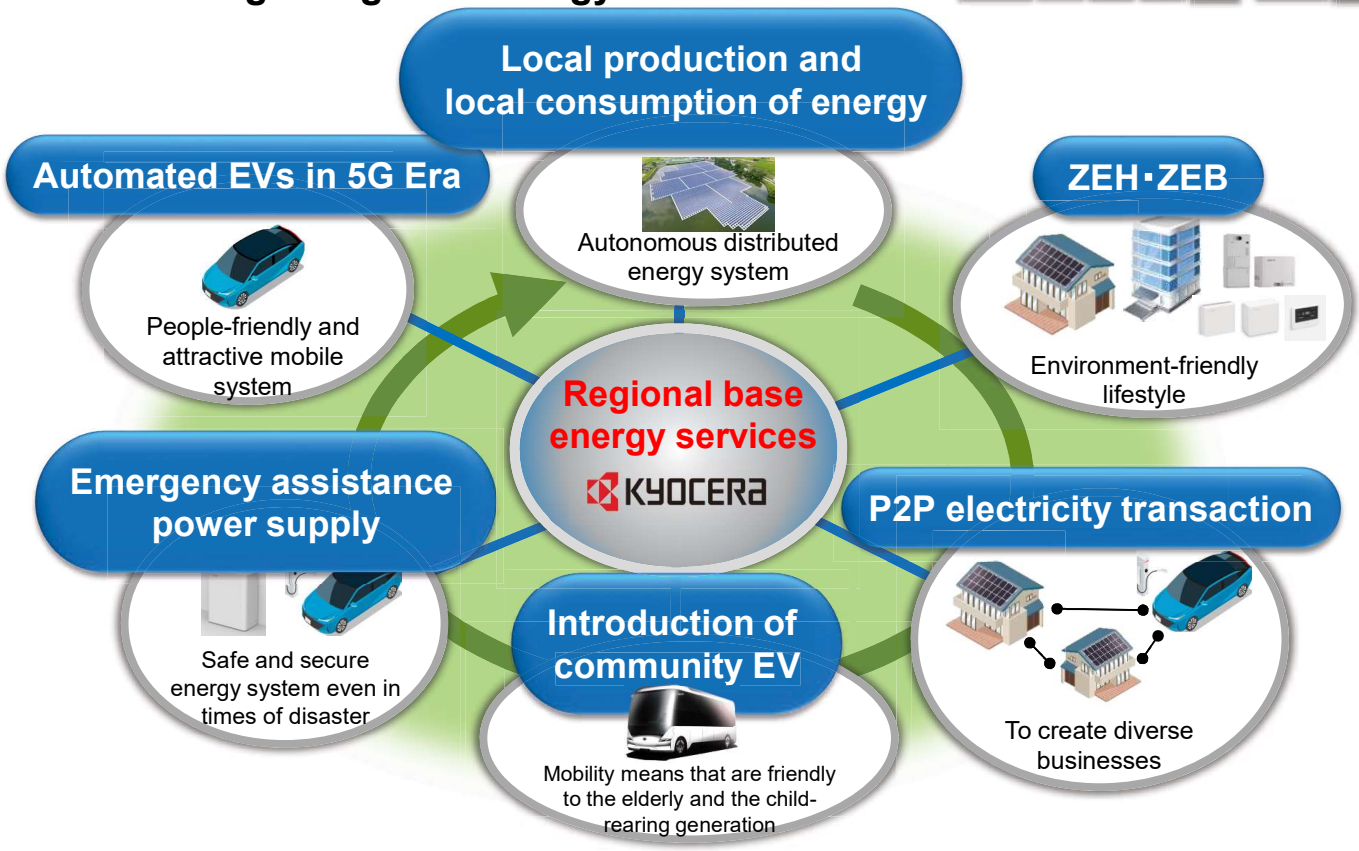


Launched a service that enables the introduction of photovoltaic power generation without initial investment

Promote regional energy optimization by resolving technological and economic issues

Future: Building a Regional Energy Service Base

Step 2 3 4 **5** Scenario **4℃** **2℃**



Build regional energy service infrastructure by linking many services

Other Sector

- ✓ Practice Case①：KYOCERA Corporation (Electronic Equipment)
- ✓ **Practice Case②：YASKAWA Electric Corporation (Electronic Equipment)**
- ✓ Practice Case③：ASKUL Corporation(Retailing)
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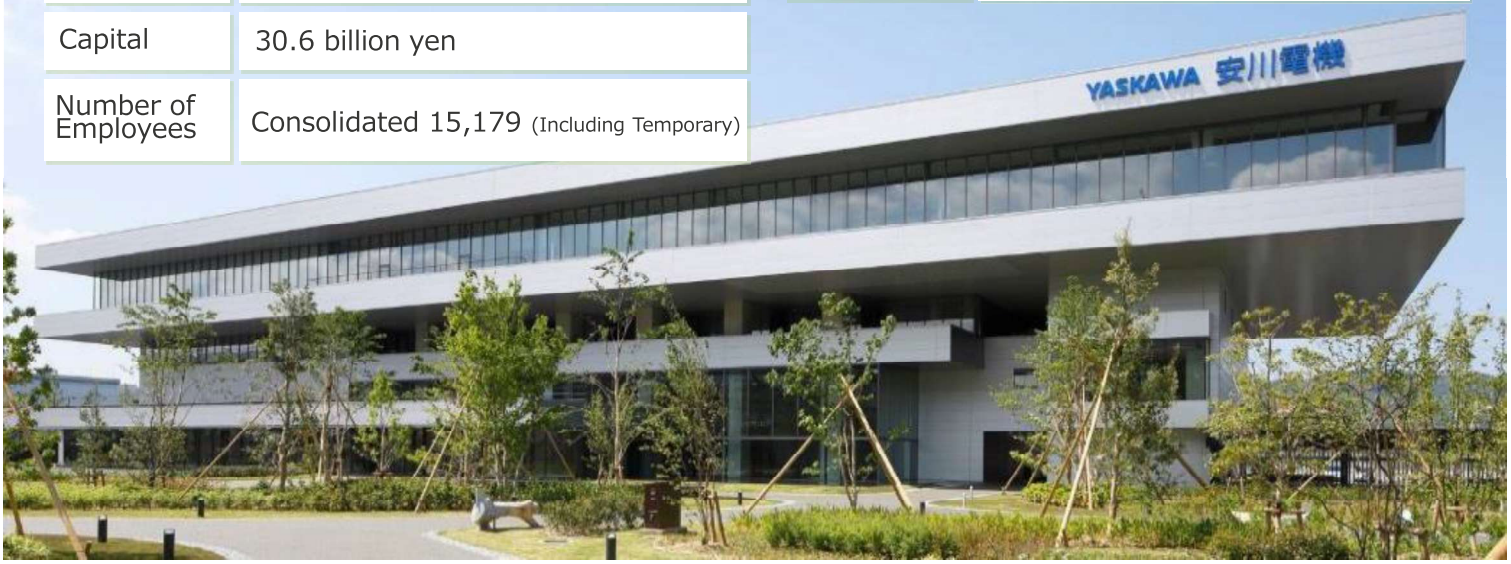
YASKAWA Electric: Profile (as of February 29, 2020)

*Consolidated fiscal year from March 1, 2019 to February 29, 2020

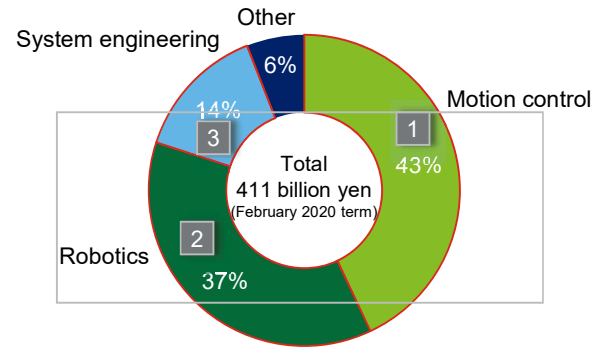
Corporate Name	YASKAWA Electric Corporation	Consolidated Revenue	411.0 billion yen
Founded	July 16, 1915	Main Business	・Motion Control (AC servos, controllers and AC drives) ・Robotics ・System Engineering
Head Office Location	2-1 KurosakiShiroishi, Yahatanishi-ku, Kitakyushu Fukuoka JAPAN		
Capital	30.6 billion yen		
Number of Employees	Consolidated 15,179 (Including Temporary)		



[Covered business]

We targeted the “Motion control”, “Robotics”, and “System engineering” businesses, and narrowed our focus to significant products in these areas to conduct our analysis

Business portfolio



Business area	Products
1 Motion control	AC servo motors, AC spindle motors for machine tools, linear motors, various motor control equipment, machine controllers, vision systems, general-purpose inverters, power regenerative converters, matrix converters
2 Robotics	Arc welding robots, spot welding robots, painting robots, handling robots, sealing/cutting robots, deburring/polishing robots, clean/vacuum handling robots used with semiconductor/LCD manufacturing equipment, robot peripheral equipment, robot-applied FA systems, robots for biomedical applications
3 System engineering	Electrical systems for steel plants, electrical systems for water supply and sewage, electrical systems for various industries, high-voltage inverters, high-voltage matrix converters, industrial motors/generators, wind power converters/motors, small hydroelectric power generators, electric power distribution equipment, wind power generation systems, solar power generation systems, systems for ships and watercraft, energy-related systems

Risks and significant products in each value chain

: Significant products ■ : Main risks

R&D	Procuring raw materials	Processing/manufacturing	Shipping/ product sales	Product use/disposal
…	• Factory automation devices (industrial robots, AC servos) • Industrial inverters • Products related to renewable energy generation equipment	• Factory automation devices (industrial robots, AC servos) • Industrial inverters • Products related to renewable energy generation equipment	…	• Factory automation equipment (industrial robots, AC servos) • Industrial inverters • Products related to renewable energy generation equipment
	■ Changes in prices for significant commodities/products ■ Carbon pricing ■ Changes in reputation with investors ■ Changes in rainfall/weather patterns ■ Extreme weather conditions, etc.	■ Changes in prices for significant commodities/products ■ Various countries’ carbon emission targets/policies ■ Spread of low-carbon technologies ■ Changes in rainfall/weather patterns ■ Extreme weather conditions, etc.		■ Changes in prices for significant commodities/products ■ Recycling regulations ■ Extreme weather conditions, etc.

We evaluated high-impact risks and determined significant products for each value chain

 Source: YASKAWA Electric website, summary of financial statements (May 2020 term)

[Risk significance assessment (1/2)]

Step 2 3 4 5 Scenario 4°C 2°C YASKAWA

We investigated risks/opportunities ranging from procuring raw materials to product use

Risks/opportunities related to transition risks

Item		Business impact		
Subcategory	Parameter	Study: risks	Study: opportunities	Rating
A Carbon pricing	Expenditures, assets	➢ The P/L is impacted by an **increased cost of production at factories** due to taxes imposed on fuel procurement costs with **the introduction of carbon taxes by the governments of various countries**	➢ N/A	High
B Various countries' carbon emission targets/policies	Revenue, expenditures	➢ **With the introduction of emissions trading and stricter regulations on energy conservation**, conversion to renewable energy will be required, and the corresponding costs for **YASKAWA facilities/green power purchasing will increase**	➢ P/L is impacted by a **decrease in costs such as green power purchasing** due to an **increased ratio of renewable energy in commercial electricity**	High
C Various countries' restrictions on exports	Revenue, expenditures	➢ P/L is impacted when **the global shift to electrification, EVs, and hybrids** leads to a **shortage of rare earths (neodymium and dysprosium) and copper for magnets**, **affecting production when prices for these materials soar and they become difficult to obtain** due to restrictions on exports by producing countries	➢ N/A	Low
D Recycling regulations	Revenue, expenditures	➢ P/L is impacted when expenditures increase due to **increased costs from the adoption of alternative materials** caused by **regulations on plastic**	➢ N/A	Low
E Changes in prices for significant commodities/products	Revenue, expenditures	➢ There is a risk that **energy prices will rise** due to changes in the supply-demand balance as a result of the **introduction of carbon taxes and a decreased supply of fossil fuels due to global warming**. As a result, P/L may be impacted by increased procurement costs ➢ P/L is impacted **when the global shift to EVs and hybrid automobiles leads to a shortage of rare earths (neodymium and dysprosium) and copper for magnets, affecting production when prices for neodymium magnets/copper soar and these materials become difficult to obtain** ➢ P/L is impacted **when the oil and gas market shrinks**, and the **U.S. inverter business aimed at the same market shrinks**, as well (significance: low)	➢ **Demand for factory automation equipment and industrial inverters increases** due to the growing need for energy-saving measures. As a result, **there are expanding opportunities for solution businesses for improving productivity / energy efficiency of corporate plants/facilities**, impacting P/L ➢ **Demand for solar, wind, hydro, geothermal, and biomass power generation facilities increases due to FIT policy incentives, etc**. As a result, business opportunities for related control equipment expand, impacting P/L ➢ As **the shift to EV automobiles** continues, **demand for EV motors and drive units increase, and business opportunities for EV-related electrical products expand**, impacting P/L (significance: low) ➢ **Business opportunities for electrical ship products expand** due to increased **demand for environmentally friendly marine transportation** and **increased demand for EV and hybrid ships**, and P/L is impacted (significance: low)	High
F Spread of low-carbon technologies	Expenditures	➢ **Competition intensifies for the energy-saving performance of products** due to the growing need for energy-saving measures. As a result, there is **an increased burden of investment costs toward R&D, etc.**, and P/L and B/S are impacted	➢ N/A	Med.
G Changes in investor/customer behavior	Expenditures, assets	➢ Increased investor interest leads to **preference for companies that have made progress with environmental initiatives such as RE100**, which in turn leads to **additional initiative costs** from the need to implement low-carbon manufacturing processes. As a result, P/L and B/S are impacted ➢ **Increased customer environmental awareness** leads to demands for environmental considerations in information disclosure and procurement, and a **delayed response to these demands will result in lost business opportunities** and impact P/L	➢ Making use of green bonds has the potential to **reduce risk through diversified investment**, impacting B/S ➢ **Expanding YASKAWA's environmental contribution business** will raise the company's reputation among investors and **increase its corporate value through increased stock prices**	Low

[Risk significance assessment (2/2)]

Step 2 3 4 5 Scenario 4°C 2°C YASKAWA

We investigated risks/opportunities ranging from procuring raw materials to product use

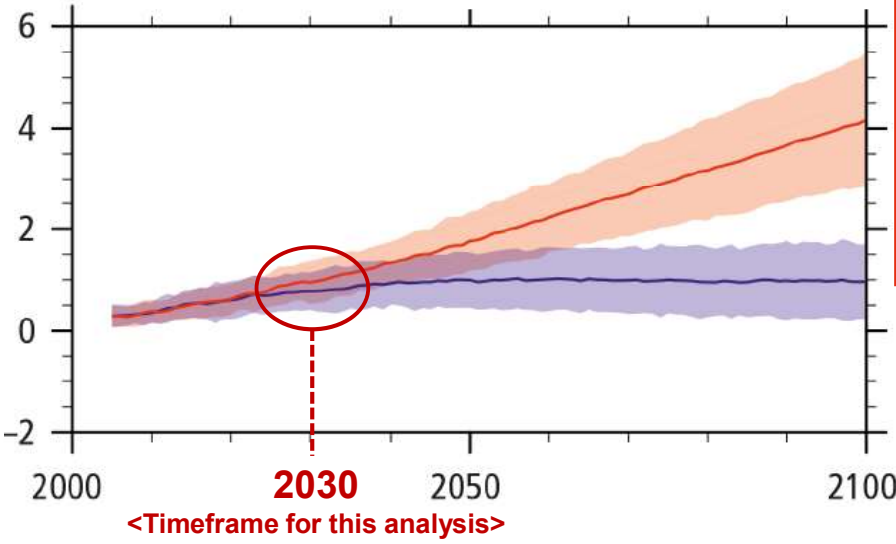
Risks/opportunities related to physical risks

Item		Business impact		
Subcategory	Parameter	Study (example): risks	Study (example): opportunities	Rating
H Changes in rainfall/weather patterns	Revenue, expenditures, assets	➢ **An increase in lightning strikes** creates a risk of power outages and an increased possibility of shutdowns for plant equipment. As a result, there **are increased costs for additional investments toward facility restoration and insurance premiums**, impacting P/L and B/S	➢ The need for a stable food supply increases demand for food product plants, impacting P/L	Low
I Increased average temperatures	Revenue, expenditures, assets	➢ There are increased energy costs due to increased use of energy for air condition at the company's plants, impacting P/L	➢ Inverter sales increase due to rising demand for inverter air conditioning equipment, impacting P/L	Med.
J Increase in infectious diseases	Revenue	➢ N/A	➢ Increased pandemics result in increased demand for reducing manpower at production sites, and automation and robotization business expands, impacting P/L	Low
K Elevated sea levels	Expenditures, assets	➢ An **elevated sea level** makes it necessary to **relocate production sites where the risk of flooding exceeds acceptable levels**, impacting P/L and B/S	➢ N/A	Low
L Water management (droughts)	Expenditures, assets	➢ **During droughts and similar events, there is a risk of plant shutdowns, and measures toward water recycling and reuse are required**, impacting P/L and B/S	➢ N/A	Low
M Extreme weather conditions	Revenue, expenditures, assets	➢ There is a risk of **shutdowns / reduced production / additional investments toward facility restoration** due to damage to employees/plants from **typhoons/tornados/flooding**. Furthermore, there are **increased costs for insurance premiums**, etc., toward assets in high-risk areas, impacting P/L and B/S	➢ N/A	High

[Step 3: Scenario group definition]

For climate change, which has a high degree of uncertainty, we studied two scenarios for a 2030 society

[Projected average global surface temperature change]
(compared with the average from 1986-2005)



Definition of 4°C (2.7°C+) scenarios

4°C scenario:
3.2-5.4°C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

Over 2°C (2.7-4°C) scenario:
2.7-4.0°C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

2°C scenario:
0.9-2.3°C higher than pre-Industrial Revolution levels if strict measures are taken

(Source) AR5 SYR, Table SPM.6

The TCFD recommendations for scenario analysis suggest that multiple temperature range scenarios be selected, including those below 2°C

[Step 3: Scenario group definition]

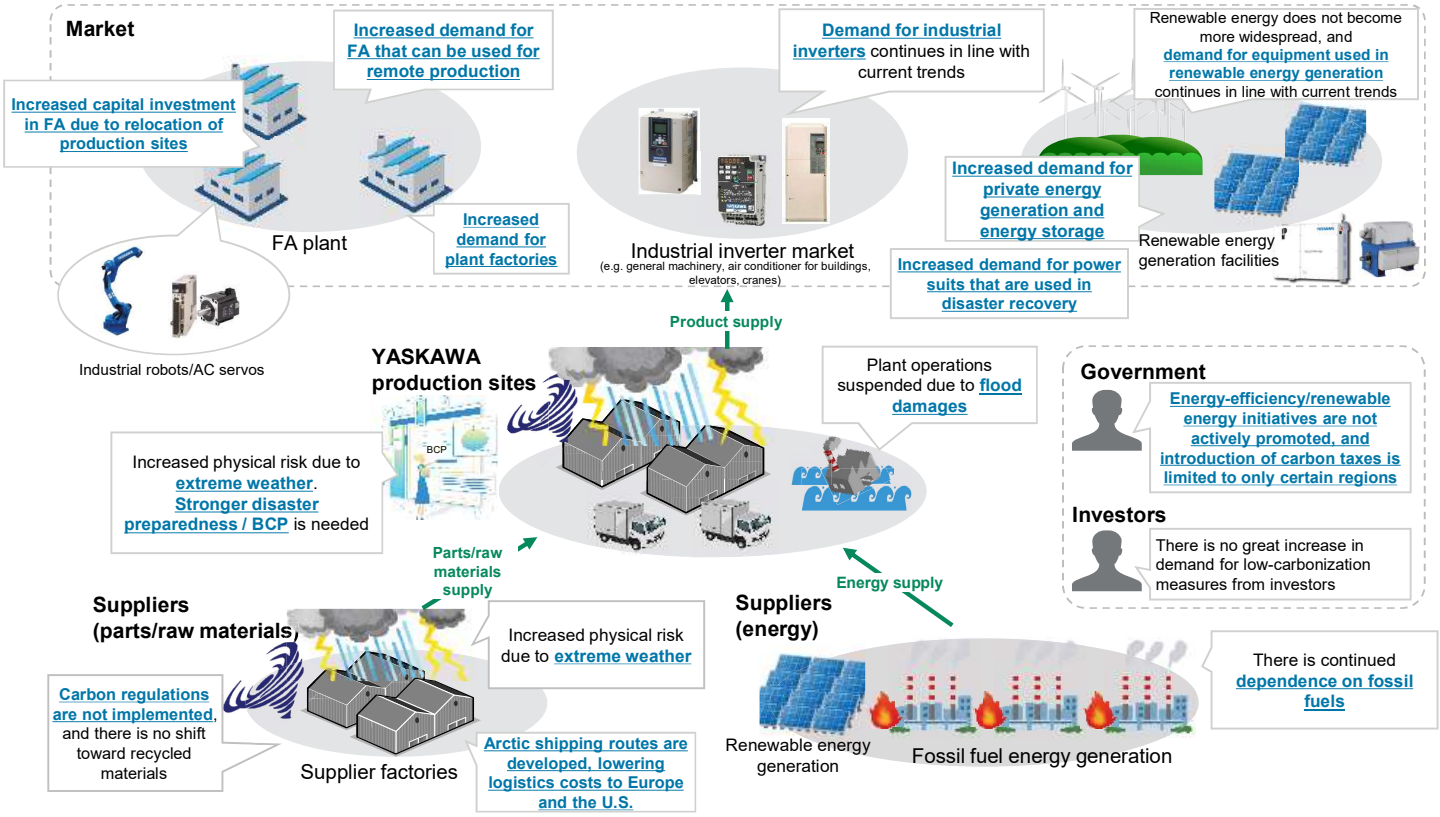
Definition of various worldviews based on scientific evidence from IEA and other sources

*Exchange rate: 1 USD = 106 JPY (based on the October 1, 2020 rate)

		Currently	2030		Source
			4°C (2.7°C+)	2°C	
Transition risks (increased expenses)	Carbon tax	–	–	10,600 JPY/t-CO_2	• IEA WEO2019, 2020 • We hypothesize that levels in the 4°C (2.7°C+) scenario will be the same as current levels
	Carbon pricing	23,328 JPY/MWh	22,572 JPY/MWh	24,948 JPY/MWh	• IEA WEO2019
	Emission factors for electric utilities	0.488kg-CO_2/kWh	0.37kg-CO_2/kWh	0.37kg-CO_2/kWh	• The Ministry of the Environment's "CO2 emission factors for each electric utility" was used
	Volume of demand for neodymium/dysprosium	Neodymium: 84.9 thousand tons Dysprosium: 5.7 thousand tons	Neodymium: 153.6 thousand tons Dysprosium: 10.2 thousand tons	Neodymium: 179.5 thousand tons Dysprosium: 12.0 thousand tons	• Sebastiaan Deetman et al., "Scenarios for demand growth of metals in electricity generation technologies, cars and electronic appliances"
Transition risks (increased sales)	AC servo market size	621.8 billion JPY	1189 billion JPY	1343 billion JPY	• Aggregated from: Fuji Keizai, "General survey of the state of the 2020 featured mechatronics parts market", IEA, WEO2019
	Industrial robot market size	1187.7 billion JPY	2293.7 billion JPY	2589.7 billion JPY	• Aggregated from: International Federation of Robotics, World Robotics 2019 Industrial Robots、IEA, WEO2019
	Inverter market size	1344 billion JPY	5769 billion JPY	6451.1 billion JPY	• Aggregated from: ResearchStation LCC, "The global inverter market" forecast, IEA, WEO2019
	Rate of improvement in specific energy consumption (industrial sector)	—	—	1.3%	• IEA, WEO2019
	Energy mix	Wind power: 2,955TWh Solar power: 2,265TWh	Wind power: 3,361TWh Solar power: 2,764TWh	Wind power: 4,770TWh Solar power: 4,315TWh	• IEA, WEO2020
Physical risks	Level of flood risk for each site	—	(Frequency estimated from aqueduct data)	(Frequency estimated from aqueduct data)	• The estimate is based on current sites, as the number of sites in 2030 is unknown • The estimate is made by applying the assumed level of flood depth to the "length of time business is interrupted for each level of flooding"
	Percentage increase in the probability of flooding	—	50%	150%	• Review Meeting of Technologies Related to Flood Control Planning Based on Climate Change: "A proposal for flood planning based on climate change"
	Length of time business is interrupted for each level of flooding	—	We estimate the average length of time that business is interrupted for each level of flooding	We estimate the average length of time that business is interrupted for each level of flooding	• Explanatory materials on the simulation of estimated damage from flooding by the Cabinet Office

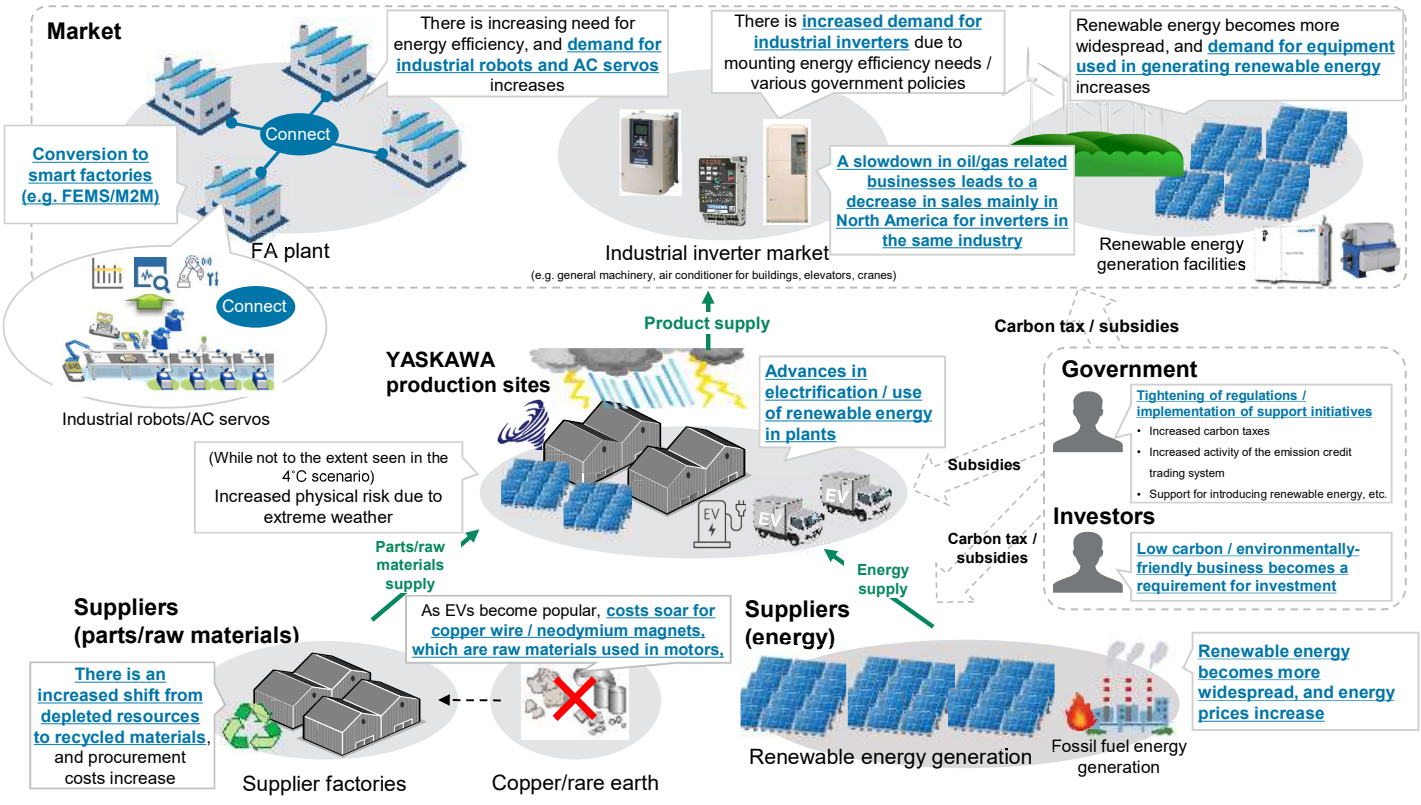
[Visual representation of future society in the 4˚C (2.7˚C+) scenario]

The 4˚C (2.7˚C+) world: Low-carbonization measures do not advance, and physical risks increase



[Visual representation of future society in the 2˚C scenario]

The 2˚C world: Low-carbonization initiatives advance, and there is increased demand for FA equipment / industrial inverters / devices used in generating renewable energy



Step 2 3 4 5 Scenario 4°C 2°C

YASKAWA

[Scenario group definition]

Low-carbonization trends weaken, and physical risks increase

The 4°C (2.7°C+) worldview in the 2030s (examples)

: Actions for responding to risks

: Actions for seizing opportunities

Industrial equipment industry

Sellers (parts/raw materials)

- Carbon regulations are not introduced, and there is no change in procurement costs for raw materials
- We hypothesize that there will be no shift toward recycled materials
- Physical risks become tangible for certain plants / resource suppliers

Review procurement strategies (consider diversifying procurement sources)

Sellers (energy)

- There is no significant progress toward the introduction of renewable energy, and electricity prices remain at the current level

Optimize investment related to renewable energy

New entrants

- There is no particular impact from climate change

Industry

- Initiatives toward renewable energy / energy efficiency are implemented as usual (no significant change)
- There is an increased risk of production line downtime and logistics disruptions due to catastrophic weather events
- Increased expenses for BCP countermeasures
- New arctic shipping routes open, lowering logistics costs to Europe and the U.S.

Implement initiatives toward renewable energy/ energy efficiency as usual, and evaluate portfolios, etc., for sites with high physical risks

(Substitutes)

- There is no particular impact from climate change

Buyers (customers)

- There is increased capital investment in FA due to relocation of production sites prompted by natural disasters, rising sea levels, etc.
- Increased demand for private energy generation and energy storage boosts demand for generators and power converters
- The need to secure a stable food supply boosts demand for plant factories
- Increased infectious diseases lead to advances in automation accompanying the reduction of manpower in many diverse areas (example: increased demand for robots used to produce ready-made meals (lunchboxes, etc.))
- Demand is created for power suits used during disaster recovery
- Demand is created for FA that can be used for remote production due to extreme weather (we hypothesized that there would be conditions that made work attendance difficult)

Take actions to address the increasing demand for products related to disaster preparedness as the need for this increases

Government

- Carbon taxes are introduced in certain regions, but there is no increase in activity for emission credit trading, etc.
- There is no significant growth in demand for renewable energy due to renewable energy policies remaining at the current level
- The world continues to depend on gray energy/fuel due to difficulty in achieving targets for CO_2 emissions reduction
- Initiatives for promoting EVs, etc., do not advance, and the number of vehicles being produced/sold does not increase
- Subsidies (for breakwaters, etc.) are created as sea levels rise and water stress increases

Promptly obtain information on government policies, and secure subsidies

Investors

- N/A

Step 2 3 4 5 Scenario 4°C 2°C

YASKAWA

[Scenario group definition]

As the world moves toward energy efficiency / low-carbonization, there is increased demand for FA equipment / industrial inverters / renewable energy generation facilities

The 2°C worldview in the 2030s (examples)

: Actions for responding to risks

: Actions for seizing opportunities

Industrial equipment industry

Sellers (parts/raw materials)

- Increased procurement costs due to carbon regulations
- Increased shift to recycled materials
- With the spread of EVs, there is increased demand for rare earths and copper that are raw materials used in motors, affecting production when prices for these materials soar and they become difficult to obtain

Review procurement strategies (consider diversifying procurement sources and strengthening partnerships with suppliers of recycled materials)

Sellers (energy)

- Renewable energy holds an increased share in the energy mix, and electricity prices increase

Continue/increase investment related to renewable energy

New entrants

- Increased activity for entry into new business from energy-saving and low-carbon products/business models

Strengthen partnerships (alliances, M&A)

Industry

- Advances in electrification / use of renewable energy in plants
- Increased procurement costs due to increased prices of raw materials / intensified competition for resources
- Increased R&D activity toward conversion to smart factories, such as FEMS/M2M

Low-carbonization of plants

Promoting R&D toward conversion to smart factories (e.g. FEMS/M2M)

(Substitutes)

- There is no particular impact from climate change

Buyers (customers)

- Increased demand for FA equipment and industrial inverters due to increased energy efficiency needs
- Increased demand for equipment used in generating renewable energy
- Increased demand for motor drive systems for EVs and FCVs
- Customers' needs for low-carbon / recycled materials increase, and they demand the use of these materials in manufacturing processes
- A slowdown in oil/gas related areas leads to a decrease in sales mainly in North America for inverter products in the same industry

Low-carbonization of manufacturing processes

Develop/sell products that meet the preferences of customers with strong needs for energy efficiency

Government

- Carbon taxes are introduced, stimulating the low-carbon market
- Policies toward spreading energy efficiency / renewable energy and encouraging low-carbonization are implemented with the aim of achieving CO_2 emissions reduction targets. Subsidies are also enhanced
- Fossil fuel subsidies end
- Policies aimed at popularizing EVs and FCVs are moved forward
- A charging network is established to promote popularization of EVs
- Certain subsidies (for breakwaters, etc.) are created as sea levels rise and water stress increases

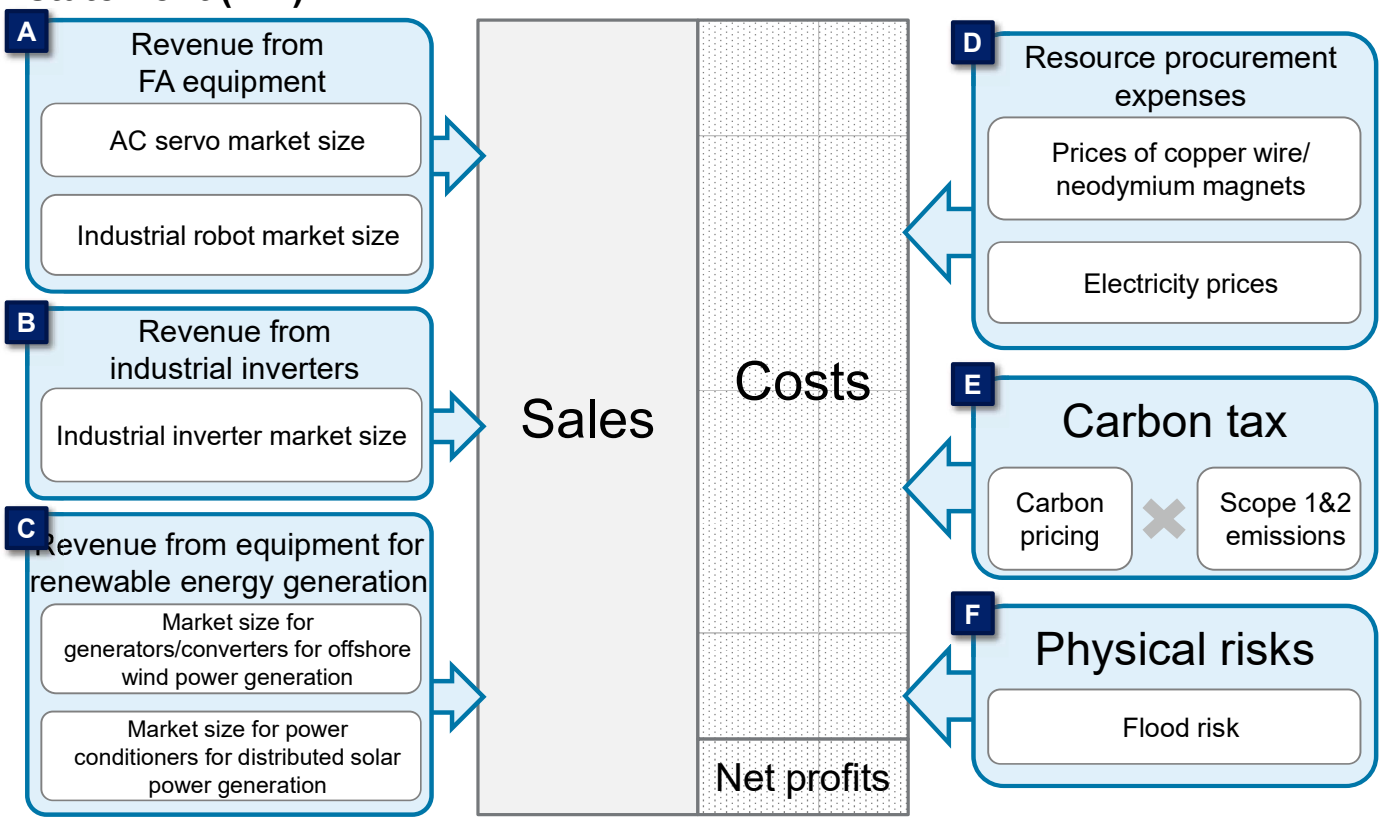
Promptly obtain information on government policies, and secure subsidies

Investors

- Low carbon / environmentally-friendly business becomes a requirement for investment

[Visual representation for assessing impact on business]

We evaluated the impact of each key driving force on the profit/loss statement (P/L)



[Results of the climate change scenario analysis]

Impact of climate change on YASKAWA's business	• When we based our hypotheses in the year 2030, we determined that the impact from climate change on YASKAWA's business (operating profits) was not particularly significant in either the 2˚C scenario or the 4˚C scenario. • The following identified risks and opportunities will need to be evaluated depending on the situation in the future. ➢ Opportunities: FA equipment, renewable energy-related equipment, expansion of business corresponding to extreme weather conditions ➢ Risks: Carbon tax hike, increase in procurement costs for copper/neodymium magnets, severe weather

[Future TCFD initiatives (suggested)]

TCFD disclosure	•Conduct an initial disclosure by preparing information on deficiencies and setting long-term CO_2 reduction targets based on the results of this analysis.
Post-disclosure initiatives	• After disclosing the results of this analysis, confirm the results of feedback from various stakeholders, including investors, and work to review (improve) the disclosure contents.

Other Sector

- ✓ Practice Case①：KYOCERA Corporation (Electronic Equipment)
- ✓ Practice Case②：YASKAWA Electric Corporation (Electronic Equipment)
- ✓ **Practice Case③：ASKUL Corporation(Retailing)**
- ✓ Practice Case④：Seven & i Holdings Co., Ltd. (Retailing)
- ✓ Practice Case⑤：Lion Corporation (Consumer Products)

ASKUL

Step 2 3 4 5 Scenario 4°C 2°C

[Step 2: Risk significance assessment]

We evaluate risk/opportunities ranging from storage/transport (copier paper is sourced from raw materials) to product usage

Business risks/opportunities related to transition risks

Risk		Business impact		Rating
Subcategory	Parameter	Study: risks	Study: opportunities	
Carbon pricing	Revenue Expenditures	➢ **The application of carbon pricing** will increase costs such as operating costs for logistics facilities/offices and costs of fuel used in deliveries	➢ Operating costs and fuel costs will decrease due to **investments made toward increased environmental performance**. The company may also be eligible for public support or tax relief	High
Various countries' carbon emission targets/government policies	Revenue Expenditures	➢ **Tighter greenhouse gas reduction obligations** will increase costs for improving the environmental performance of logistics facilities, delivery vehicles, and so on ➢ **ASKUL will need to purchase emissions credits** if carbon emissions cannot be reduced ➢ **The cost for procuring timber will increase** due to government policies/logging taxes related to forests being used as solutions for absorbing carbon, resulting in increased acquisition cost for copier paper (ASKUL's key products) and other items	➢ **If significant reductions in carbon emissions are achieved**, the company may be able to sell emission credits if a system such as emissions trading is introduced	Med.
Shifts in energy prices	Revenue Expenditures	➢ **Rising fossil fuel and electricity prices** will increase costs such as operating costs for logistics facilities and costs of fuel used in deliveries	—	High
Increases/ decreases for main products	Revenue Expenditures	➢ **Progress toward a paperless society is made due to the influence of decarbonization**, resulting in declining sales from reduced demand for copier paper, stationery, and other related office supplies ➢ **ASKUL is forced to use materials sourced from renewable resources and bio-based plastics**, resulting in increased costs due to the use of alternative materials	➢ There will be **increased demand for environmentally friendly products** such as ethical consumption goods/services, including low-carbon/decarbonized products and packaging ➢ There will be increasing momentum towards a circular economy across all of society, which could lead to **increased business opportunities through various collection services**	High
Spread of low carbon technologies	Revenue Expenditures	➢ Costs increase due to the **introduction of environmentally friendly vehicles and high-efficiency low carbon technologies/equipment**	➢ Lower fuel costs and other delivery-related costs due to **improved fuel efficiency of environmentally friendly vehicles** ➢ Lower energy costs through **introducing more efficient logistics and energy-saving equipment**	High
Changes in reputation with customers	Revenue Expenditures	➢ There is an increased risk to ASKUL's reputation if it fails to respond appropriately to the **growing public awareness of climate change**	➢ There will be more opportunities to improve the company's reputation if it responds appropriately to **growing public awareness of climate change**	High
Changes in reputation with investors	Capital	➢ **If investors perceive ASKUL as being reluctant to take environmental action**, it will be more difficult to procure funds, and financing costs will increase	➢ It will be easier to procure funds from ESG investors, etc., and financing costs will decrease if the company **gains a reputation with investors of being proactive in its environmental measures** as a result of **shifting its business to low carbon/environmentally friendly practices** and communicating this shift effectively	Low

Step 2 3 4 5 Scenario 4˚C 2˚C

[Step 2: Risk significance assessment]

We evaluate risk/opportunities ranging from storage/transport (copier paper is sourced from raw materials) to product usage

Business risks/opportunities related to physical risks

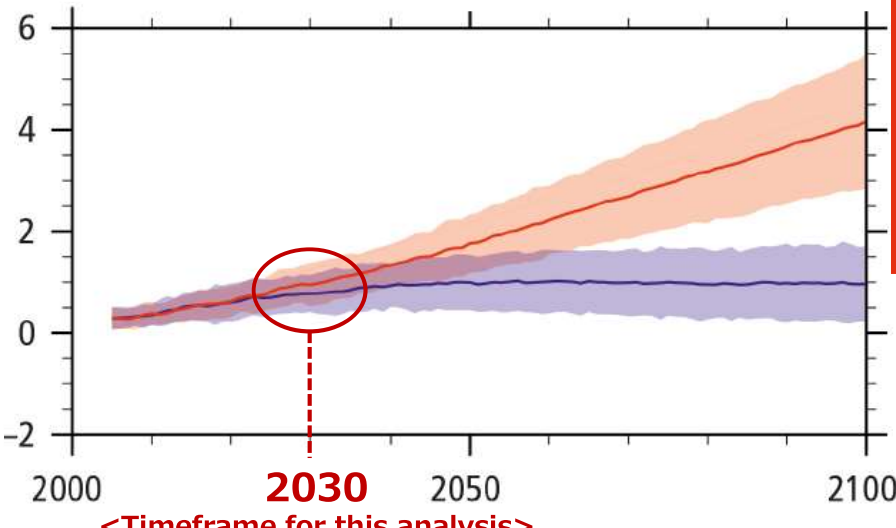
Risk		Business impact		Rating
Subcategory	Parameter	Study: risks	Study: opportunities	
Increased average temperatures	Revenue Expenditures Capital	➢ Increased costs for energy needed for **air conditioning/refrigeration in logistics facilities and delivery vehicles** ➢ **The cost for procuring timber will increase due to forest fires and tree diseases and pests**, resulting in increased acquisition cost for ASKUL's copier paper (key products) and other items which use timber as a raw material	—	High
Changes in precipitation/ weather patterns	Revenue Expenditures	➢ There will be **more delivery delays and accidents due to increased rainfall/strong winds**, resulting in increased costs from paying delivery fees/personnel costs/compensation/insurance ➢ The **cost for procuring timber will increase due to changes in flora and timber sourcing areas**, resulting in increased acquisition cost for ASKUL's copier paper (key products) and other items	➢ By **increasing the resilience of its business by diversifying its portfolio in respect to supplier countries/tree species and strengthening its supply chains**, the company will be able to avoid a decline in sales for timber-based products such as copier paper	High
Elevated sea levels	Revenue Expenditures Capital	➢ Relocation costs will arise from the need to **reconsider the location of sites over the medium- to long-term due to increased risk of flooding from storm surges/tidal waves**	➢ **Supply chains can be maintained by addressing the impact of increasing sea levels** on deliveries and logistics centers	Low
Extreme weather conditions	Revenue Expenditures Capital	➢ There will be **more delivery delays and accidents due to increased rainfall/strong winds**, resulting in increased costs from paying delivery fees/personnel costs/compensation/insurance ➢ There will be **a decrease in asset values for logistics centers/offices at high risk of flooding**, and **insurance premiums for these will increase** ➢ **The cost for procuring timber will increase due to plants ceasing operations and a decrease in forest resources**, resulting in increased acquisition cost for ASKUL's main products (copier paper and similar products) ➢ **Capital investments made for resilience** due to extreme weather conditions	➢ By **increasing the resilience of its business through diversifying its portfolio in respect to supplier countries/tree species and strengthening its supply chains**, the company will be able to avoid a decline in sales for timber-based products such as copier paper ➢ **Supply chains can be maintained by addressing the impact of extreme weather conditions** on deliveries and logistics centers	High

Step 2 3 4 5 Scenario 4˚C 2˚C

[Step 3: Scenario group definition]

We investigate society in 2030 using two scenarios for climate change with a high degree of uncertainty

[Projected average global surface temperature change] (compared with the average from 1986-2005)



<Timeframe for this analysis>

As stated in the following pages, the physical risks from climate change itself are limited due to this being only 10 years in the future

(Source) AR5 SYR: Table SPM.6

Definition of 4˚C (2.7˚C+) scenarios

4˚C scenario:
3.2-5.4˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

Over 2˚C (2.7˚C-4˚C) scenario:
2.7-4.0˚C higher than pre-Industrial Revolution levels if no additional measures against global warming are taken

2˚C scenario:
0.9-2.3˚C higher than pre-Industrial Revolution levels if strict measures are taken

The TCFD recommendations for scenario analysis suggest that multiple temperature range scenarios be selected, including those below 2˚C

Step 2 3 4 5 Scenario 4°C 2°C

[Step 3: Scenario group definition]

Definition of each worldview based on scientific evidence from IEA, etc.

*Exchange rate: 1 USD = 106 JPY (based on the late September 2020 rate)

Key items	Assumed parameters	Currently	2030		Source
			4°C	2°C	
Carbon pricing	Carbon tax	(Not implemented)	—	100 USD/tCO2	• IEA WEO2020
Shifts in energy prices	Oil price	63 USD/barrel	76 USD/barrel	52 USD/barrel	• IEA WEO2020
	Electricity price	216 USD/MWh	209 USD/MWh	231 USD/MWh	• IEA WEO2018
Increase/ decrease in staple commodities	Recycled plastic usage rate	—	—	14%	• We hypothesize that this will reach a level similar to European plastic strategies
	Sales for certified sustainable products	125.4 billion USD	183.4 billion USD	198.1 billion USD	• Nielsen: "Product Insider"
Spread of low carbon technologies	EV penetration rate	0.3%	5%	39%	• Global Calculator
Increased average temperatures	Increased temperatures	—	Increase of 1.1 °C	Increase of 1.0 °C	• World Bank: "Climate Change Knowledge Portal"
Extreme weather conditions	Flood frequency (Japan)	—	4x	2x	• "A proposal for flood planning based on climate change"
	Flood damage costs (Indonesia)	404.6 million USD/year	875.3 million USD/year	404.6 million USD/year	• WRI: "The Aqueduct Global Flood analyzer"
Key materials **Various countries' carbon emission targets/government policies**	Forest area reduction targets (Indonesia)	450ha/year	325ha/year	Stricter than in the 4°C scenario. Peatland restrictions on artificial forests introduced	• "First Nationally Determined Contribution REPUBLIC of INDONESIA"
Key materials **Extreme weather conditions**	Flood damage costs (Indonesia)	404.6 million USD/year	875.3 million USD/year	404.6 million USD/year	• WRI: "The Aqueduct Global Flood analyzer"

Step 2 3 4 5 Scenario 4°C 2°C

[Step 3: Scenario group definition (visual representation of a future society)]

The 4°C (2.7°C+) world: Government policies do not move forward, and physical risk increases

Promotion of measures for disaster prevention/mitigation in preparation for extreme weather conditions such as floods

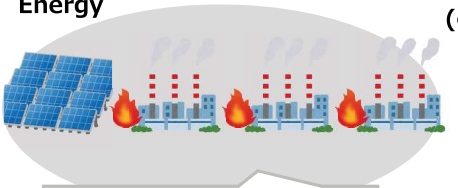
Indonesian government

No major changes can be seen in regulations or government policies, but reviews of disaster prevention/mitigation plans move forward due to increased physical risk

Japanese government

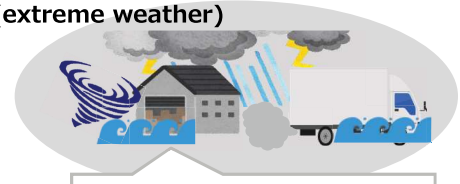
Procurement | **Storage/transport** | **Product use/collection**

Energy



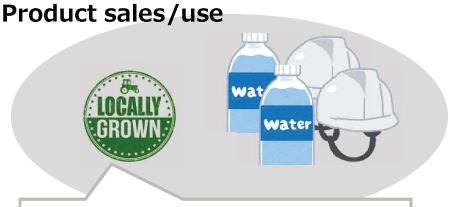
Gasoline prices soar as energy-saving initiatives fail to spread

Facilities/delivery vehicles (extreme weather)



Increased damage to supplier plants/ASKUL facilities/deliveries due to flooding, etc.

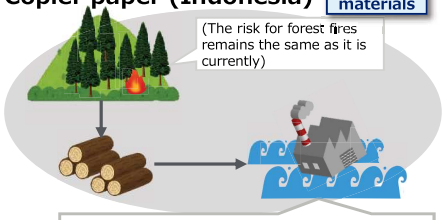
Product sales/use



(While not as much as in the 2°C scenario) Ethical consumption increases, and demand for sustainable products increases along with it

Demand for heat-protection products increases due to factors such as an increased number of extremely hot days. Increased awareness toward disaster prevention/mitigation increases demand for products related to disaster prevention/mitigation measures

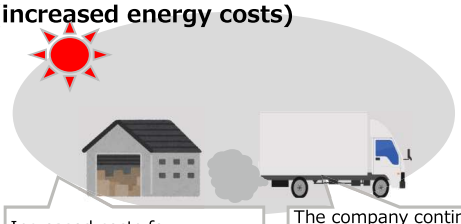
Copier paper (Indonesia) Key materials



(The risk for forest fires remains the same as it is currently)

Paper plant operations cease due to flooding, resulting in a halt in copier paper shipping

Facilities/delivery vehicles (increased energy costs)



Increased costs for AC/refrigeration needed for logistics facilities/deliveries

The company continues to use mainly ICE vehicles in its deliveries, and delivery costs increase due to the soaring price of gasoline

Step 2 3 4 5 Scenario 4°C 2°C

[Step 3: Scenario group definition (visual representation of a future society)]

The 2°C world: Low-carbon initiatives move forward, and there is increased demand for sustainable and energy-efficient products

Indonesian government

Regulations tighten and the logging tax is raised in order to protect national forests

Japanese government

Support initiatives are implemented
- Sustainable product certification
- Promotion of energy-saving investments
- Support for introducing ZEVs/energy-efficient equipment

Regulations are tightened
- Increased carbon taxes
- Activation of systems such as emissions credit trading
- Recycled plastic regulations, etc.

Procurement

Energy

Use of renewable energy expands, resulting in increased energy costs

Plastic products

Product prices increase due to regulations on recycled plastic

Copier paper (Indonesia) Key materials

(The risk for forest fires remains the same as it is currently)

Reduced supply due to stricter forest protection regulations

Paper plant operations cease due to flooding, resulting in a freeze in copier paper stock

Storage/transport

Facilities/ delivery vehicles

(While not as much as in the 4°C scenario) an increase in extremely hot days result in increased energy demand

There is a shift toward low carbon electricity due to increased carbon tax, etc.

Accelerated implementation of low-carbon delivery methods, such as the introduction of ZEVs

Product use/collection

Product sales/use

Increased demand for sustainability-certified and energy-efficient products due in part to support from the government

Slight increase in demand for products related to heat protection/disaster prevention/disaster mitigation

Product collection

Increased momentum toward a circular economy

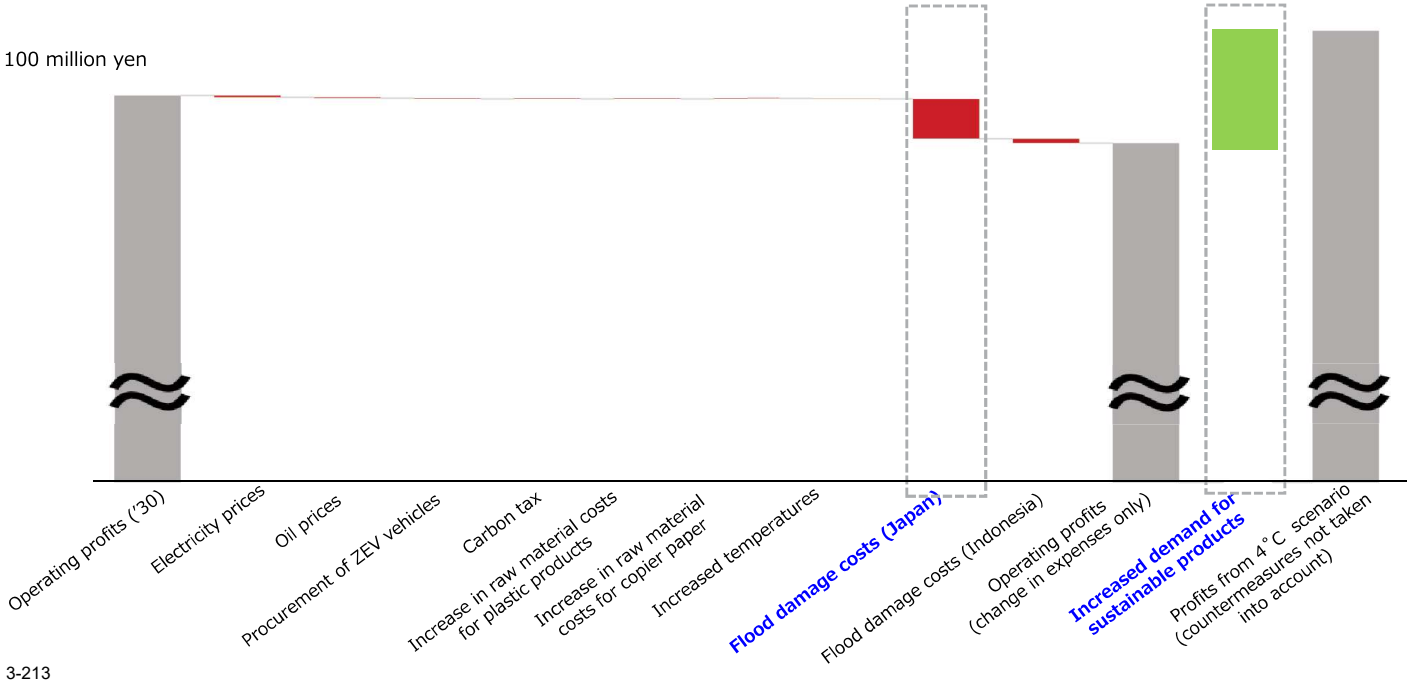
Step 2 3 4 5 Scenario 4°C 2°C

[Step 4: Business impact evaluation]

In the 4°C (2.7°C+) scenario, it will be important to take measures against flood damage and seize opportunities for increased product demand

Increase/decrease in expenses

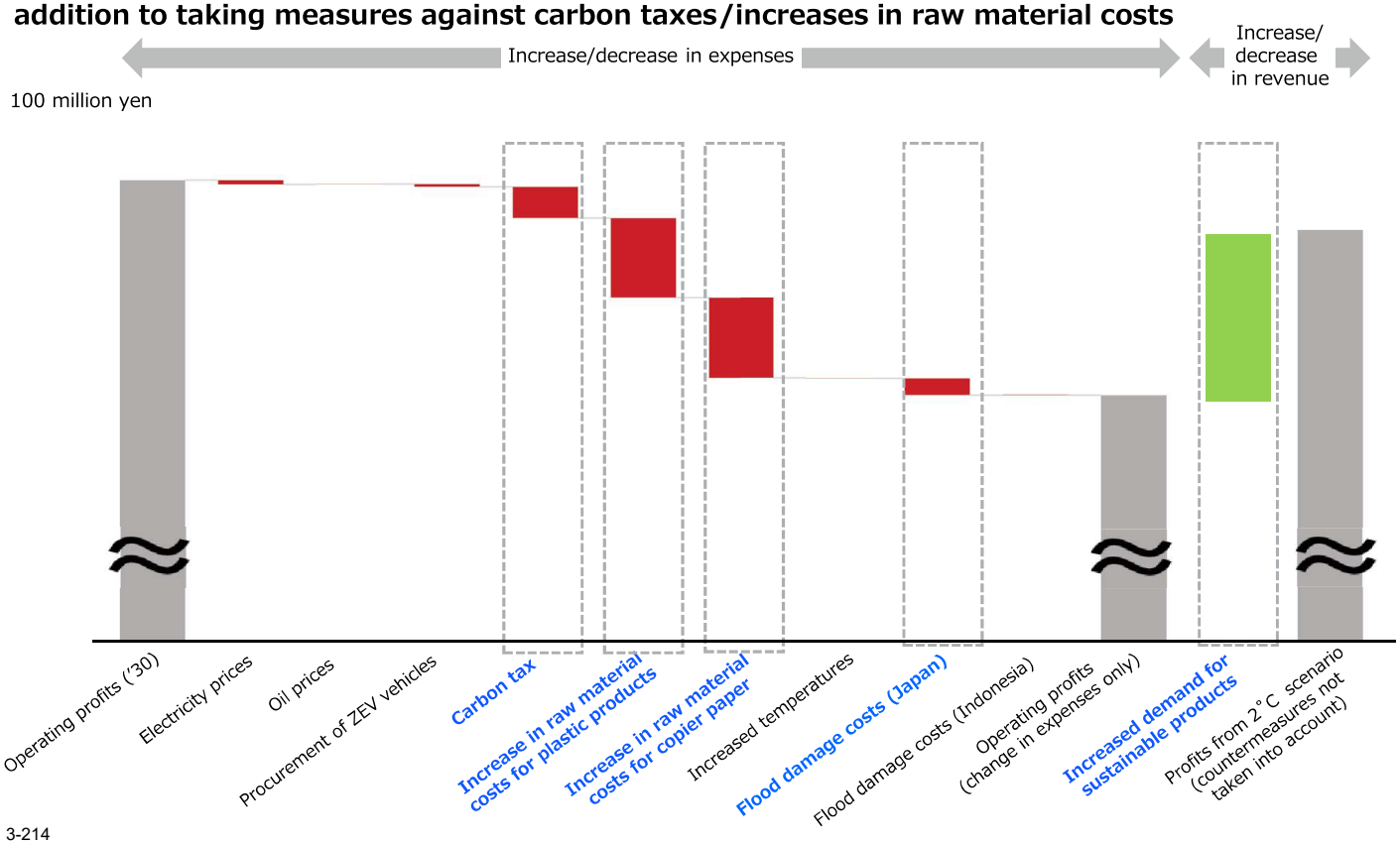
Increase/decrease in revenue



[Step 4: Business impact evaluation]

Step 2 3 **4** 5 Scenario 4°C **2°C**

In the 2°C scenario, it will be important to seize opportunities for increased product demand in addition to taking measures against carbon taxes/increases in raw material costs



[Step 5: Definition of countermeasures]

Step 2 3 4 **5** Scenario 4°C **2°C**

Although existing response policies such as those in the medium-term management plan already include some countermeasures, we will continue developing countermeasures that are even more robust while referring to initiatives taken by leading companies

Item	Perspectives for approaching risk countermeasures	Category	Response policy	Risk countermeasures
Carbon pricing	✓ Reduce **CO2 emissions from logistics facilities, vehicles, etc.**	Adapted	RE100 EV100	✓
	✓ Reduce utility costs for cooling, etc. by **introducing automation to increase unmanned operations in logistics facilities**	Adapted	Medium-term management plan	✓
	✓ Reduce fuel consumption throughout the entire supply chain by achieving **efficient transportation and delivery of products**	Adapted	Medium-term management plan	✓
Product raw material costs	✓ Investigate sustainable **sources/procurement methods for copier paper**	Established	Medium-term management plan	✓
	✓ Avoid the **impact of increased costs from pushes toward using recycled plastics**	Adapted	Medium-term management plan	✓
Extreme weather conditions (flooding)	✓ Establish **redundancy against flooding risk**	Adapted	Risk management plan	✓
	✓ Establish measures to **reduce the duration of shutdowns** in the event of a disaster	Adapted	Risk management plan	✓
	✓ Establish countermeasures against **increased disaster risks for suppliers**	Retained	Risk management plan	✓

Step 2 3 4 **5** Scenario **4°C** **2°C**

[Step 5: Definition of countermeasures]
Although existing response policies such as those in the medium-term management plan already include some countermeasures, we will work proactively to take advantage of business opportunities with solutions for individual risks

Item	Perspectives for approaching risk countermeasures	Category	Response policy	Measures for taking advantage of opportunities
Sustainable products/ circular economy	✓ Formulate **strategies** for what kinds of products to **make into sustainable products**, and in what ways	Adapted	Medium-term management plan	✓
	✓ Achieve **a circular economy utilizing ASKUL's supply chain**	Established	Medium-term management plan	✓
Increased average temperatures Extreme weather conditions (flooding)	✓ **Respond to increased demand for products** corresponding with increasing temperatures and increasing disaster awareness	Adapted	Medium-term management plan	✓

[Disclosure process]
We expect to make a disclosure of ASKUL's scenario analysis using the following three processes below :
1. Identify the substantial risks for each scenario
2. Clearly state that the efforts concerning countermeasures have been initiated in conjunction with medium- to long-term strategies
3. Provide specific examples of how opportunities (particularly those for high-impact key products) are proactively utilized to create value

[Disclosure process]
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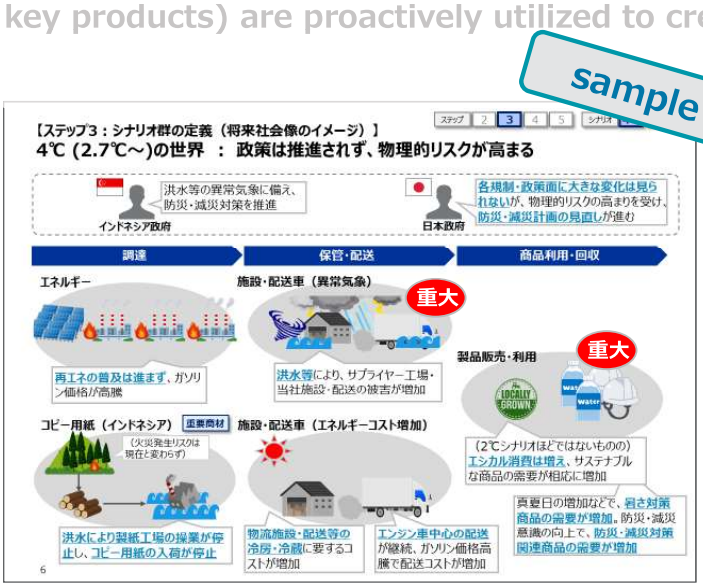

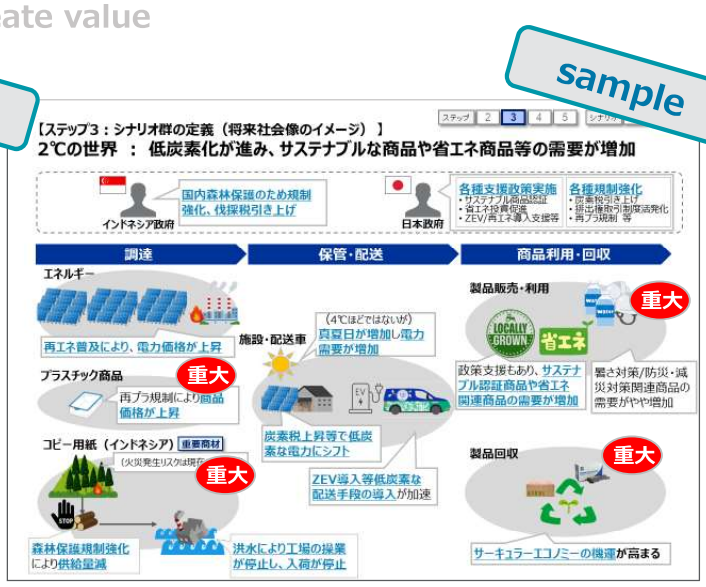

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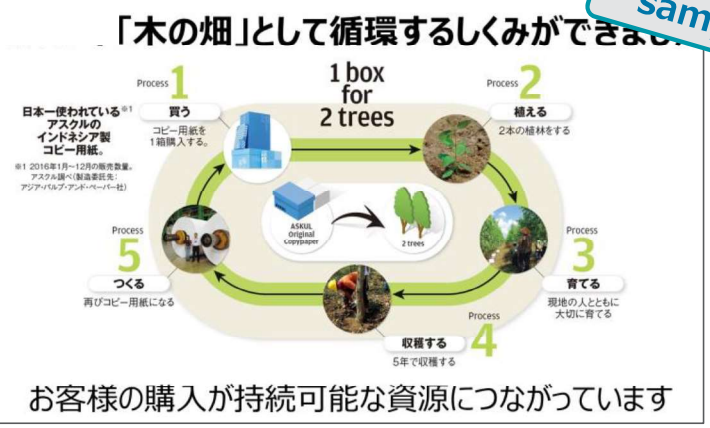
3. **Provide specific examples of how opportunities (particularly those for high-impact key products) are proactively utilized to create value**

sample



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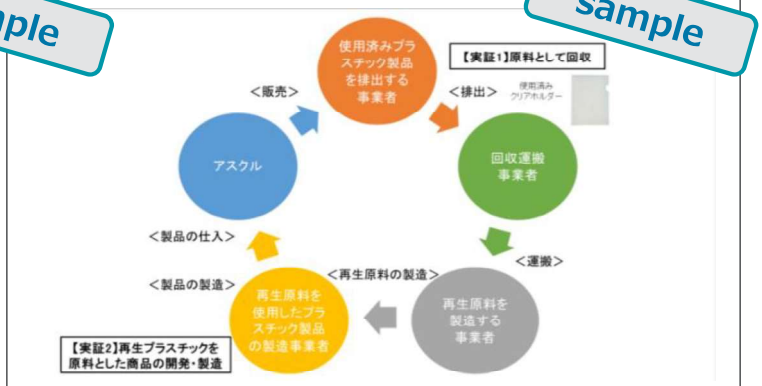


[FY2020 demonstration project for establishing a recycling system for plastics and other resources to support a decarbonized society]
(Establishing a new "resource recycling value chain" that extends from collecting clear file folders to creating new products)

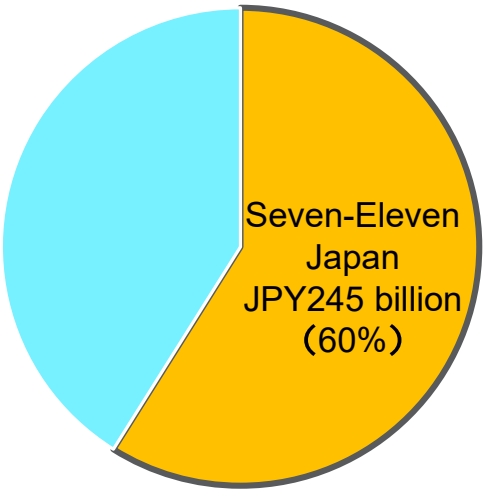
Other Sector

- ✓ Practice Case①：KYOCERA Corporation (Electronic Equipment)
- ✓ Practice Case②：YASKAWA Electric Corporation (Electronic Equipment)
- ✓ Practice Case③：ASKUL Corporation(Retailing)
- ✓ **Practice Case④：Seven & i Holdings Co., Ltd. (Retailing)**
- ✓ Practice Case⑤：Lion Corporation (Consumer Products)

Scope of this analysis

The scope of consideration is Seven-Eleven Japan, which accounts for 60% of consolidated operating income

Seven & i Holdings Co., Ltd.
Consolidated Operating Income
JPY411.5 billion
(Fiscal year ended in February, 2019)



Corporate Profile: Seven-Eleven Japan

(as of February 28, 2019)

Revenue from operations
873,555 millions yen

Net Income
153,233 millions yen

Operating Income
245,088 millions yen

Total Store Sale in Japan
4,898,872 millions yen

Ordinary Income
252,917 millions yen

Number of Stores in Japan
21,005 (as of July 31, 2019)

Assess materiality of climate-related risks and opportunities

Risks and opportunities at Seven-Eleven Japan are extracted from the items listed in TCFD based on external views

Risks and Opportunities in TCFD

Classification	TCFD Risks/Opportunities	
Transition risks and opportunities	Policies/ Regulation	Carbon price
		Carbon Emissions Targets/Policies in Each Country
		Energy-saving policy
		Fossil fuel subsidies
		Renewable energy subsidy policy
	Industry/ Market	Changes in the energy mix
		Energy Demand
		Changes in important products/prices
	Technologies	Spread of low-carbon technologies
		Dissemination of renewable energy and energy-saving technologies
		Developing next-generation technologies
	Reputation	Customer reputation change
		Changes in the investor's reputation

Classification	TCFD Risks/Opportunities	
Physical risks and opportunities	Acute	Increasing severity of extreme weather conditions
	Chronic	Increase in the average temperature
		Changes in rainfall and weather patterns
		Rising sea level

External Views
(Examples)
① SASB
② EBRD
③ Retail Industry Leaders Association “Retail Horizons Toolkit”
④ CDP

Risks and Opportunities in Seven - Eleven Japan

Classification	TCFD Risks/Opportunities	
Transition risks and opportunities	Policies/ Regulation	Carbon price
		Carbon Emissions Targets/Policies in Each Country
	Technologies	Efficiency of resources through the introduction of technology
	Reputation	Customer reputation change
		Changes in the investor's reputation
Physical risks and opportunities	Acute	Increasing severity of extreme weather conditions
	Chronic	Changes in rainfall and weather patterns
		Rising sea level

Assess materiality of climate-related risks and opportunities

セブン&アイHLDGS.

Assess the significance of risk and opportunity for Seven-Eleven Japan (Qualitatively)

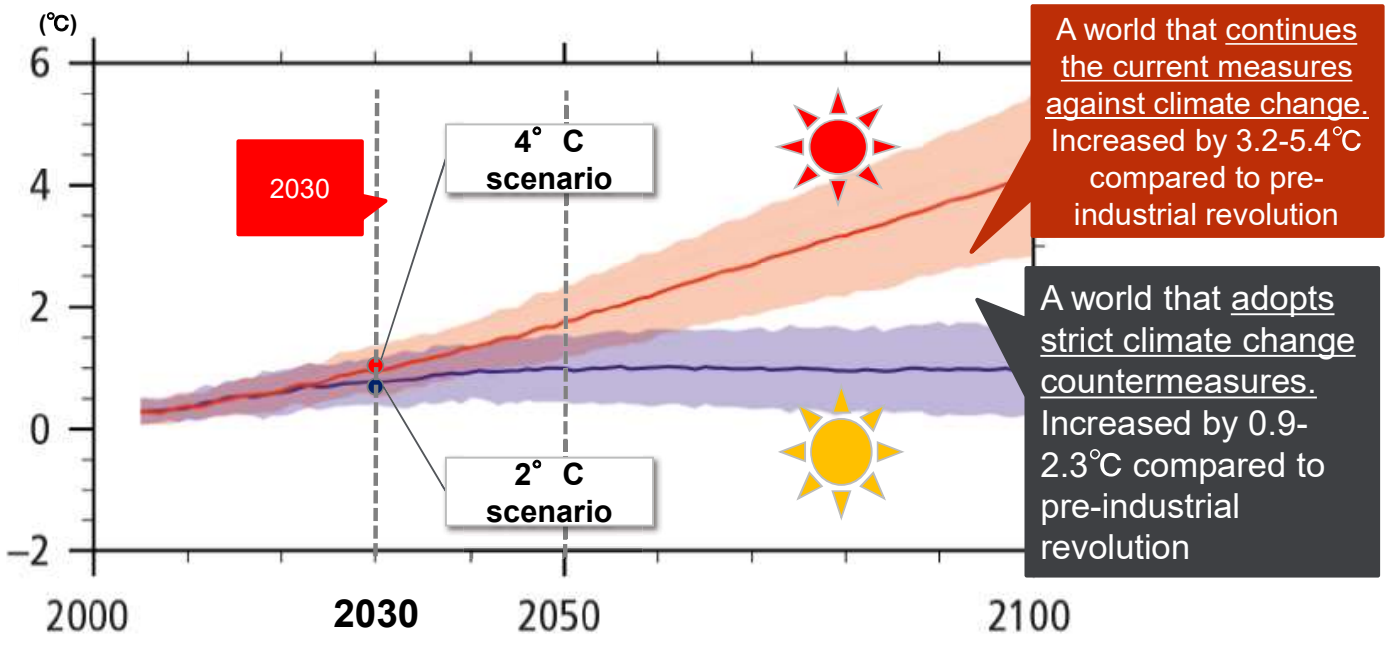
Significance level Large	[Transition risks and opportunities] ・Carbon prices ・National carbon emissions targets and policies ・Changing consumer reputation [Physical risks and opportunities] ・Severity of extreme weather (acute) ・Changes in precipitation and weather patterns (chronic)
Significance level Medium ～ Small	[Transition risks and opportunities] ・Efficiency of resources through the introduction of technology [Physical risks and opportunities] ・Rising sea level
Significance level Small	[Transition risks and opportunities] ・Changes in investor's reputation

Identify and define range of scenarios

セブン&アイHLDGS.

Consideration of 2030 society based on representative scientific scenarios “2° C scenario” and “4° C scenario”
※ Multiple different forecasts are used, because accurate forecasts are almost impossible.

[Global Average Terrestrial Temperature Change (Difference from the 1986-2005 Average)]



Source: AR5 SYR chart, SPM. 6 IEA.

Definitions of worldview

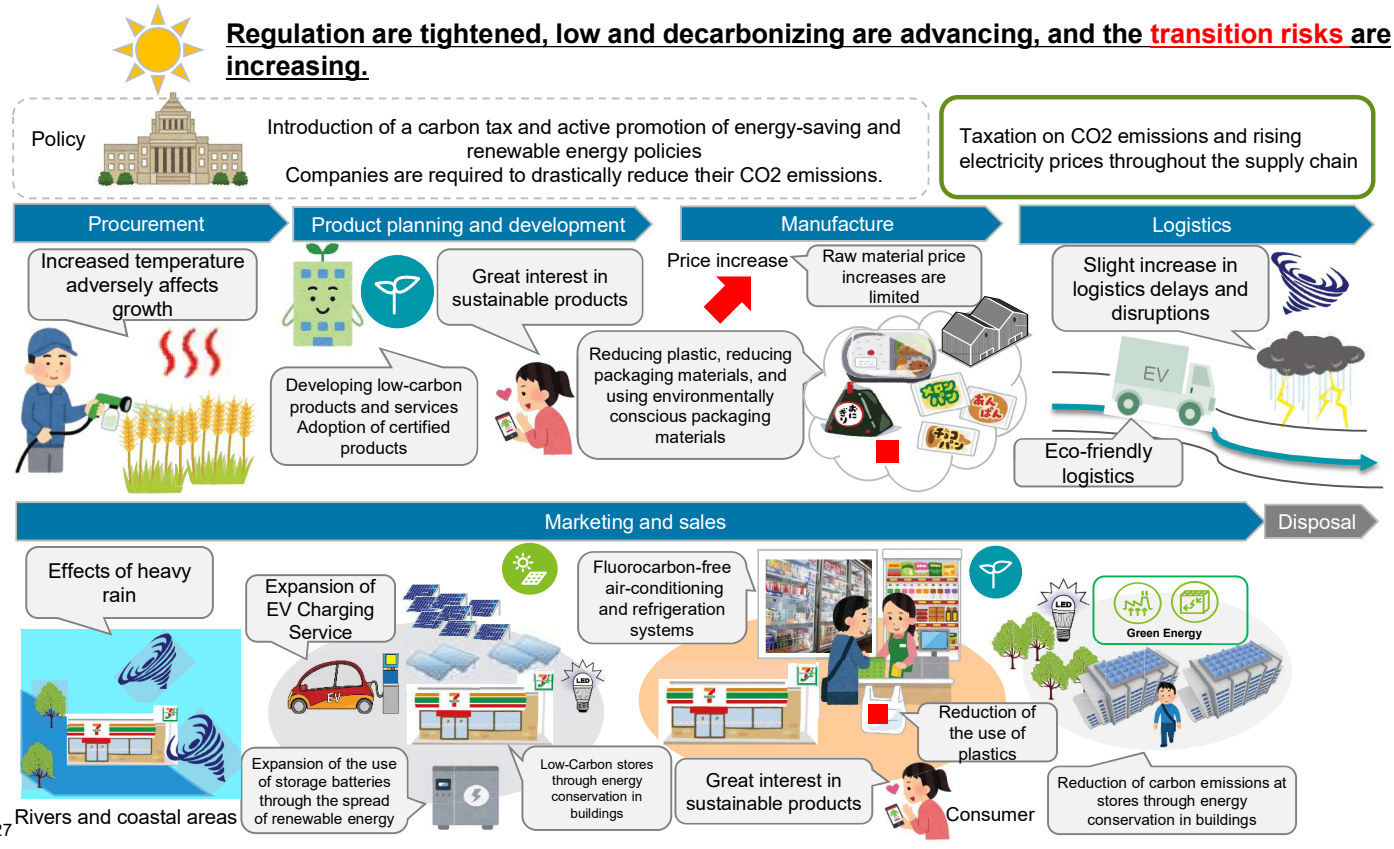
Define a worldview based on scientific grounds such as IEA

Important items (Items of high significance)	Assumed parameter	At present	2030		Source (excerpt)
			4℃	2℃	
Carbon prices, national carbon emissions targets and policies	Carbon price	No introduction	Not adopted at 4° C	$100 per t-CO2	IEA
	Target for GHG emissions	207.5 Million t-CO2	168 Million t-CO2		Ministry of the Environment
	Electricity price	$216/MWh	$209/MWh	$231/MWh	IEA
Changing consumer reputation	Sales of sustainable certification products	128.5 billion USD	296.7 billion USD		Nielsen, etc.
	Diffusion of EV	Percentage of vehicles owned 0.3%	Percentage of vehicles owned 5%	Percentage of vehicles owned 39%	Next Generation Vehicle Promotion Center
Increasing severity of extreme weather conditions	Frequency of typhoons and cyclones	-	High uncertainty (frequency may decrease or remain unchanged; severity may increase)		Japan Meteorological Agency and the Ministry of the Environment
	Frequent heavy rains	2.5 days of occurrence	3.0 days of occurrence	2.5 days of occurrence	Ministry of the Environment
	Flood damage	3.6 billion USD/ years	8 billion USD/ years	Not adopted at 2° C	WRI
Changes in rainfall and weather patterns	Changes in rice (prime rice) yields	(Base year: 2012)	7% decrease	5% decrease	Mitsubishi UFJ Research and Consulting
	Increase in hot weather days	(Base year: 2019)	+0.3 days per year	+0.05 days per year	Ministry of the Environment
	Increase in the amount of electricity used for air-conditioning	(Base year: 2016)	1.7 times	1.6 times	IEA

Identify and define range of scenarios (2° C, 2030)

Seven-Eleven Japan in 2° C scenario

Regulation are tightened, low and decarbonizing are advancing, and the transition risks are increasing.

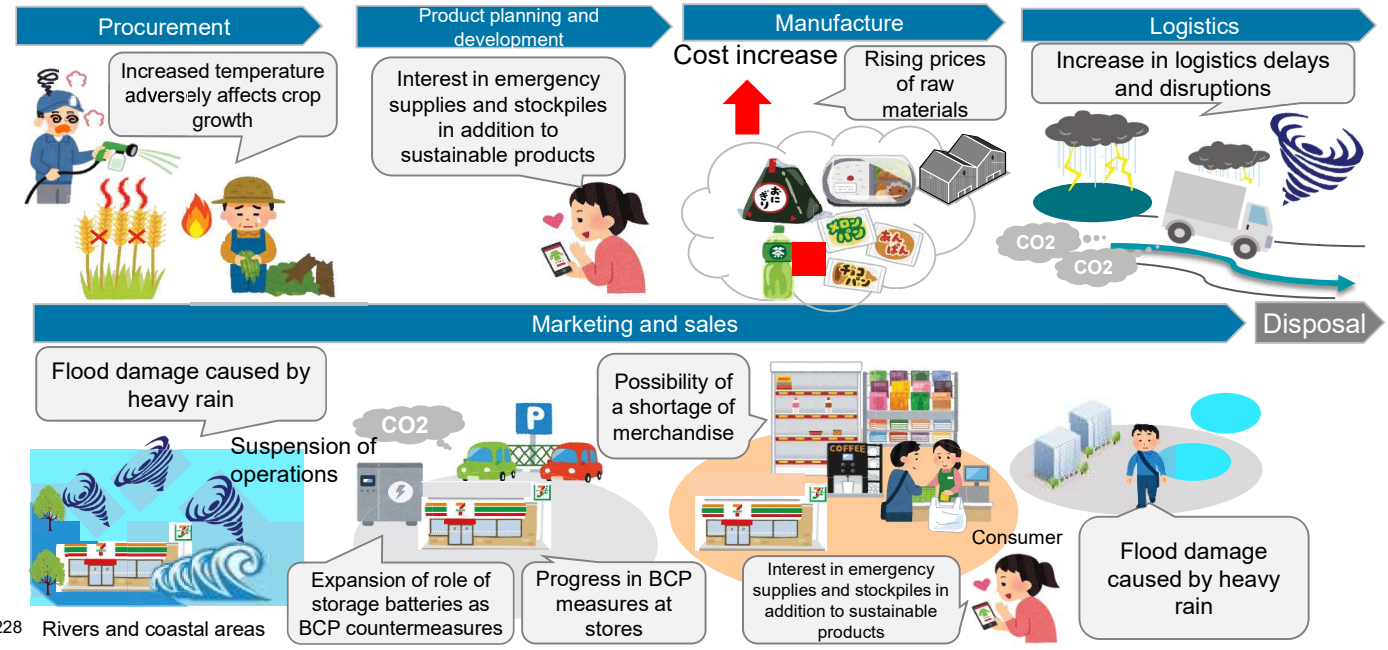


Identify and define range of scenarios (4° C, 2030)

Seven-Eleven Japan in 4° C scenario

Increase physical risks such as extreme weather

Policy: Energy-saving and renewable energy policies are not actively promoted (carbon tax not introduced)

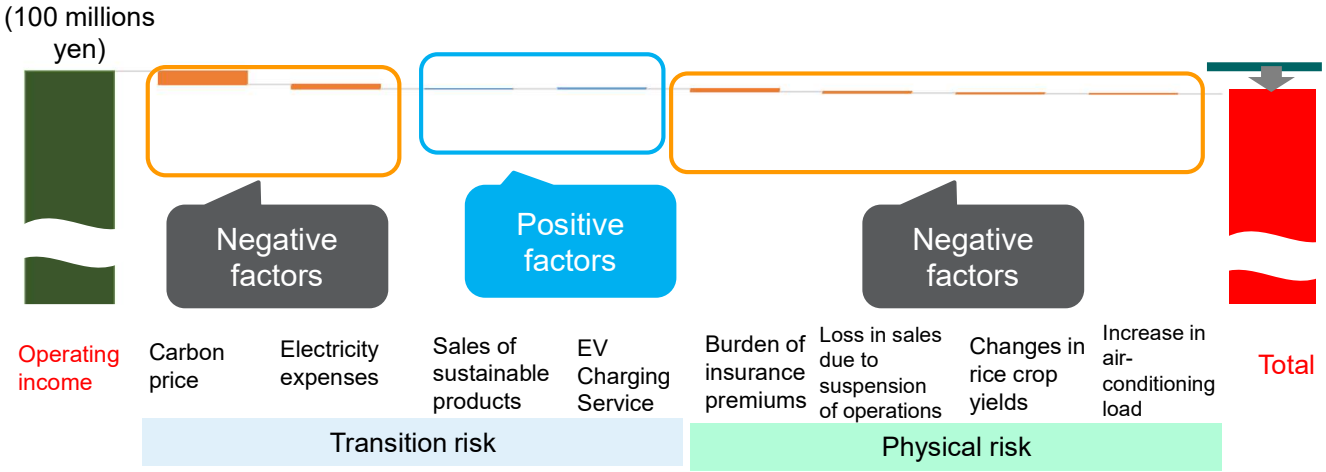


Rivers and coastal areas

Evaluate business impacts (2° C, 2030)

We have picked up specific examples of risks and opportunities which were assessed as significant and estimated their impact (based on business as usual) .

◆ Business impact of 2° C



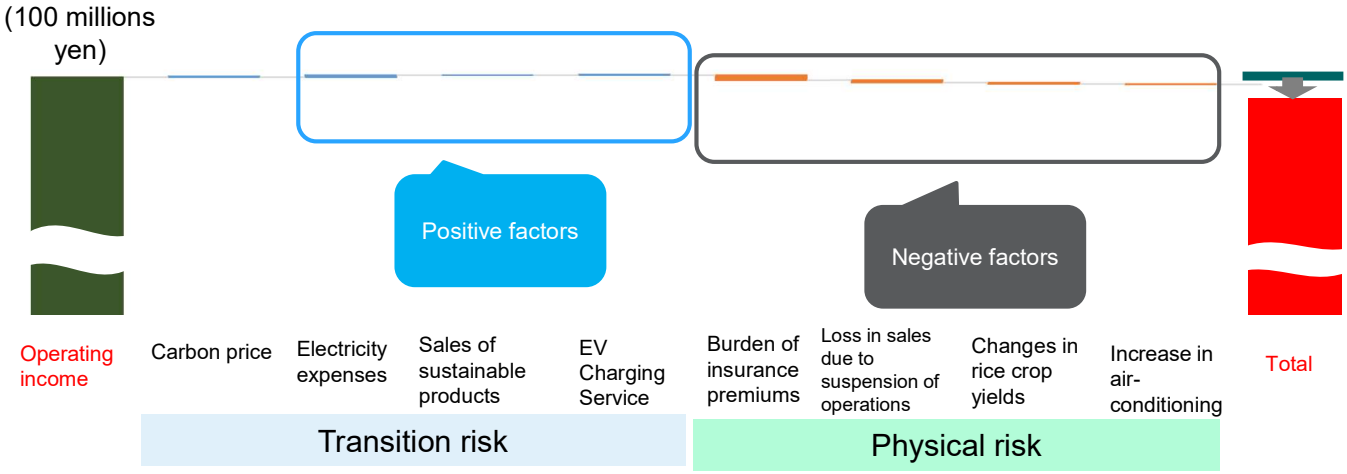
Increased transition risks

Regulations are tightened, low-carbon and decarbonization are advancing, and carbon taxes and electricity prices are rising.

Evaluate business impacts (4℃, 2030)

We have picked up specific examples of risks and opportunities which were assessed as significant and estimated their impact (based on business as usual) .

◆ Business impact of 4° C

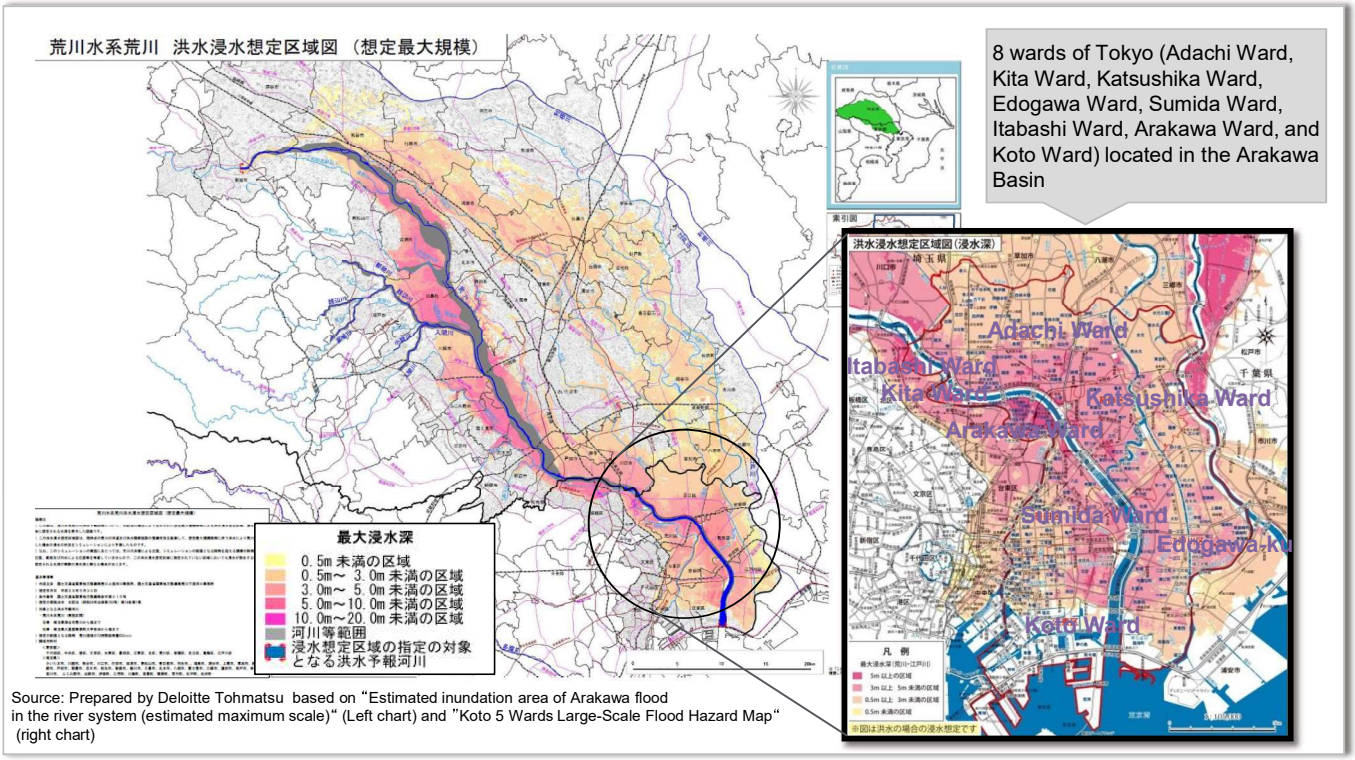


Increased physical risks
Increase in insurance premiums and loss due to suspension of operations due to extreme weather.

3-230

Evaluate business impacts - flood risk assessment

The flood risk at the time of Arakawa collapse is assessed by using a hazard map. Store damages in 8 wards of Tokyo located along Arakawa river were evaluated.



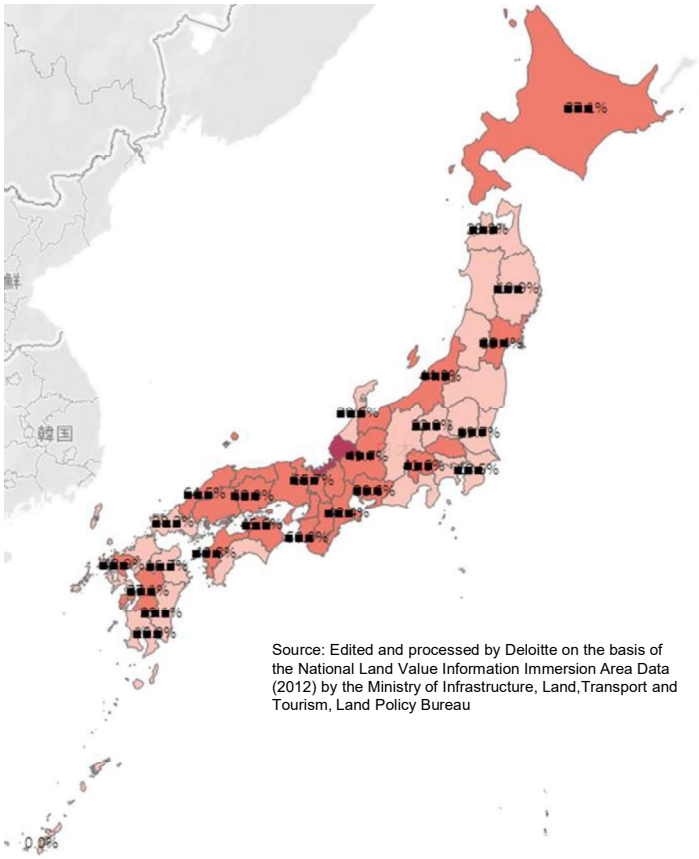
Source: Prepared by Deloitte Tohmatsu based on "Estimated inundation area of Arakawa flood in the river system (estimated maximum scale)" (Left chart) and "Koto 5 Wards Large-Scale Flood Hazard Map" (right chart)

3-231

Evaluate business impacts - flood risk assessment

◆ Percentage of stores that may have flood risk

Calculate the proportion of stores that may be flooded by comparing domestic store locations with hazard maps



Source: Edited and processed by Deloitte on the basis of the National Land Value Information Immersion Area Data (2012) by the Ministry of Infrastructure, Land,Transport and Tourism, Land Policy Bureau

Increasing importance of disaster response

Identify potential responses

Countermeasures to mitigate climate-related risks and expand opportunities

Items that have a major impact on Seven-Eleven Japan

- Carbon price
- Electricity expenses
- Changing consumer reputation
- Increasing severity of extreme weather conditions
- Changes in rainfall and weather patterns

- Reducing risks by promoting our initiatives, 7&i's environmental declaration "GREEN CHALLENGE 2050"
- We, as Seven-Eleven Japan, will expand business opportunities through our contribution to implementing various measures at stores where can contact with customers

Other Sector

- ✓ Practice Case①：KYOCERA Corporation (Electronic Equipment)
- ✓ Practice Case②：YASKAWA Electric Corporation (Electronic Equipment)
- ✓ Practice Case③：ASKUL Corporation(Retailing)
- ✓ Practice Case④：Seven & i Holdings Co., Ltd. (Retailing)
- ✓ **Practice Case⑤：Lion Corporation (Consumer Products)**

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Scope of Scenario Analysis and Promotion Structure

- **Timeline: 2030**
- **Target businesses: Oral care business and Fabric care business in Japan (Taking into account our core business and the impact of climate change)**

	2030 Domestic business	Overseas business
Risk	[Scope of this investigation] Mainly Oral Care Business Fabric Care Business 	Not considered
Opportunity		

- **Promotion System: Internal Project**
  Corporate Planning Division (including IR), Accounting Division, Marketing Division, and Purchasing Division, CSV Promotion Department Environmental Strategy Office (Secretariat)

Assess materiality of climate-related risks: Transition Risk

Increases in production costs due to carbon taxes, changes in raw material procurement regulations and prices, and changes in customer behavior can have significant financial consequences

Blue: Risk,
Red: Opportunity

Risk Item		Business Impact	Assessment
Carbon emissions targets/ Policies in each country	Carbon tax	➢ **Full-scale introduction of emissions trading and the application of carbon taxes by governments will increase the operating costs of factories** and increase expenditures ➢ The use of low-carbon energy will enable us **to cope with future rises in carbon prices** and reduce costs.	Large
	Containers	➢ **Introduction of regulations on plastic and other packaging materials and products in each country, incurring response costs and** increasing expenditures ➢ **By making use of low-carbon, non-plastics products, it is possible to provide products that meet the ethical needs of consumers,** thereby increasing corporate value and generating profits	Large
Raw materials procurement	Regulations relating to land use	➢ **If demand for raw materials for biofuels and petrochemical substitutes increases and competition arises with the use of agricultural land to produce agricultural products, procurement costs for agricultural products (palm oil, etc.) will increase** and expenditures will increase ➢ Although regulations are tightened as forest area decreases, **by using sustainable paper products (certified paper) that comply with regulations,increase the sustainability of products and companies,** and may contribute to increasing corporate value and earnings	Large
	Steep rise in prices	➢ **Higher premium prices for certified palm oil (nuclear oil)** and increased expenditures due to tighter regulations and demand for biofuels ➢ **Costs associated with the switch to alternative raw materials are also incurred**, resulting in an increase in expenditures ➢ In procuring palm oil, we can **increase the sustainability of our products by helping themacquire RSPO certification** May contribute to enhancing corporate value and increasing earnings	Large
Changes in customer behaviours		➢ **As consumers become more aware of ethical consumption, demand for products using unsustainable plastics and palm oil declines** and profits decline ➢ On the other hand, as consumers **become more aware of the importance of ethical consumption, demand for water saving products, non-plastics, and sustainable raw materials expands** and revenues increase	Large
Changes in the investor's reputation		➢ If climate change is not addressed, the investor may have a poor impression, and there is a possibility that a high interest rate may have to be charged for the issuance of corporate bonds. This may affect the BS due to the impairment of capital.	Small

Assess materiality of climate-related risks: Physical risk

Rising average temperature, raw material prices, water stress, and extreme weather events can have significant financial influence

Blue: Risk,
Red: Opportunity

Risk Item		Business impact	Assessment
Increase in the average temperature		➢ Expenditures will increase **due to higher operating and personnel costs resulting from increased energy costs and burdens on workers.** ➢ **Higher average temperature** will increase the number of laundry operations**, while demand for laundry detergents and antiperspirants will increase**, leading to higher earnings**.** ➢ In some areas, a certain increase in temperature may contribute to increased crop productivity, **leading to higher production and lower raw material costs**	Large
Raw materials procurement	Pests	➢ Large outbreaks of pests **affect the production volume and price of plant-derived raw materials, increase raw material costs,** and increase expenditures ➢ In some areas, a certain increase in temperature may contribute to a decrease in pests, **leading to an increase in production and a decrease in raw material costs**	Medium
	Atmospheric CO2 concentrations Increase	➢ **Increased use of herbicides** due to improved water efficiency and growth efficiency of weeds and **increased expenditure** ➢ On the other hand, **increased crop growth potential and increased crop yields could lead to lower raw material costs** ➢ Expenditures increase due to a decrease in earnings associated with a **decline in the quality** of plant-derived raw materials or an **increase in raw material costs**	Medium
Water stress (drought)		➢ Expenditure increases due to **shortage of water supply due to drought, deterioration of water quality, and increase in operating costs** ➢ On the other hand, **demand for water-saving products and products that do not require water may increase** and profits may increase	Large
Increasing severity of extreme weather conditions (Direct/ Indirect effects)	Flood	➢ **Revenue declines due to delays or disruptions in logistics** caused by climate events, etc. ➢ In preparation for natural disasters such as floods, **demand for specific products that provide clean and healthcare in the event of a disaster may increase** and earnings may increase	Large
	Heavy rains, typhoons and storms	➢ Revenues and asset values will decrease due to **damage to equipment caused by heavy rains, typhoons and storms, and have an impact on infrastructure and business continuity (including transfer costs)** ➢ **The market for disaster prevention goods used for evacuation in the event of natural disasters** such as large-scale typhoons and concentrated torrential rains **will expand**, and profits will increase	Large

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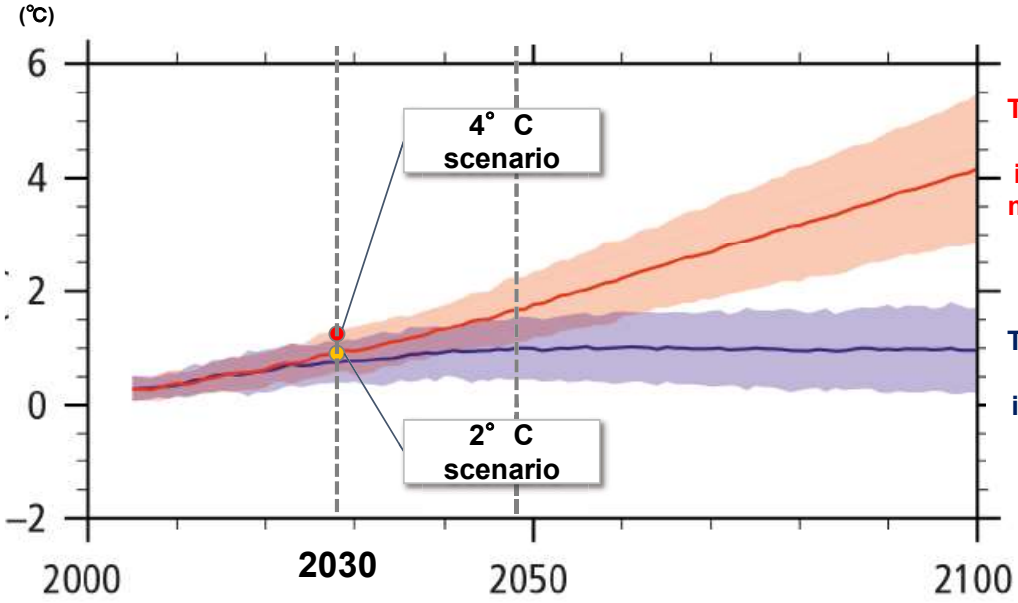
Identify and define range of scenarios: Consider society in 2030 under two scenarios

Since there is no unified climate change scenario in the consumer goods industry and it is thought that the influence of the average temperature change is large, we examined society in 2030 by using the 2° C scenario (tightened regulation) and the 4° C scenario (business as usual).

[Global Average Terrestrial Temperature Change (Difference from the 1986-2005 Average)]



The temperature will rise 3.2-5.4°C above pre-industrial levels, unless more rigorous measures are taken.

The temperature will rise 0.9-2.3°C above pre-industrial levels, if strict measures are taken.

Source: AR5 SYR Diagram SPM.6

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Definition of each worldview based on scientific grounds, etc. of the IEA, etc.

Risk Item	Assumed parameter	Current situation	2030		Source
			4℃	2℃	
Carbon emission targets and policies of each country (A Carbon tax)	Carbon prices in each country	—	(Not iintroduced at 4° C)	**10,900 Yen and tCO2**	IEA WEO 2019
Carbon emission targets and policies of each country (Plastics)	Use rate of recycled plastics in equipment *1	—	(Not iintroduced at 4° C)	**14.0%**	European plastics strategy
Changes in customer behaviours	Sales of sustainable certified products	—	(Expand in the millennial generation)	(Expand among consumers as a whole)	Deloitte Survey, Nielsen
Increase in the average temperature	Increase in the average temperature	—	**+1.14℃**	**+1.02℃**	Climate Change Knowledge Portal
	Due to heat stress Loss of labor productivity	—	(Extract figures for each region)	(Extract figures for each region)	ILO "Working on a warmer planet"
Water stress (drought)	Probability of occurrence of drought (Water stress)	—	(Extract figures for each region)	(Extract figures for each region)	WRI AQUEDUCT
Extreme weather conditions (flooding)	Frequency of flooding *2	—	**4 times**	**2 times**	Ministry of Land, Infrastructure, Transport and Tourism, "Recommendation for Ideal Flood Control Plan Based on Climate Change"
	Population affected by floods	**0.704 million**	**1.03 million**	**1.154 million**	WRI AQUEDUCT
Increasing severity of extreme weather conditions (heavy rain, storm, typhoon)	Increasing number of days of heavy rain per year	**4.0 days/year**	**4.0 days/year**	**4.2 days/year**	Tokyo Regional Meteorological Observatory HP and Climate Change Knowledge Portal
	Number of typhoons occurring	(There are no clear figures, but the frequency of occurrence may be decreasing or unchanged, and the severity may increase)			—

*1 It is assumed that regulations similar to those in Europe will be applied to Japan.
* 2. Figures for 2040 are used as substitute for figures as of 2030.
* 3 Converted at $ 100 per tCO2, 109 ¥/US$

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Identify and define range of scenarios: World View at 2° C @ 2030s

Raw material costs soar due to the introduction of regulations and certification
Growing environmental awareness and increased demand for "ethical" value-added products

Seller (Raw Material Suppliers)

Compliance with RSPO certification, Consideration of alternative raw materials in anticipation of rising procurement costs

- Increase in raw material production and procurement costs **due to carbon regulations**
- **Increase in procurement and manufacturing costs for products using plastics** due to increasingly shift to recycled materials
- **Demand for raw materials to acquire RSPO certification increased**, and procurement and manufacturing costs increased
- Increased temperatures lead to heat stress, rising labor costs related to agriculture, and **soaring prices for natural raw materials (palm oil, etc.)**. There is a possibility that production may decline due to pests and changes in vegetation areas
- Dealing with plants and resource suppliers with high water risk

Newcomer

- Entry and expansion of Loop and other recycle industries
- Other consumer goods manufacturers with cooling-effective products

Consumer products industry

Reduction of CO2 emissions at plants
R&D on recycled materials
Providing ethical products

- **Rising production, procurement, and transportation costs** due to soaring fuel prices and rising raw material prices
- Active R&D activities for recycled materials (plastics, etc.)
- Possibility of **passing on cost increases to recycled materials products as ethical products**

(Alternative)

Changing containers and brush materials to biodegradable plastics

- Bio-plastics, Bio-degradable plastics
- Air-conditioning clothes, highly deodorizing clothes, and cooling sprays

Buyer (Consumer)

Provision of products in line with the ethical orientation (RSPO certification, use of recycled plastic, etc.), expansion of stockpiled products for disaster prevention

- Demand for ethical raw material-using products (RSPO certification, recycled plastics, etc.) increased due to **increased consumer preference for ethical materials.**
- **Demand for antiperspirants is expanding gradually** due to the increase in midsummer days. Potential growth in **demand for household fabric care products** with more frequency of laundry
- Gradual increase in demand for hand soap and other products with fungicide effects
- **Increase in stockpiling for disasters in households**

Government

Compliance with regulations related to GHGs, recycled plastics and palm oil

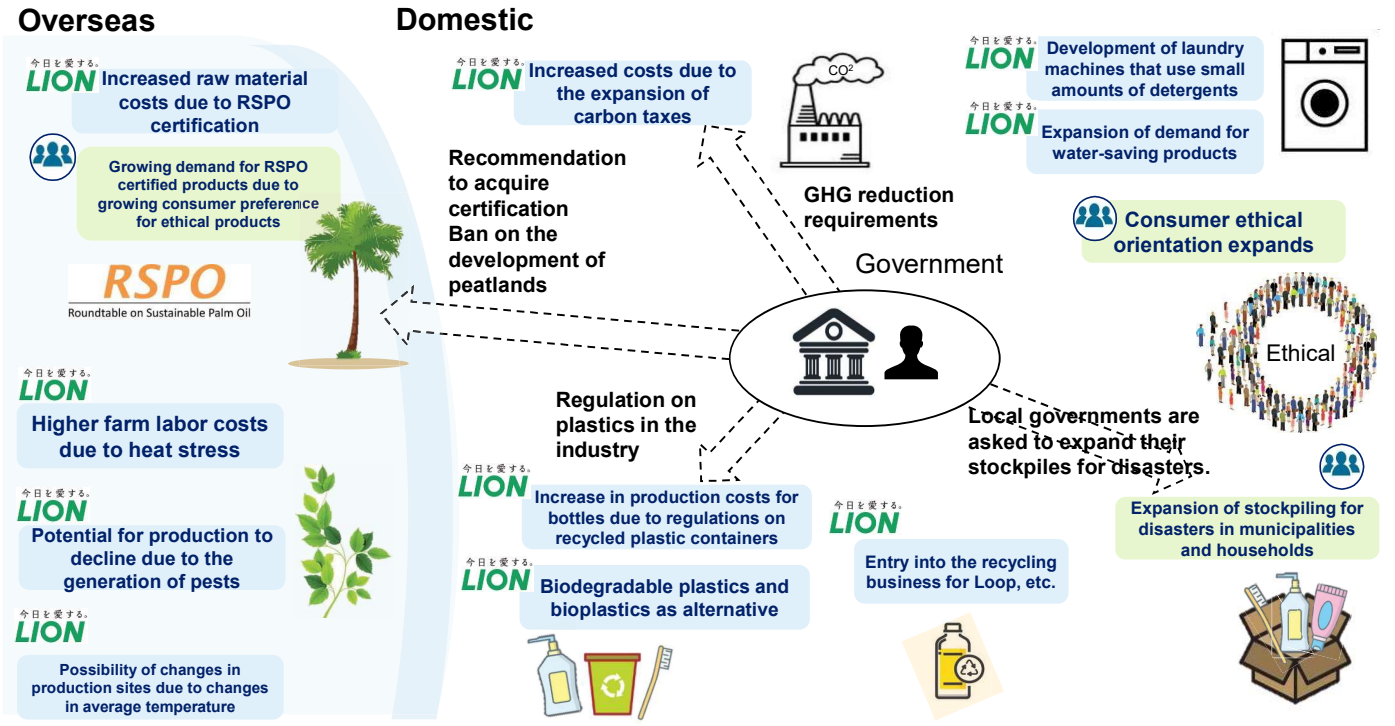
Expansion of stockpiled products for disaster prevention in line with the timing of the government's stockpiling of disaster preparation sets

- **Introduction of a carbon tax**. Factories that emit a large amount of CO2 are subject to the regulations
- **Introduction of regulation on the use of recycled plastics**
- Peat land development banned. Recommendation for acquiring RSPO certification when using palm oil
- **Stockpiling of disaster prevention sets** to enhance the facilities of evacuation centers

今日を愛する。 LION

Identify and define range of scenarios: Future Social Image under the 2° C Scenario

Raw material costs soar due to the introduction of regulations and certification
Growing environmental awareness and increased demand for "ethical" value-added products



Step 2 3 4 5

今日を愛する。 LION

Identify and define range of scenarios: 4° C Worldwide @ 2030s

Low carbon/decarbonization trends weaken and physical risks increase
Increase in demand for certain products due to temperature increase

Seller (Raw Material Suppliers)

Response to physical risks at plants and suppliers

- Raw material costs remain unchanged
- Assuming no shift to recycled materials
- **RSPO Certification required for domestic use palm oil**
- Increased temperature leads to heat stresses, rising labor costs related to agriculture, and **soaring prices for plant-derived raw materials**. Potential for lower production due to pest generation and changes in vegetation areas
- Responses to plants and resource suppliers **with high water risk**
- **Physical risks materialized** for some factories and suppliers

Newcomer

- Entry of recyclers such as Loop
- Manufacturers of consumer goods with products having cooling effects

Consumer products industry

Existing energy-saving measures Response to Physical Risks at Factories

- Implement energy-saving measures as in the past (no major changes)
- **Emerging physical risks to the company's plants**

(Alternative)

- Air-conditioning clothes, highly deodorizing clothes, and cooling sprays

Buyer (Consumer)

Expanding demand for products for daily use in the midsummer and emergency supplies

- Need for low-carbon, recycled materials, etc. are low
- **Interest in ethical products increased** among the millennial generation
- **Demand for antiperspirants expanded** due to the increase in midsummer days. Potential growth in **demand for household fabric care** with more frequency of laundry
- Demand for hand soaps and other products with fungicide effects expanding
- **Increase in stockpiling for disasters** in households

Government

Expansion of reserve products for disaster prevention in line with the timing of the government stockpiling disaster preparation sets

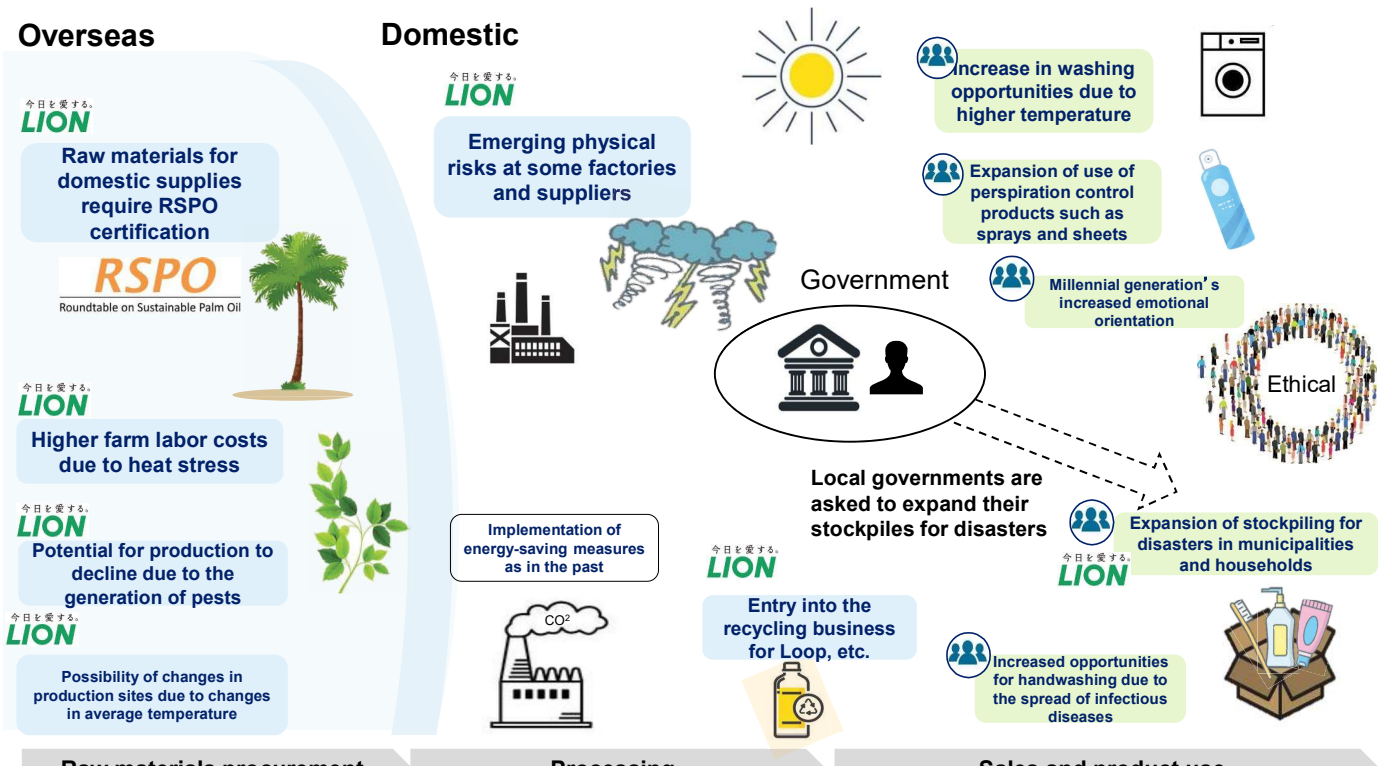
- Regulations are not advancing as low carbon/decarbonization trends weaken and external pressures from the international community weaken.
- Regulations on carbon tax and use of recycled plastics are not introduced.
- **Stockpiling of disaster prevention sets** to enhance the facilities of evacuation centers

Step 2 3 4 5

今日を愛する。 LION

Identify and define range of scenarios: Image of the future society of the 4° C scenario

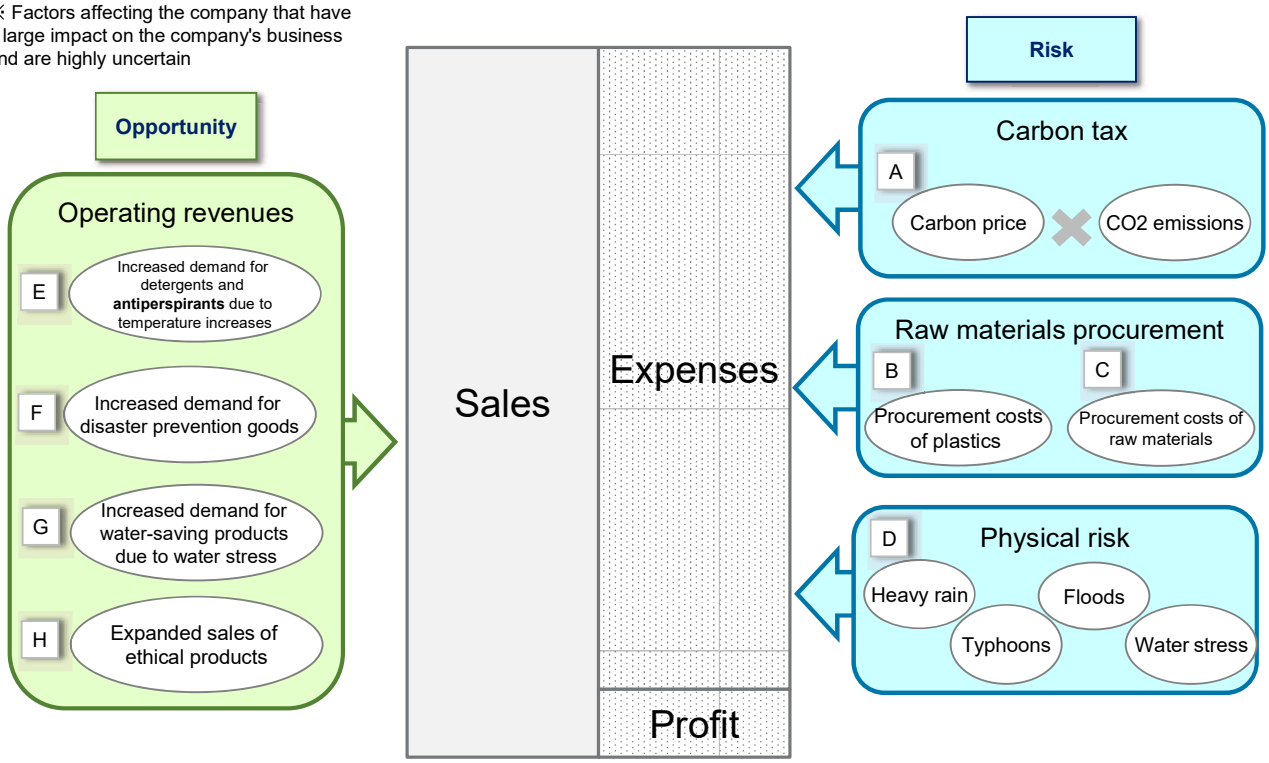
Low carbon/ decarbonization trends weaken and physical risks increase
Increase in demand for certain products due to temperature increase



Evaluate business impacts: Image

8 key driving forces* are set to estimate the impact on each of our businesses.

※ Factors affecting the company that have a large impact on the company's business and are highly uncertain



Evaluate business impact: Transition and Physical Risks

Due to the difficulty of obtaining data, there are items that are limited to qualitative evaluations
Costs are expected to increase due to rising raw material prices caused by policy changes and rising temperatures, and natural disasters such as typhoons

Risk Item				Impact on business	Business impact on annual earnings	
					2℃	4℃
Transition risk	Carbon emission targets and policies of each country	Carbon tax	A	• The effect of carbon tax is significant at 2℃, and operating costs increase • In case of 4℃, no carbon tax is included	X.X billion yen	JPY 0 billion
	Carbon emission targets and policies of each country	Plastics	B	• Cost increase at 2℃ due to introduction of recycled plastic regulations • It is assumed that the regulation for recycled plastics will not be implemented at 4℃	X.X billion yen	JPY 0 billion
	Soaring feedstock costs	Palm oil	C	• At 2℃, stricter RSPO regulations tighten the supply-demand balance for certified oil and raise palm oil procurement costs (transition risks) • At 4℃, harvest volume increases with temperature increase, supply-demand tightness does not progress, and prices remain at the current level (physical risk)	X.X billion yen	X.X billion yen
Physical risk	Increase in the average temperature	Procurement price of plant-derived raw materials		• Increase in procurement cost due to decrease in cultivated area due to change in vegetation area of vegetable raw materials	X.X billion yen	X.X billion yen
	Increase in the average temperature	Procurement price of natural raw materials		• Decrease in cultivated area of natural crops and increase in procurement costs • Besides, the harvest volume of plant-based raw materials in the sub-tropical region is expected to increase (qualitative assessment)	Qualitative	Qualitative
	Increasing severity of extreme weather conditions	Damage to facilities, impact on infrastructure	D	• Increasing frequency of typhoons, storm surges, etc., is expected to cause damage to plant facilities and infrastructure and increase costs	X.X billion yen	X.X billion yen
	Increasing severity of extreme weather conditions	Shutdown and damage to the supply chain		• Sales are expected to decline due to plant shutdowns or suspension of product transportation (supply chain breakdown) (qualitative assessment)	Qualitative	Qualitative
	Water stress	Drought damage		• Water shortages are anticipated, leading to an increase in operating costs at production sites and a decline in sales due to supply chain breakdowns (qualitative assessment)	Qualitative	Qualitative

※ Quantitative assessments are difficult, but qualitative assessments are conducted on important matters.

Evaluate business impact: Opportunity

The 2℃ scenario has a greater impact on business profits than the 4℃ scenario, as the business impact is expected to see an increase in sales of detergents and other products along with an increase in temperature, as well as an increase in demand for disaster-prevention goods and water-saving products.

Risk Item				Impact on business	Business impact on annual earnings	
					2℃	4℃
Opportunity	Increase in the average temperature	Sales of detergents	E	• Increase in sales of detergents due to higher temperature	X.X billion yen	X.X billion yen
	Increase in the average temperature	Sales of perspiration control products	E	• Increase in sales of **antiperspirants** due to higher temperature	X.X billion yen	X.X billion yen
	Increase in the average temperature	Increase in infections	E	• Expansion of infectious diseases increases opportunities forhandwashing and profits of hand soap are expected to increase (qualitative assessment)	Qualitative	Qualitative
	Increasing severity of extreme weather conditions	Sales of disaster prevention goods	F	• Increase in demand for stockpiles (disaster prevention goods) at evacuation centers (qualitative assessment)	Qualitative	Qualitative
	Water stress (drought)	Water-saving products	G	• As the frequency of water shortages increases, consumer demand for water-saving products increases, and sales of water-saving products are expected to increase (qualitative assessment).	Qualitative	Qualitative
	Changes in customer behaviours	Ethical products	H	• Increased consumer interest in ethical products (qualitative assessment)	Qualitative	Qualitative
Total (transition risk, physical risk, opportunity)					**▲ X.X billion yen**	**▲ X.X billion yen**

※ Quantitative assessments are difficult, but qualitative assessments are conducted on important matters.

Identify potential responses:
Proposed Future Countermeasures for Risks/Opportunities

Promoted along with LION Eco Challenge 2050 measures and sustainable raw material purchasing measures

Item	Lion's Current Initiatives	Risk Countermeasures (Example)	Measures to Incorporate Opportunities (Examples)
Carbon price	✓ CO2 emissions generated by each of departments 30% reduction by 2030 (vs. 2017) Set the total amount and the target of zero emissions by 2050.	✓ Introduction of renewable energy	✓ N/A
Recycled plastics	✓ Set a target to double the amount of recycled plastics and biomass plastics used by 2030 ✓ Cooperation with TerraCycle to develop toothbrush recycling program	✓ Set further targets for reduction of virgin plastics from petrochemical ✓ Conversion to a sustainable resource circulation program	✓ Promoting cooperation with the recycling industry
Steep rise in the price of raw materials (palm oil)	✓ Replace all palm oil derivatives from no-certified to RSPO certified products by 2020. Formulation of sustainable raw material procurement policy for 2030	✓ Implement measures based on the company's own Sustainable Raw Material Procurement Guidelines	✓ N/A
Steep rise in the price of raw materials (other than palm oil)	✓ N/A	✓ Identification and monitoring of risks associated with the procurement of plant raw materials due to climate change	✓ N/A
Changes in customer behavior	✓ Establishment of in-house Lion Eco Standards and labeling of Eco-Products	✓ N/A	✓ Expansion of Eco/Ethical Products ✓ Promotion and educational activities concerning eco/ethical consumption
Increasing severity in extreme weather conditions	✓ Carry out awareness-raising activities for hygiene and health care in the event of a disaster ✓ Establishment of BCPs at business sites	✓ Understand the impact on supply chain (raw material suppliers, transportation and delivery) and strengthen countermeasures	✓ Expand sales of products for disaster prevention

Appendix.

Appendix.

Provide useful materials for scenario analysis based on supporting case studies

Appendix.

Appendix1. Parameter list

Appendix2. Physical risk assessment tools

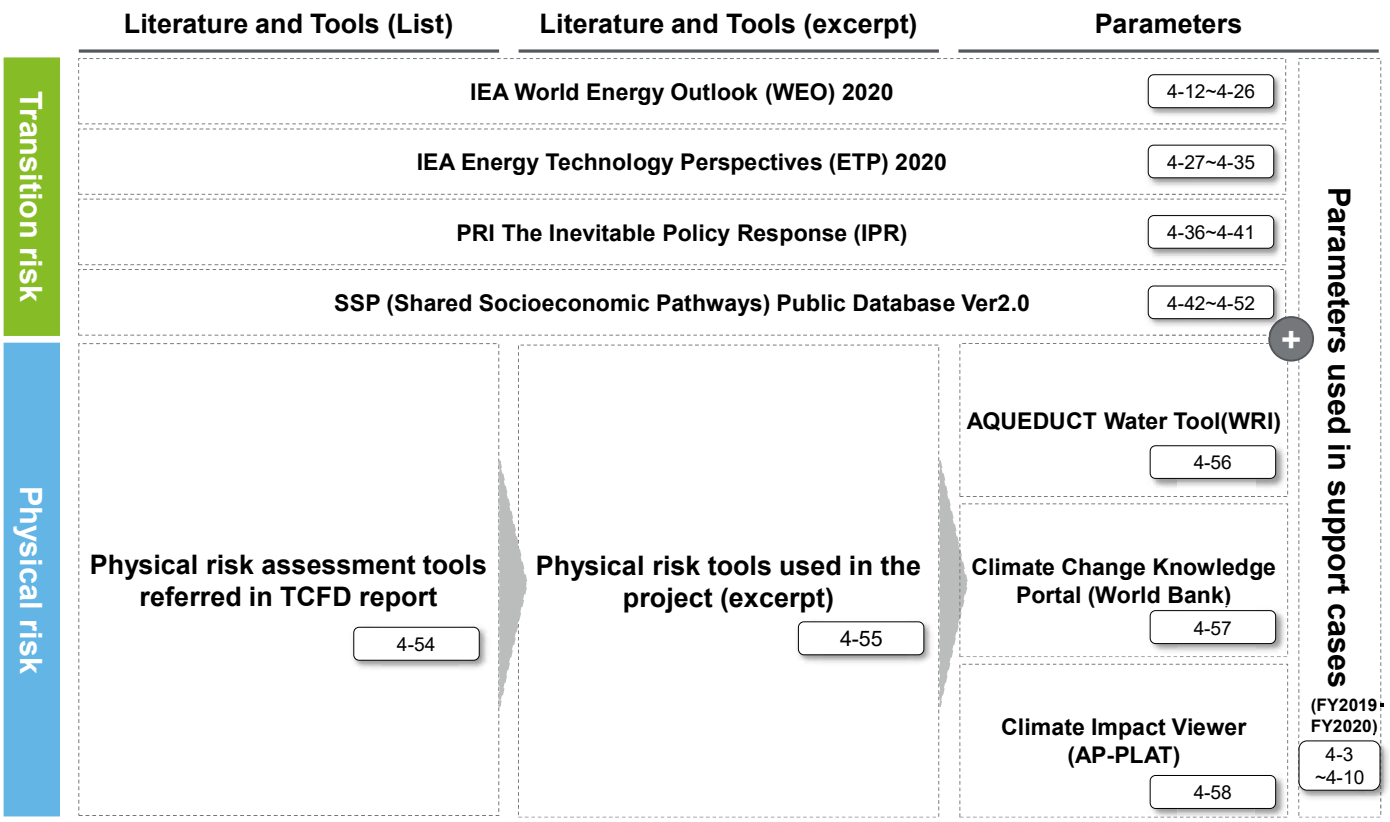
Appendix3. Examples of scenario analysis

Appendix.

Provide useful materials for scenario analysis based on supporting case studies

[Summary of parameter list]

Partial excerpts on transition risk and physical risk parameters



※ Data on parameters as of February 2021

【Parameters referenced in support cases 1/8】
Transition risk 1/5

	Item	Parameter	Source	Reference: Companies referenced parameters
Transition risk	**Carbon price**	Carbon tax	• IEA WEO 2018, IEA WEO 2019, IEA WEO 2020 • PRI IPR FPS • Information of countries	Kagome, Kajima Corporation., Calbee, Seven & i HD., Chiyoda Corporation, FUJIFILM HD, Furukawa Electric, Meiji Holdings HD, Lion Corporation, LIXIL, ASKUL Corporation, ORIX Asset Management Corporation, Kyushu Railway Company, Shin-Etsu Chemical, Mitsui Mining & Smelting, YASKAWA Electric Corporation
		Electricity price	• IEA WEO 2018	Kyocera, Seven & i HD., LIXIL, ASKUL Corporation, ORIX Asset Management Corporation, Kyushu Railway Company
	Carbon emissions targets/policies	Target values for emissions	• Ministry of the Environment's "Draft Japanese Commitments," "Toward Significant Reductions in Greenhouse Gases by 2050," IEA ETP • Target set by countries	Kajima Corporation., Kyocera, Seven & i HD., Chiyoda Corporation, FUJIFILM HD, Furukawa Electric, LIXIL, Kyushu Railway Company, Shin-Etsu Chemical, YASKAWA Electric Corporation
		Annual target of forest area decrease	• Indonesia NDC “First Nationally Determined Contribution REPUBLIC of INDONESIA”	ASKUL Corporation
	Changes in the energy mix	Power Generation Mix (Japan)	• IEA WEO2018,2019,2020 • PRI IPR FPS • Japanese Government	Kajima Corporation., FUJIFILM HD, Furukawa Electric, Chiyoda Corporation, LIXIL, Kyushu Railway Company, Mitsui Mining & Smelting, YASKAWA Electric Corporation
		Primary energy demand	• IEA WEO2019 • PRI IPR FPS	Chiyoda Corporation
		Final energy demand	• IEA WEO2019	Chiyoda Corporation
		LNG: pipeline ratio	• IEA WEO2019	Chiyoda Corporation
		Unit price of renewable energy generation	• IEA WEO2017	Kyocera, Furukawa Electric

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【 Parameters referenced in support cases 2/8】
Transition risk 2/5

	Item	Parameter	Source	Reference: Companies referenced parameters
Transition Risk	**Changes in energy costs**	Energy price (Oil, electricity)	• IEA WEO 2020	Mitsui Mining & Smelting
	Plastic Regulation	Recycled plastic usage rate	• EU Government • European Strategy for Plastics	ASKUL Corporation, Shin-Etsu Chemical
	Changes in important products	Newspaper production	• IEA WEO2018	FUJIFILM HD
		Recycled aluminum utilization rate Aluminum production	• IEA WEO2018 • IEA ETP2017	FUJIFILM HD, LIXIL
		Aluminum price	• World Bank " World Bank Commodities Forecast"	LIXIL
		Forecast demand for copper	• Sebastiaan Deetman others “Scenarios for demand growth of metals in electricity generation technologies, cars and electronic appliances”	Mitsui Mining & Smelting.
		Forecast demand for zinc	• World Bank “The Growing Role of Minerals and Metals for a Low Carbon Future“	Mitsui Mining & Smelting
		Forecast demand for lead	• World Bank “The Growing Role of Minerals and Metals for a Low Carbon Future“	Mitsui Mining & Smelting
		Forecast demand for Cobalt / nickel / platinum	• World Bank “The Growing Role of Minerals and Metals for a Low Carbon Future“	Mitsui Mining & Smelting
	Dissemination of renewable energy and energy-saving technologies	ZEB target	• METI's Basic Energy Program	Kajima Corporation
		ZEH introduction target	• Ministry of Economy, Trade and Industry, "Policy Trends for Promoting ZEV and Related Budget Draft for FY2018"	LIXIL
		ZEV ratio	• IEA ETP2017 • Shinichiro Fujimori et al. “The marker quantification of the Shared Socioeconomic Pathway 2: A middle-of-the-road scenario for the 21st century”	Seven & i HD., Chiyoda Corporation, Development Bank of Japan, Furukawa Electric, ASKUL Corporation, Kyushu Railway Company, Shin-Etsu Chemical
		Increase in the amount of electricity used for air-conditioning	• IEA「The Future of Cooling」(2018)	Seven & i HD.
		World's storage capacity	• IRENA “ELECTRICITY STORAGE AND RENEWABLES: COSTS AND MARKETS TO 2030”	Chiyoda Corporation, Furukawa Electric

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【Parameters referenced in support cases 3/8】
Transition risk 3/5

	Item	Parameter	Source	Reference: Companies referenced parameters
Transition risk	**Development of next-generation technologies**	CO2 recovery by CCSs	• IEA WEO 2018	FUJIFILM HD
		Hydrogen penetration rate	• IEA WEO 2019 • PRI IPR FPS	Chiyoda Corporation
		CCU penetration rate	• IEA WEO 2019 • ICEF Roadmap	Chiyoda Corporation
		Biomass production (primary energy)	• SSP Public Database Version 2.0	Development Bank of Japan
		Share of biomass in primary energy	• SSP Public Database Version 2.0	Development Bank of Japan
		Hydrogen-production (primary energy)	• SSP Public Database Version 2.0	Development Bank of Japan
		Share of hydrogen in primary energy	• SSP Public Database Version 2.0	Development Bank of Japan
		Production of renewable energy	• SSP Public Database Version 2.0	Development Bank of Japan
		Non biomass renewables's share in primary energy	• SSP Public Database Version 2.0	Development Bank of Japan
		CCSs' share of primary energy	• SSP Public Database Version 2.0	Development Bank of Japan
		Percentage of each energy (biomass, coal, oil, gas, fossil) in CCSs	• SSP Public Database Version 2.0	Development Bank of Japan
		Demand response capacity	• IEA ETP 2017	Kyocera
		Spread of environmental friendly trains	• East Japan Railway Company “Production of hybrid vehicle (fuel cell) test vehicle using hydrogen as energy source and implementation of demonstration test” June 2019	Kyushu Railway Company

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【 Parameters referenced in support cases 4/8】
Transition risk 4/5

	Item	Parameter	Source	Reference: Companies referenced parameters
Transition risk	**Changes in important products/ prices**	Oil price	• IEA WEO 2020	ASKUL Corporation, Kyushu Railway Company, Shin-Etsu Chemical
		Iron price	• 2ii "The Transition Risk-o-Meter Reference Scenarios for Financial Analysis"	Kyushu Railway Company
		Energy intensity	• Japanese Government	Shin-Etsu Chemical
		Smart city market size and M2M traffic	• SMART CITY PROJECT “Smart City – A Highest Priority in National Strategies across the world” • Statista “Smart City Market revenue worldwide 2019 – 2025, by segment”	Shin-Etsu Chemical
		Industrial robot market size in major countries	• Japanese Government and others	Shin-Etsu Chemical
		Sales of sustainable certified product	• Nielsen “Product Insider”	ASKUL Corporation
		Improvement rate of energy consumption intensity（Industrial sector）	• IEA WEO2019	YASKAWA Electric Corporation
		Market size of industrial robots	• International Federation of Robotics, World Robotics 2019 Industrial Robots, IEA, WEO2019	YASKAWA Electric Corporation
		Market size of AC servos for industrial robots	• Fuji Keizai “2020 Featured Mechatronics Parts Market Survey”, IEA, WEO2019	YASKAWA Electric Corporation
		Market size of industrial inverters	• Research Station LCC, Global market forecast for inverters, IEA, WEO2019	YASKAWA Electric Corporation
		Neodymium dysprosium demand forecast	• Sebastiaan Deetman他 “Scenarios for demand growth of metals in electricity generation technologies, cars and electronic appliances”	YASKAWA Electric Corporation

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【 Parameters referenced in support cases 5/8】
Transition risk 5/5

	Item	Parameter	Source	Reference: Companies referenced parameters
Transition risk	**Changes in customer reputation**	Market size of Smart city	• Tokyu “Integrated Report 2020”	Kyushu Railway Company
		Changes in the volume of air passenger	• 2ii "The Transition Risk-o-Meter Reference Scenarios for Financial Analysis"	Kyushu Railway Company
	Compliance with GHG emission regulations	Energy intensity of buildings	• IEA ETP2017 • MLIT ”Energy consumption reduction targets in global warming countermeasure plans based on the Paris Agreement”p.1	ORIX Asset Management Corporation
		Zero emission target of Tokyo	• Tokyo	ORIX Asset Management Corporation
		Emission factor of grid power	• IEA WEO2020	ORIX Asset Management Corporation
		Mandatory introduction of ZEB / ZEH（Government goal）	• IEA ETP2017 • Agency for Natural Resources and Energy General Energy Policy（2018.7） • METI	ORIX Asset Management Corporation
	Changes in customer behavior	Increase / decrease in rent due to environmental performance	• Xymax “Economic analysis of environmental management” • Smart Wellness Office Research Committee “Improving the sustainability of environmental real estate and its added value” • Japan Real Estate Institute “Investors' perceptions of real estate ESG investment” • JRE ”Economy of ESG Investment”（DBJ FY2019 Seminar “Sustainability and ESG Investment in Real Estate- GRESB evaluation result announcement and real estate ESG Investment outlook-”）	ORIX Asset Management Corporation

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【 Parameters referenced in support cases 6/8】
Physical risk 1/3

	Item	Parameter	Source	Reference: Companies referenced parameters
Physical risk	**Increases in the average temperature**	Average temperature in Japan	• “Japan’s weather at the end of the 21st Century” (2015) by the Ministry of the Environment and the Japan Meteorological Agency • World Bank, “Climate Change Knowledge Portal”	Kajima Corporation., Lion Corporation
		Changes in tomato, carrots and orange yield	• FAO,”GAEZ（Global Agro-Ecological Zones)“	Kagome
		Population at risk for mosquito-borne infections in East Asia	• Ministry of the Environment, “Global Warming and Infectious Diseases” • National Institute for Environmental Research on the Impact of Global Warming on Infections • Ryan SJ and others “Global expansion and redistribution of Aedes-borne virus transmission risk with climate change” (2019)	Meiji HD
		Number of outbreaks of waterborne infections (diagnostics) (Asia)	• Ministry of the Environment, “Global Warming and Infectious Diseases”	Meiji HD, Lion Corporation
		Loss of labor productivity due to heat stress in the industrial sector	• ILO “Working on a warmer planet”（2019）	Mitsui Mining & Smelting
		Increase of hot summer days	• WRI “The Aqueduct Global Flood analyzer” • World Bank "Climate Change Knowledge Portal"（ASKUL）	ASKUL Corporation, Mitsui Mining & Smelting
		Increase of temperature	• World Bank "Climate Change Knowledge Portal"	ASKUL Corporation, Kyushu Railway Company
		Relationship between temperature rise and electricity demand	• IEEJ	Kyushu Railway Company
		Track buckling rate	• ELSEVIER “Impacts of climate change on operation of the US rail network” (2017)	Kyushu Railway Company
		Air conditioning cost	• IEA “The Future of Cooling”	ASKUL Corporation
		Forest fire outbreak situation	• AP-PLAT	ASKUL Corporation
		Average temperature in Japan	• MOE・JMA「Japan's weather at the end of the 21st century」（2015） • World Bank, “Climate Change Knowledge Portal”	Kajima Corporation, Lion Corporation

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【Parameters referenced in support cases 7/8】
Physical risk 2/3

	Item	Parameter	Source	Reference: Companies referenced parameters
Physical risk	**Changes in precipitation / weather patterns**	Days of heavy rain (Japan)	• Japan's Weather at the End of the 21st Century (2015) by the Ministry of the Environment and the Japan Meteorological Agency • Ministry of the Environment, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Land, Infrastructure, Transport and Tourism, Meteorological Agency, "Observation and Prediction of Climate Change and Integrated Impact Assessment Report 2018-Climate Change and Its Impact in Japan" • World Bank, "Climate Change Knowledge Portal For Development practitioners and Policy Makers"	Kagome, Kajima Corporation, Seven & i HD., FUJIFILM HD, Lion Corporation
		Amount of rainfall	• "Japan's Climate at the End of the 21st Century," Ministry of the Environment and the Japan Meteorological Agency, "Observations and Forecasts of Climate Change and Integrated Report on Impact Assessments 2018-Climate Change and Its Impact in Japan." • Technical Review Committee on Flood Control Plans Based on Climate Change "Recommendations on Water Control Plans Based on Climate Change"	Kagome., LIXIL
	Effects of raw material growth due to changes in precipitation patterns and rises in average temperature	Changes in potato yield due to the impact of climate change	• "Climate change impact on global potato production"(2018)	Calbee
		Changes in oat yield due to the impact of climate change	• FAO"GAEZ (Global Agro-Ecological Zones)"	Calbee.
	Sea level rise	Magnitude of sea level rise	• Ministry of the Environment, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Land, Infrastructure, Transport and Tourism, Meteorological Agency, "Observation and Prediction of Climate Change and Integrated Impact Assessment Report 2018-Climate Change and Its Impact in Japan" • Japan Meteorological Agency Website "Past and Future Sea Level Changes in the World"	Furukawa Electric, Meiji HD
	Deterioration of labor and construction conditions	Rate of decrease in labor productivity due to heat stress	• ILO "Working on a warmer planet"	Kajima Corporation, Lion Corporation
		Extreme heat (Japan)	• Ministry of the Environment press release (2014) • Academic paper "Anthropogenic-contribution-to-global-occurrence-of-heavy-precipitation-and-high-temperature-extremes" (2015) • Ministry of the Environment, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Land, Infrastructure, Transport and Tourism, Meteorological Agency, "Observation and Forecasting of Climate Change and Integrated Impact Assessment Report 2018-Climate Change and its Impact in Japan."	Calbee, Seven & i HD.

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

【Parameters referenced in support cases 8/8】
Physical risk 3/3

	Item	Parameter	Source	Reference: Companies referenced parameters
Physical risk	**Increasing extreme weather conditions (typhoons, heavy rains, sediment, storm surges, etc.)**	Flood damage in urban areas	• WRI "The Aqueduct Global Flood Analyzer"	Kajima Corporation, ASKUL Corporation, ORIX Asset Management Corporation, Kyushu Railway Company, Mitsui Mining & Smelting
		Flow rate	• Ministry of Land, Infrastructure, Transport and Tourism, "Proposals for Flood Control Plans Based on Climate Change"	LIXIL
		Frequency of floods	• Ministry of Land, Infrastructure, Transport and Tourism, "Proposals for Flood Control Plans Based on Climate Change"	Kyocera, Lion Corporation, LIXIL, ASKUL Corporation, ORIX Asset Management Corporation, Kyushu Railway Company, Mitsui Mining & Smelting
		Occurrence of typhoons and cyclones	• MOE・JMA and Others 「Climate Change Observation / Forecast and Impact Assessment Integrated Report 2018 -Japan's Climate Change and Its Impact-」	ORIX Asset Management Corporation, Mitsui Mining & Smelting
		Average sea level rise	• IPCC「Mitigation Pathways Compatible with 1.5° C in the Context of Sustainable Development」(Mitsui) • MOE・JMA "Outline of IPCC Fifth Assessment Report -Working Group 1 Natural Science Basis-"2014(p.41)(ORIX)	ORIX Asset Management Corporation, Mitsui Mining & Smelting
		Water risk by base (flood, drought)	• WRI "The Aqueduct Global Flood analyzer"	Shin-Etsu Chemical, YASKAWA Electric Corporation
		Sediment disaster occurrence probability	• A-PLAT Climate Change Adaptation Information Platform	Kyushu Railway Company
	Drought	Water stress	• WRI "The Aqueduct"	Kagome., Furukawa Electric, Lion Corporation
	Changes in the marine environment	Changes in fish catches in general	• "Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems "(2012)	Calbee, Furukawa Electric

※ The parameters surveyed in the course of support program by the Ministry of the Environment are shown regardless of whether or not they are actually used by each company.

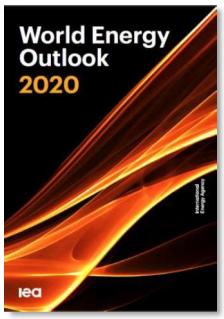
【IEA WEO, ETP】
Report on transition scenarios published by the IEA

IEA World Energy Outlook 2020
IEA Energy Technology Perspectives 2020

What is the International Energy Agency (IEA)?

- Organization established in 1974 after the first oil crisis to avert oil supply crises (to establish a stable energy supply and demand structure) of the member countries.
- The objective is to promote energy security through collective response by members to the physical disruptions of oil supply.
- Energy-related surveys, statistical compilation, and publication of various reports and books.
- There are 30 members, including Japan.

World Energy Outlook（WEO）



- A report on energy supply and demand published every autumn.
- World Energy Outlook includes medium and long-term energy market forecasts.

Energy Technology Perspectives（ETP）

- Describes the process of energy technology innovation.
- Focusing on opportunities and challenges for expanding and accelerating clean energy technologies.

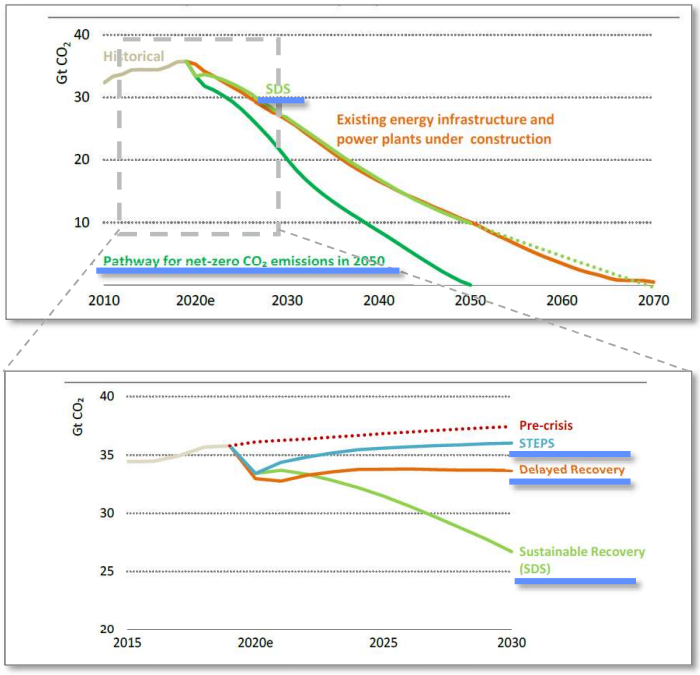
Source: IEA website

【The Outline of IEA WEO2020】
The 2 ℃ scenario and 2.7 ℃ scenario are the main scenarios, and the COVID stagnation scenario and 1.5 ℃ scenario are described.

The Scenario in WEO2020

Stated Policies Scenario (STEPS)	**The Scenario of Current Policy** Economic recovery in 2021 from the influences by COVID 2.7DS
Delayed Recovery Scenario (DRS) New	**The Scenario of World Economy Stagnation** Due to COVID
Sustainable Development Scenario (SDS)	**The Scenario of Achieving the target of Paris Agreement** 2DS
Net Zero Emissions by 2050 case (NZE2050) New	**The Scenario of Net Zero Emissions in 2050** 1.5DS

The transition of CO2 emissions in Energy Sector



Source：IEA Website

【The Outline of IEA WEO 2020：Delayed Recovery Scenario (DRS)】
DRE expects a 10% reduction in GDP due to COVID, a reduction in fuel consumption based on it, and changes associated with it.

Figure 1.2 ▷ Gross domestic product and primary energy demand by scenario

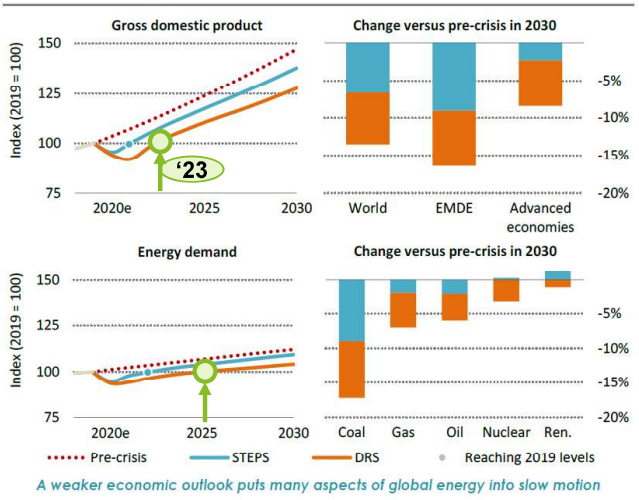


Table 2.1 ▷ Real GDP average growth assumptions by region and scenario

		STEPS/SDS			DRS
	2010-19	2019-25	2025-40	2019-40	2019-40
North America	2.3%	1.4%	2.0%	1.9%	1.4%
United States	2.3%	1.3%	1.9%	1.7%	1.4%
Central and South America	1.0%	1.8%	3.1%	2.7%	2.2%
Brazil	0.7%	1.2%	3.1%	2.6%	2.0%
Europe	1.9%	1.4%	1.5%	1.5%	1.1%
European Union	1.6%	1.2%	1.3%	1.3%	0.9%
Africa	3.1%	2.6%	4.4%	3.9%	3.5%
South Africa	1.5%	1.0%	2.8%	2.3%	1.9%
Middle East	2.2%	1.1%	3.1%	2.5%	2.1%
Eurasia	2.2%	1.6%	2.1%	2.0%	1.6%
Russia	1.6%	1.2%	1.6%	1.5%	1.1%
Asia Pacific	5.5%	4.2%	3.9%	4.0%	3.5%
China	7.2%	4.9%	3.6%	4.0%	3.6%
India	6.6%	4.5%	5.7%	5.4%	4.9%
Japan	1.0%	0.7%	0.9%	0.8%	0.6%
Southeast Asia	5.1%	4.2%	4.1%	4.2%	3.6%
World	3.4%	2.7%	3.1%	3.0%	2.6%

10%

The Scenario of World Economy Stagnation due to COVID
GDP will recover to 2019 levels in 2023. Energy demand will return to 2019 levels in 2025. World economy shrinks 10% of STEPS in 2040

Source：IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 1/13】
Carbon price, CO2 emissions 1/3

IEA World Energy Outlook 2020

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Carbon price	CO2 prices in selected regions by scenario ($2019 per tonne)				○					○	
CO2 emissions	Energy-sector and industrial process CO_2 emissions by recovery trajectory	○	○	○					○		
	CO_2 emissions from energy infrastructure in use and power plants under construction operated in line with past practice	○	○	○					○		
	Large methane emissions from oil and gas operations detected by satellite in 2019 and 2020	○	○						○		
	CO2 emissions reductions in the Sustainable Development Scenario and Net Zero Emissions by 2050 case, 2019-2030	○		○					○		
	Key estimated energy demand, CO_2 emissions and investment indicators, 2020 relative to 2019	○	○						○		
	CO_2 emissions from existing energy infrastructure and power plants under construction operated in line with past practice	○	○	○					○		
	Change in CO_2 emissions by sector, 2019-2030, and average annual investment 2021-2025 in the Sustainable Development scenarios in WEO-2019 and WEO-2020	○	○						○		
	Historical and projected CO_2 emissions from energy infrastructure in use and power plants under construction operated in line with past practice	○	○	○	○	○	○	○	○		
	CO2 emissions reductions in the Sustainable Development Scenario relative to the Stated Policies Scenario	○	○	○					○		
	CO_2 emissions from coal-fired plants and average annual change by scenario	○	○	○					○		
	CO_2 emissions from selected transport modes in the Sustainable Development Scenario and the Stated Policies Scenario	○	○	○					○		
	Direct and indirect CO_2 emissions in buildings in the Stated Policies and the Sustainable Development scenarios	○	○	○					○		
	Direct CO_2 emissions reductions in selected sectors in the Sustainable Development Scenario	○	○	○	○	○			○		

 Source：IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 2/13】
CO2 emissions 2/3

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
CO2 emissions	Energy and industrial process CO_2 emissions and reduction levers in the scenarios	○	○	○					○		
	CO_2 emissions reductions by sector in the NZE2050, 2019-2030	○		○					○		
	Global primary energy demand and CO2 emissions in 2030			○					○		
	Behaviour change measures and impact on CO_2 emissions in the NZE2050 to 2030			○					○		
	Impact of behaviour changes on CO_2 emissions in the NZE2050			○					○		
	Global frequency distribution of car trips by length and corresponding cumulative CO_2 emissions								○		
	Impact on CO_2 emissions from reducing space heating temperature settings by 3 ° C in the NZE2050		○	○					○	○	
	Change in annual global energy consumption and CO_2 emissions from one day of home working per week		○	○					○		
	CO_2 emissions from passenger aviation by flight duration and trip purpose in 2018 and in the NZE2050 in 2030	○		○					○		
	Announced net-zero CO_2 or GHG emissions by 2050 reduction targets					○				○	
	Remaining CO_2 emissions in selected sectors in the European Union in the Sustainable Development Scenario in 2050					○				○	
	Global energy demand and CO_2 emissions trends in the Stated Policies Scenario to 2030	○	○	○					○		
	Cumulative energy efficiency savings in selected regions in STEPS	○	○	○					○		

 Source：IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 3/13】
CO2 emissions 3/3, Energy demand 1/5

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
CO2 emissions	CO_2 emissions and carbon intensity in the power sector in selected regions in the Stated Policies Scenario	○	○	○						○	
	Reductions in GHG emissions attributable to changes in natural gas supply and use in the Sustainable Development Scenario, 2019-2040	○	○	○	○				○		
	Change in CO_2 emissions by effect in the Delayed Recovery Scenario relative to the Stated Policies Scenario			○	○				○		
	Energy sector and industrial process CO_2 emissions in the scenarios, 2010-2030		○	○					○		
Energy demand	Total primary energy demand by fuel and scenario	○		○					○		
	Gross domestic product and primary energy demand by scenario		○	○					○	○	
	Oil demand by scenario and changes by key sector	○	○	○	○				○		
	Changes in natural gas demand by driver in the Stated Policies and Sustainable Development scenarios, 2019-2040	○	○	○	○				○		
	Share of global energy demand affected by full or partial lockdowns, 2020		○							○	
	Liquids demand and supply in 2020 relative to 2015-2019	○	○						○		
	Year-on-year change in weekly electricity demand in selected countries, 2020		○							○	
	Change in electricity demand by region	○	○						○	○	
	Change in renewables and nuclear power generation and fossil fuel demand by region 2019-2020	○	○							○	
	Changes in fuel consumption for energy and feedstock use in industry in the Sustainable Development Scenario, 2019-2030	○	○	○					○		

 Source：IEA World Energy Outlook 2020

【 Parameters in IEA WEO 2020 4/13】
Energy demand 2/5

Category	Datasets	Timeframe							Country/region		
		Past	’20	’30	’40	’50	’60	’70	Global	Several areas	Japan
Energy demand	Primary energy demand in the scenarios	○	○	○					○		
	Total final energy consumption by sector in the NZE2050	○	○	○					○		
	Differences in fossil fuel demand in the scenarios in 2030			○					○		
	Efficiency improvements in heavy industry and share of lowcarbon hydrogen used in ammonia and methanol production								○		
	Retrofit of existing floor area (left) and share of heat pumps to meet space heating energy needs (right)	○	○	○						○	
	Total final consumption in the Stated Policies Scenario, 2019-2030	○	○	○					○		
	Changes in primary energy demand by fuel and region in the Stated Policies Scenario, 2019-2030	○	○	○					○		
	Total primary energy demand by key fuels in the Stated Policies Scenario relative to the WEO-2019, 2030-2040			○	○				○		
	Key post-COVID uncertainties affecting oil demand								○		
	Key post-COVID uncertainties affecting natural gas demand									○	
	Key post-COVID uncertainties affecting coal demand									○	
	Key post-COVID uncertainties affecting modern end-use renewables								○		
	Global oil demand in the States Policies Scenario	○	○	○					○		
	Oil demand by sector in the Stated Policies Scenario, 2019-2030	○	○	○					○		

Source：IEA World Energy Outlook 2020

【 Parameters in IEA WEO 2020 5/13】
Energy demand 3/5

Category	Datasets	Timeframe							Country/region		
		Past	’20	’30	’40	’50	’60	’70	Global	Several areas	Japan
Energy demand	Impacts of deferred car sales on oil demand relative to pre-crisis projected trends, 2020 and 2025		○						○		
	Oil demand for trucks and key drivers of change in the Stated Policies Scenario	○		○					○		
	Reduction in aviation oil demand due to behavioural changes	○		○					○		
	Drivers of changes in transport oil demand and impacts of behaviour changes in the Stated Policies Scenario	○	○	○					○		
	Change in natural gas demand by sector in STEPS, 2019-2030	○	○	○					○		
	Drivers of change in natural gas demand in the power sector in STEPS in advanced and emerging economies, 2020-2030	○	○	○						○	
	Change in natural gas demand in industry by key driver in STEPS, 2019-2030	○	○	○						○	
	Coal consumption by sector (2010-2030)	○	○	○						○	
	Annual change of coal demand by region (2020-2030)	○	○	○					○	○	
	Heat supply in residential and industry	○		○					○		
	Annual change in final demand and avoided demand through energy efficiency by sector in the Stated Policies Scenario	○	○	○					○		
	Global electricity demand and share of electricity in total final consumption in the Stated Policies Scenario	○	○	○					○		
	Annual change in global electricity demand by sector in the Stated Policies Scenario		○	○					○		
	Changes in electricity demand in selected regions in the Stated Policies Scenario	○	○	○						○	

 Source：IEA World Energy Outlook 2020

IEA World Energy Outlook 2020

【 Parameters in IEA WEO 2020 6/13】
Energy demand 4/5

Category	Datasets	Timeframe							Country/region		
		Past	’20	’30	’40	’50	’60	’70	Global	Several areas	Japan
Energy demand	Drivers of electricity demand in emerging market and developing economies in the Stated Policies Scenario	○	○	○	○				○		
	Drivers of electricity demand in advanced economies in the Stated Policies Scenario	○	○	○	○				○		
	Recent revenue trends for transmission system operators in selected regions	○								○	
	Global oil demand by scenario and declines in supply from 2019	○	○	○	○				○		
	Changes in oil product demand by type and call on refineries in the Stated Policies Scenario	○		○					○		
	Refinery runs and capacity at risk in selected regions in the Stated Policies Scenario	○		○	○					○	○
	Breakeven costs of non-associated gas resources developed for domestic consumption in selected Middle East countries in the Stated Policies Scenario, 2020-2040		○	○	○					○	
	Global liquefaction capacity versus total LNG demand by scenario	○	○	○	○				○		
	Demand for hydrogen from electrolysis and fossil fuels with CCUS by scenario			○	○				○		
	Change in energy demand in the Delayed Recovery Scenario relative to the Stated Policies Scenario		○	○					○		
	Energy demand by sector and region in the Delayed Recovery Scenario compared with the Stated Policies Scenario		○	○	○					○	
	Global oil demand by scenario and sector to 2030	○	○	○					○		
	Global electricity demand by scenario and sector to 2030	○	○	○					○		
	Global natural gas demand by scenario and sector to 2030	○	○	○					○		

Source：IEA World Energy Outlook 2020

IEA World Energy Outlook 2020

【 Parameters in IEA WEO 2020 7/13】
Energy demand 5/5, Energy mix , Price of key commodities/products

Category	Datasets	Timeframe							Country/region		
		Past	’20	’30	’40	’50	’60	’70	Global	Several areas	Japan
Energy demand	Coal demand in the DRS and reduction in 2030 by sector relative to the STEPS	○	○	○					○		
	Global total final consumption of renewables by scenario, 2030			○					○		
Energy mix	Energy sector transformation in advanced economies (top) and emerging market and developing economies (bottom)	○		○					○		
	Total primary energy demand in the Stated Policies Scenario, 2019 and 2030	○		○					○		
	Change in total primary energy in the States Policies and Sustainable Development scenarios, 2019-2030	○	○	○					○		
	Growth of renewable energy by sector and by source in the Stated Policies Scenario	○	○	○					○		
	Renewables, nuclear and coal shares of global electricity supply in the Stated Policies Scenario, 2010-2030	○	○	○					○		
	CAAGR of key energy intensity and efficiency indicators by sector and scenario, 2020-2030		○	○					○		
Price of key commodities /products	Fossil fuel prices by scenario	○		○	○					○	○
	Selected fossil fuel prices in 2019-2020	○	○							○	
	Changes in payback period for key efficiency measures under low fossil fuel prices								○		
	Difference in natural gas import costs in China and the European Union under 100% spot or 100% oil-indexed prices	○	○							○	

Source：IEA World Energy Outlook 2020

IEA World Energy Outlook 2020

【 Parameters in IEA WEO 2020 8/13】
Predictions on production and sales 1/4

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Predictions on production and sales	Average annual solar PV and coal annual capacity additions worldwide and electricity generation by scenario	○	○	○					○		
	Estimated present value of future oil and natural gas production to 2040 by scenario				○				○		
	Real GDP average growth assumptions by region and scenario	○	○	○	○					○	
	Evolution of global GDP forecasts for 2020 and historical context	○	○						○		
	Changes in cost of capital macro indicators for selected countries, 2019-2020, and their indicative impact on the levelised cost of new onshore wind	○	○							○	
	Changes in the global average emissions intensity of oil and gas operations between 2019 and 2030 in the Sustainable Development Scenario	○		○					○		
	Average annual solar PV and wind capacity additions in the Sustainable Development Scenario to 2030	○	○	○					○	○	
	Global installed solar PV capacity by scenario, 2010-2030, and annual solar PV capacity additions in the NZE2050	○	○	○						○	
	Use of fossil fuels for industrial process heat in 2019 and in the three scenarios in 2030	○		○					○		
	Annual electric and fuel cell vehicle sales in the three scenarios	○	○	○					○		
	Global growth in selected energy-related activities in the Sustainable Development Scenario, 2019-2030	○	○	○					○		
	Electricity generation in the United Kingdom historically and in the CCC's "Further Ambition" scenario in 2050					○				○	
	Electricity generation by source in the European Union in the Sustainable Development Scenario, 2019-2050	○		○		○				○	

 Source：IEA World Energy Outlook 2020

IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 9/13】
Predictions on production and sales 2/4

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Predictions on production and sales	Business models and indicative WACCs of solar PV projects, 2019	○								○	
	Electricity outlook in the Stated Policies Scenario, 2019-2030	○	○	○						○	
	Global average annual power capacity additions in the Stated Policies Scenario	○	○	○					○		
	Solar PV and wind power capacity additions in the Stated Policies Scenario	○	○	○	○				○	○	
	Power capacity in India by source in the Stated Policies Scenario	○	○	○	○				○		
	Average annual coal-fired power capacity additions and retirements by region in the Stated Policies Scenario, 2011-2030	○	○	○						○	
	Nuclear power installed capacity, capacity additions and retirements in the Stated Policies Scenario, 2019-2030	○		○					○		
	Indicative WACC for utility-scale solar PV projects with revenue support	○	○							○	
	Utility-scale solar PV LCOE under revenue support mechanisms, 2020 FID		○						○		
	Power system flexibility needs in selected regions in the Stated Policies Scenario, 2020-2030		○	○						○	
	Battery storage capacity and share of variable renewables in selected regions in the Stated Policies Scenario		○	○						○	
	Fuel supply by scenario	○	○	○	○				○		
	Estimated present value of future upstream net income for publicly listed companies by scenario to 2040				○				○		
	Differences in US tight crude and condensate production at various levels of average annual investment to 2030	○	○	○					○		

 Source：IEA World Energy Outlook 2020

【 Parameters in IEA WEO 2020 10/13】
Predictions on production and sales 3/4

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Predictions on production and sales	Indicators of financial resilience and changes in production for selected producer economies in the Stated Policies Scenario	○	○	○						○	
	Oil production by type and region in the Stated Polices Scenario	○	○	○					○		
	Top-12 oil-producing countries in the Stated Policies Scenario, 2019 and 2040	○			○					○	
	Changes in natural gas production in the Stated Policies Scenario, 2019-2030	○	○	○						○	
	Changes in natural gas production for today's ten-largest producers in the Stated Policies Scenario, 2019-2040	○	○	○	○					○	
	Share price and cost of long-term debt for selected coal companies	○	○							○	
	Coal production by key country	○		○					○	○	
	Supply of low-carbon fuels by scenario	○			○				○		
	Biomethane production by region in the Stated Policies Scenario and sensitivity on cost-competitive volumes available in 2040	○		○	○				○	○	
	Cost gap to be bridged between the costs of delivered lowcarbon and merchant hydrogen in Europe, 2020 and 2030		○	○						○	
	Real gross domestic product by scenario, 2019-25	○	○							○	
	Reduction in oil production by selected regions in the Delayed Recovery Scenario relative to the Stated Policies Scenario, 2030			○						○	
	Electricity generation mix in the Delayed Recovery Scenario relative to the Stated Policies Scenario, 2019-2030	○	○	○						○	
	Change in natural gas export revenue in selected regions in the Delayed Recovery Scenario relative to the Stated Policies Scenario, 2020-2040		○	○	○					○	

Source：IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 11/13】
Predictions on production and sales 4/4, Technology, Policy/Regulation 1/2

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Predictions on production and sales	Net income from oil and gas in selected producer economies in successive World Energy Outlook scenarios for 2020-2030	○	○	○						○	
	Acquisitions and refinancing of energy supply projects	○	○						○		
Technology	Evolution of selected technologies in the Sustainable Development Scenario and Net Zero Emissions by 2050 case	○	○	○					○		
	Capital costs for selected energy technologies in 2040 relative to 2019	○			○				○		
	Coal-fired electricity generation by technology in the NZE2050	○	○	○					○		
	Share of most efficient available technologies in cumulative residential equipment sales, 2020-2030		○	○					○		
	Evolution of selected end-use technologies in the European Union in the Sustainable Development Scenario, 2050	○		○		○				○	
	Estimated technically avoidable methane emissions for selected companies by type of asset, 2019	○							○		
	Variation of low-carbon hydrogen production capacity with project capital budget and technology choice, 2020		○						○		
Policy/Regulation	Average annual energy investment by economy and instrument by scenario	○	○	○					○	○	
	Average annual energy investment in the Sustainable Development Scenario	○								○	
	Clean energy-related investment in the Sustainable Development Scenario, 2025-2030			○						○	
	Key financing issues and strategies to bridge investment gaps								○		
	Selected new energy-related policies adopted in 2019 and 2020 by country	○	○						○		

Source：IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 12/13】
Policy/Regulation 2/2, Air pollution, Other 1/2

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Policy/Regulation	Global power sector investment in the Stated Policies Scenario	○	○	○	○					○	
	Redoubling efforts to shift to a sustainable electricity pathway	○	○	○					○		
	Length of new and replaced electricity network lines by selected region in the Stated Policies Scenario, 2019-2030	○	○	○					○		
	Annual investment in electricity networks by sector in the Stated Policies Scenario	○	○	○						○	
	Historical and planned investments in large-scale CCUS projects, 1980-2030	○	○	○					○		
	Impact of a longer pandemic on global grid investments and revenues	○	○	○					○		
	Global energy supply investment by sector in the Delayed Recovery Scenario and average annual change relative to the Stated Policies Scenario	○	○	○					○		
Air pollution	Air pollution emissions by pollutant and related premature deaths, 2019 and 2030	○		○					○		
	Premature deaths from air pollution by region and air pollution emissions by pollutant and scenario, 2019 and 2030	○	○	○					○	○	
	PM2.5 levels in selected cities in 2015 and in the SDS in 2030, and change in PM2.5 during lockdowns	○		○						○	
Other	Annual changes in population without access to electricity in sub-Saharan Africa by scenario	○	○							○	
	New reported COVID-19 cases by region		○							○	
	People with access to electricity in Asia and Africa at risk of losing the ability to pay for basic electricity services in 2020		○							○	
	Population without electricity access and sovereign risk in key access deficit countries	○	○							○	

Source：IEA World Energy Outlook 2020

【Parameters in IEA WEO 2020 13/13】
Other 2/2

Category	Datasets	Timeframe							Country/region		
		Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Other	Population without electricity access and sovereign risk in key access deficit countries	○	○							○	
	Population without access to energy in the Stated Policies and Delayed Recovery scenarios by region, 2019-2030	○	○	○					○	○	
	Sustainable debt issuance and types of issuers	○	○						○		
	Key post-COVID uncertainties affecting efficiency								○		
	Population without access to clean cooking and traditional use of biomass per capita by region in the STEPS, 2019-2030	○		○					○	○	
	Energy intensity improvements and trajectories	○	○	○					○		
	Population without access to electricity by main countries and regions in the Stated Policies Scenario, 2019-2030	○	○	○					○	○	
	Selected indicators in the Delayed Recovery Scenario	○	○	○					○		
	Population without access to electricity and clean cooking by scenario (million)	○		○					○	○	

Source：IEA World Energy Outlook 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020　1/9】
CO2 emissions　1/4

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
CO2 emissions	General	Global primary energy demand and energy-related CO2 emissions, 1971-2020	○							○		
	General	Global energy-related CO2 emissions by region	○							○	○	
	General	Global energy sector CO2 emissions by fuel and technology in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	General	Cumulative energy sector CO2 emissions by region and scenario, 2019-70	○	○	○	○	○	○	○	○	○	
	General	Global CO2 emissions in transport by mode in the Sustainable Development Scenario, 2000-70	○	○	○	○	○	○	○	○		
	General	Global industrial energy consumption and CO2 emissions in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	General	Global energy consumption and CO2 emissions in long-distance transport by sub-sector in the Sustainable Development and Stated Policies scenarios	○	○	○	○	○	○	○	○		
	General	Global energy sector CO2 emissions reductions by current technology maturity category in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-70	○	○	○	○	○	○	○	○		
	General	Global CO2 emissions reductions by current technology maturity category and sector in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2040 and 2070				○			○	○		
	General	Global energy sector CO2 emissions by sector, 2019 and 2050	○				○			○		
	General	Global captured CO2 emissions by source, 2050					○			○		
	General	Share of energy-related CO2 emissions covered by national and supra-national public net-zero emissions targets today	○							○		
	Specific sector	Global energy-related CO2 emissions by fuel (left) and sector (right), 2000-19	○							○		
	Specific sector	Global CO2 emissions from existing energy infrastructure by sub-sector, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global energy sector CO2 emissions by sector and sub-sector/fuel in the Sustainable Development Scenario, 2040 and 2070				○	○	○	○	○		
	Specific sector	Growth in global CO_2 capture by sector and fuel in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global energy sector CO2 emissions by sector in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global direct CO2 emissions in industry by sub-sector and region in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○		○	

4-27 Source：IEA Energy Technology Perspectives 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 2/9】
CO2 emissions　2/4

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
CO2 emissions	Specific sector	Global chemical sector direct CO2 emissions and energy consumption in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	CO2 emissions from the use phase of buildings by sub-sector and region in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○		○	
	Specific sector	Global iron and steel sector direct CO2 emissions and energy consumption in the Sustainable Development Scenario, 2019-70	○	○	○		○		○	○		
	Specific sector	Global cement sector direct CO2 emissions and energy consumption in the Sustainable Development Scenario, 2019-70	○	○	○		○		○	○		
	Specific sector	Decomposition of embodied cement and steel sector CO2 emissions in buildings construction, 2000-20	○	○						○		
	Specific sector	CO2 emissions in the buildings and construction value chain in the Sustainable Development Scenario, 2010-70	○	○	○	○	○	○	○	○		
	Specific sector	World cement- and steel-related CO2 emissions in the buildings construction sector by scenario and driver, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Share of vehicle sales covered by fuel economy and/or CO2 emissions standards by vehicle type and country/region	○								○	○
	Specific sector	Global CO2 emissions from trucks by abatement measure (left) and technology readiness level (right) in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global freight activity, energy consumption and CO2 emissions in international maritime shipping by vessel type and fuel, 2019	○							○		
	Specific sector	Global energy consumption and CO2 emissions in international shipping in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Share of activity covered by corporate carbon-neutral targets among the largest corporate players										
	Specific sector	Global CO2 emissions locked in by existing energy-related assets by sector measured against the CO2 emissions trajectory of the Sustainable Development Scenario, 2019-70										
	Specific sector	Unlocking CO2 at the next investment cycle in key industrial sectors	○		○	○	○	○			○	
	Amount of reduction	The technology portfolio for reducing direct industrial CO2 emissions, 2040 and 2070				○			○	○		
	Amount of reduction	Global CO2 emissions reductions in shipping by mitigation category (left) and technology readiness level (right) in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-70	○	○	○	○	○	○	○	○		

4-28 Source：IEA Energy Technology Perspectives 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 3/9】
CO2 emissions 3/4

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
CO2 emissions	Amount of reduction	Selected decarbonisation indicators by scenario in 2050	○				○			○		
	Amount of reduction	Global CO2 emissions in aviation by abatement measure (left) and technology readiness level (right) in the Sustainable Development Scenario relative to the Stated Policies Scenario	○	○	○	○	○	○	○	○		
	Amount of reduction	Contribution to global energy sector annual CO2 emissions reductions in 2050 by current technology maturity category					○			○		
	Amount of reduction	Global energy sector annual CO2 emissions reductions by type of abatement measure and total primary energy demand, 2050					○			○		
	Amount of reduction	Global energy sector CO2 emissions reductions by measure in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Amount of reduction	Global CO2 emissions reductions in the cement sector by mitigation strategy and current technology maturity category, 2019-70	○	○	○	○	○	○	○	○		
	Amount of reduction	Global CO2 emissions reductions from electrification by sector in the Sustainable Development Scenario relative to the Stated Policies Scenario,2030-70			○	○	○	○	○	○		
	Amount of reduction	Global CO_2 use for fuel and feedstock production in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Amount of reduction	Global CO2 emissions reductions from hydrogen by sector in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2030-70			○	○	○	○	○	○		
	Amount of reduction	Global CO2 reductions from bioenergy use in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2030-70			○	○	○	○	○	○		
	Amount of reduction	Global CO2 emissions in the power sector by scenario and decomposition of the difference by technology type	○	○	○	○	○	○	○	○		
	Amount of reduction	Global development of electrolyser capacity and CO2 capture from hydrogen by region in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○		○	
	Amount of reduction	Global cumulative CO2 emissions reductions in the buildings sector by mitigation lever and technology readiness level in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2020-70		○	○	○	○	○	○	○		
	Amount of reduction	Global CO2 emissions reductions in the chemical sector by mitigation strategy and current technology maturity category, 2019-70	○	○	○	○	○	○	○	○		
	Amount of reduction	Global CO2 emissions reductions in the iron and steel sector by mitigation strategy and current technology maturity category, 2019-70	○	○	○	○	○	○	○	○		
	Power generation	Emissions from US coal-fired power plants, 1990-2018	○								○	

4-29 Source：IEA Energy Technology Perspectives 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 4/9】
CO2 emissions 4/4, Energy demand

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
CO2 emissions	Intensity	CO2 emissions by income quartile (left) and air trips by GDP per capita and region, 2018 (right)	○								○	
Energy demand	Primary energy	Global total primary energy demand, population and GDP, 1950-2019	○							○		
	Primary energy	Annual change in GDP, total primary energy demand and energy intensity in selected countries/regions, 2000-19	○							○	○	
	Primary energy	Global primary energy demand by fuel, 1925-2019	○							○		
	Primary energy	Primary demand for low-carbon energy sources, 2000-19	○							○		
	Primary energy	Primary energy demand by fuel and scenario (Mtoe)	○			○			○	○		
	Primary energy	Global primary energy demand by fuel share and scenario, 2019 and 2070	○						○	○		
	Primary energy	Primary energy demand by region and scenario	○			○			○		○	
	Final energy	Final energy consumption by sector, fuel and scenario	○			○			○	○		
	Final energy	Change in global final energy demand by fuel and sector in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Final energy	Global final energy demand for hydrogen by sector and share of hydrogen in selected sectors in the Sustainable Development Scenario	○	○	○	○	○	○	○	○		
	Final energy	Final energy demand by fuel shares for total industry and selected sub-sectors in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Final energy	Global share of hydrogen and electricity in final energy demand by end-use sector (left) and selected adoption metrics of hydrogen technologies (right), 2019 and 2050	○				○			○		
	Renewable energy	Global bioenergy demand by sector and share of bioenergy use in key sectors in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global transport sector energy consumption by fuel in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global heavy-duty trucking energy demand by fuel and average vehicle efficiency in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global aviation fuel consumption in the Sustainable Development Scenario and total fuel use in the Stated Policies Scenario, 2019-70		○	○	○	○	○	○	○		
	General	Global hydrogen production by fuel and hydrogen demand by sector in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		

Source：IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 5/9】
Energy mix , Price of key commodities/products , Predictions on production and sales 1/2

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Energy mix	Power supply	Growth in global electricity consumption by sector and scenario and electricity share in total final consumption in the Sustainable Development Scenario	○	○	○	○	○	○	○	○		
	Power supply	Contribution of residential cooling and electric vehicles to net electricity load in China in the Sustainable Development Scenario, 2030			○						○	
	Coal	Coal-fired electricity generation from existing plants in the Stated Policies and Sustainable Development scenarios, 2019-70	○	○	○	○	○	○	○	○		
	Investment	Global cumulative investment in selected energy infrastructure in the Sustainable Development Scenario				○			○			
Price of key commodities/products	Specific sector	The effect of battery and fuel cell prices on total cost of ownership of heavy-duty trucks in long-haul operations								○		
	Specific sector	Capital cost reductions of selected clean energy technologies at early stages of adoption in the Sustainable Development Scenario, 2019-30			○							
Predictions on production and sales	Power supply	Projected synthetic kerosene production costs from different sources and impact of electricity costs and full-load hours, 2050					○			○		
	Gas	US production of shale oil* and gas, 2000-19	○								○	
	General	Production growth in key heavy industries, 2000-30	○	○	○					○		
	General	Period from first prototype to market introduction for selected technologies, including the quickest examples in recent developments	○	○	○					○		
	Renewable energy	Global biofuels production by technology in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Renewable energy	Global hydrogen production and demand in the Sustainable Development Scenario, 2070							○	○		
	Renewable energy	Global hydrogen production by technology in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Renewable energy	Production of hydrogen-based fuels in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Light-duty vehicle market share by size segment, 2005-17	○							○		
	Specific sector	Age profile of global production capacity for key industrial sub-sectors	○							○		
	Specific sector	Age profile and geographic distribution of road transport vehicles	○								○	○
	Specific sector	Reduction in global steel and cement demand through material efficiency gains by stage in the supply chain in the Sustainable Development Scenario relative to the Stated Policies Scenario in 2070							○	○		
	Specific sector	Global copper and lithium demand by sector and scenario	○	○	○	○	○	○	○	○		

 Source：IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 6/9】
Predictions on production and sales 2/2

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Predictions on production and sales	Specific sector	Global primary chemical production by scenario and plastic demand by market segment, 2019-70	○	○	○	○	○	○	○	○		
	Specific sector	Global primary chemicals production routes by energy feedstock in the Sustainable Development Scenario, 2000-70	○	○	○	○	○	○	○	○		
	Specific sector	Levelised cost of ammonia and methanol production under varying techno-economic assumptions								○		
	Specific sector	Global steel production by region and end use, 2019-70	○	○	○	○	○	○	○		○	
	Specific sector	Global steel production by route and iron production by technology in the Sustainable Development Scenario, 1990-2070	○	○	○	○	○	○	○	○		
	Specific sector	Levelised cost of steel production for selected production routes when they reach commercialisation	○	○	○					○		
	Specific sector	Levelised cost of steel production for selected production pathways at varying gas, electricity and CO2 prices								○		
	Specific sector	Global cement production by region and end use, 2019-70		○					○		○	
	Specific sector	Global cement production by technology and material composition in the Sustainable Development Scenario, 2000-70	○	○	○	○	○	○	○	○		
	Specific sector	Levelised cost of cement production under varying techno-economic assumptions								○		
	Specific sector	Projected year-to-year growth of residential construction activity in 2020 relative to 2019	○	○							○	○
	Specific sector	Heavy-duty truck fleet and share of road fuel demand, 2019	○							○	○	
	Specific sector	Growth of revenue passenger-kilometres by region, 2013-19	○								○	
	Specific sector	Share of flights and fuel use in overall commercial passenger aviation, 2017	○							○		
	Specific sector	Levelised production costs of sustainable aviation fuels in 2050					○			○		
	Specific sector	Heating equipment sales share and share of near-zero energy buildings by region in the Sustainable Development Scenario		○		○			○	○	○	
	Specific sector	Global share of vehicle activity electrified by mode in the Faster Innovation Case relative to the Sustainable Development Scenario, 2050					○			○		

 Source：IEA Energy Technology Perspectives 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 7/9】
Technology 1/2

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Technology	General	Global power generation by fuel/technology in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
	General	Electricity generation mix by region, fuel/technology and scenario, 2019 and 2070	○						○	○	○	
	General	Four stages of technology innovation, feedbacks and spillovers that improve successive generations of designs								○		
	General	Public energy technology R&D and demonstration spending by IEA member governments by technology, 1977-2019	○								○	
	General	Technology readiness level scale applied by the IEA								○		
	General	Global corporate R&D spending as a share of revenue in selected sectors, 2007-19	○							○		
	General	Global early-stage venture capital deals for energy technology start-ups	○							○		
	General	Technology readiness level of technologies along the CO2 value chain								○		
	General	Growth rates for revenue and R&D for selected sectors, 2007-12	○							○		
	General	Time to materiality for selected technologies in the Sustainable Development Scenario	○	○	○	○				○		
	General	Energy technology attributes that can favour more rapid innovation cycles or faster learning								○		
	General	Global CO2 emissions savings by current technology readiness category in the Faster Innovation Case relative to the Sustainable Development Scenario in 2050					○					
	Renewable energy	Technology readiness level of technologies along the low-carbon hydrogen value chain								○		
	Renewable energy	Competitiveness of bioenergy for power generation and biofuels, 2050					○			○		
	Renewable energy	Technology readiness level of technologies along the bioenergy value chain								○		
	Renewable energy	Role of hydrogen and liquid and gaseous biofuels in the Sustainable Development Scenario		○			○		○	○		
	Renewable energy	Hydrogen production costs by technology in the Sustainable Development Scenario, 2019 and 2050	○				○			○		
	Renewable energy	Issuance of patents for low-carbon energy technologies in selected countries/regions	○								○	○

 Source：IEA Energy Technology Perspectives 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 8/9】
Technology 2/2, Policy/Regulation

	Category	Datasets	Timeframe							Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Technology	Renewable energy	Number of clean energy technology designs and components analysed in the "ETP Clean Energy Technology Guide"								○		
	Renewable energy	Technology readiness level of technologies along the low-carbon electricity value chain								○		
	Specific sector	Status of the main emerging technologies in the chemical sector	○	○	○					○		
	Specific sector	Status of main emerging technologies in the iron and steel sector	○	○	○					○		
	Specific sector	Status of main emerging technologies in the cement sector	○	○	○					○		
	Specific sector	Logistic companies and electric trucks	○	○	○		○			○		
	Specific sector	Status of the main emerging technologies in heavy-duty road freight	○	○	○	○	○			○		
	Specific sector	Status of main emerging technologies in shipping		○	○					○		
	Specific sector	Status of the main emerging technologies in the aviation sector			○					○		
	Fossil fuel	Age structure of existing fossil power capacity by region and technology								○		
	Investment	Reduction in capital cost since 2010 for PV and wind power generation technologies	○							○		
	Investment	Average annual investment in technologies by technology readiness level in the Sustainable Development Scenario			○	○	○	○	○	○		
	Amount of reduction	Unit cost reductions for selected technologies in the Sustainable Development Scenario, 2020-70		○	○	○	○	○	○	○		
	Amount of reduction	Contribution of material efficiency to reducing cumulative cement and steel demand for buildings construction in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○	○		
Policy/Regulation	Policy	A policy framework for achieving deep emissions reductions in industry								○		
	Policy	Government carbon or climate neutral targets by legal status									○	
	Policy	Governing process for a strategy towards net-zero emissions										
	Policy	Core target areas for policy instruments to advance a net-zero emissions strategy by technology maturity level										
	Policy	Number of clean energy technology designs and components analysed in the "ETP Clean Energy Technology Guide"										
	Policy	Technology readiness level of technologies along the low-carbon electricity value chain	○	○						○		

 Source：IEA Energy Technology Perspectives 2020

IEA Energy Technology Perspectives 2020

【Parameters in IEA ETP 2020 9/9】
Other

	Category	Datasets	Timeframe						Country/region		
			Past	'20	'30	'40	'50	'60	'70	Global	Several areas	Japan
Other	General	Global average energy intensity in selected end-use sectors, 2000-19	○							○		
	General	Typical lifetimes for key energy sector assets								○		
	General	Value and number of global energy-related venture capital deals (early and late stage) by semester and year	○	○						○		
	Specific sector	Building stock by year of construction and share of stock that remains in 2050	○				○				○	
	Specific sector	Age profile and geographic distribution of aircraft	○								○	
	Specific sector	Total cost of ownership of hydrogen, ammonia and electric vessels by ship type, 2030			○					○		
	Specific sector	Passenger aviation activity by region in the Sustainable Development Scenario, 2019-70	○	○	○	○	○	○	○		○	
	Specific sector	Heavy-duty truck fleet by powertrain in the Sustainable Development Scenario		○		○			○	○		
	Renewable energy	Total cost of ownership of heavy-duty trucks by low-carbon fuel in the Sustainable Development Scenario, 2040 and 2070				○			○	○		
	Investment	Change in average annual energy-related investment by sector and decade in the Sustainable Development Scenario relative to the Stated Policies Scenario	○	○	○	○	○	○	○	○		

Source：IEA Energy Technology Perspectives 2020

PRI The Inevitable Policy Response

【PRI IPR】
The scenario announced by PRI in September 2019 about Climate-related policies that can occur in the short term

- Principles for Responsible Investment (PRI) is an initiative by the world's investors that aimed at "Institutional investors incorporating ESG problems into investment decision and behavior as a shareholder, improving long-term performance, and fulfilling more trustee responsibilities"
- PRI inaugurated the Inevitable Policy Response (IPR) as a project that investors prepare for the climate-related risks that can potentially appear in the short term. Forecast Policy Scenario (FPS) scenario that describe the impact of policies expected to be announced between 2023-2025 on the timeframe of 2025-2050
- The scenario includes the perspective of "How it affects the economy" "Which sectors are most exposed to risk" "Which assets will be affected"

PRI：The Forecast Policy Scenario (FPS)

8 types of forecast policies

Coal Phase Out	Sales ban on ICE	Carbon price	CCS, Decarbonization
Zero carbon power	Energy efficiency	GHG removal based on land use	Agriculture

Source：PRI Awareness Working Group "Introduction of ESG Investment Standards" (2013), "The Inevitable Policy Response：Policy Forecasts", PRI(2019.9)

【Parameters in PRI IPR 1/5】
Carbon pricing, Energy demand

Datasets		Unit	Timeframe	Country / region			Corresponding page
#1	#2			Global	Several areas	Japan	
Carbon pricing	Carbon pricing	US$		○	○	○	Policy Forecasts
Energy demand	Coal demand by sector (Electricity, Industry, Other)	million tonnes coal per year	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.27, 52
	Oil demand by sector (Transport, Industry, Buildings, Other)	MMbbl/d	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.28, 46
	Gas demand by sector (Electricity, Buildings, Industry, Other)	bcm per year	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.30, 55
	Industry fuel mix (Coal (unabated) , Coal CCS, Gas (unabated), Gas CCS, Oil, Biomass, Heat, Electricity, Hydrogen)	EJ per year	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.34, 67
	Hydrogen contribution of energy demand in hard-to abate sectors (Iron and steel, Non-metallic minerals, Chemicals) (Hydrogen, Other fuels)	%	'50	○			p.35, 71
	Biomass Availability	EJ	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.39, 74, 84
	Primary energy demand (Coal, Oil, Natural Gas, Biomass, Other low-carbon)	EJ per year	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.44
	Primary energy demand (Coal, Oil, Natural Gas, Biomass, Other low-carbon)(IPR FPS, IEA NPS, IEA SDS, Shell Sky, Statkraft Scenario)	EJ per year	'40	○			p.45
	Oil use by sector, FPS and comparator scenarios (Transport, Industry, Buildings, Total, Other) (IPR FPS, IEA SDS, Shell Skye, BP Energy Outlook, OPEC Reference case)	MMbbl/d	'40	○			p.47
	Coal demand by sector, IPR FPS vs comparators (Electricity, Industry, Other, Total) (IPR FPS, IEA NPS, IEA SDS, Shell Sky)	million tonnes coal per year	'40	○			p.53
	Coal demand by industry sector (Non-metallic minerals, Iron and steel, Chemical and petrochemical, Pulp and paper, Non-ferrous metals, Autogeneration, Other industry)	million tonnes coal per year	'40	○			p.54
	Gas use by sector, FPS and comparator scenarios (Electricity, Buildings, Industry, Other) (IPR FPS, IEA NPS, IEA SDS)	bcm per year	'40	○			p.56

Sources：PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

【Parameters in PRI IPR 2/5】
Energy mix 1/2

Datasets		Unit	Timeframe	Country / region			Corresponding page
#1	#2			Global	Several areas	Japan	
Energy mix	Electricity generation by fuel (Low-carbon, Gas, Coal)	%	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.27, 52
	Electricity generation mix (Coal ,Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass w/CCS, Nuclear, Hydro, Solar, Wind)	%	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.31,48
	Electricity generation, IPR FPS vs comparators (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon) (IPR FPS, IEA NPS, IEA SDS, BNEF NEO)	Thousand TWh	'40	○			p.49
	Generation mix (Western Europe) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon)	TWh	'20 / '30 / '40 / '50		○		p.50
	Generation mix (United States) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon))	TWh	'20 / '30 / '40 / '50		○		p.50
	Generation mix (China) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon)	TWh	'20 / '30 / '40 / '50		○		p.50
	Generation mix (India) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon)	TWh	'20 / '30 / '40 / '50		○		p.51
	Generation mix (Japan) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon)	TWh	'20 / '30 / '40 / '50			○	p.51
	Generation mix (Canada) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon)	TWh	'20 / '30 / '40 / '50		○		p.51
	Generation mix (Australia) (Coal, Coal CCS, Oil, Gas, Gas CCS, Biomass, Biomass with CCS, Nuclear, Hydro, Solar, Wind, Other low-carbon)	TWh	'20 / '30 / '40 / '50		○		p.51
	Nuclear generation	Thousand TWh	'20 / '25 / '30 / '35 / '40 / '45 / '50				p.58
	Nuclear generation by region, 2020 and 2050 (Western Europe, United States, Australia, Canada, China, India, Japan, World)	TWh per year	'20, '50	○	○	○	p.59
	World nuclear generation in 2040, IPR FPS vs comparators (IPR FPS, IEA NPS, IEA SDS, BNEF NEO)	TWh per year	'40	○			p.59
	Gas generation by region, 2020 and 2050 (United States, China, Western Europe, Japan, India, Australia, Canada, World)	TWh per year	'20, '50	○	○	○	p.60
	World gas generation in 2040, IPR FPS vs comparators (IPR FPS, IEA NPS, IEA SDS)	TWh per year	'40	○			p.60

Sources：PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

【Parameters in PRI IPR 3/5】
Energy mix 2/2, Price of key commodities/products, Policy 1/2

Datasets		Unit	Timeframe	Country / region			Corresponding page
#1	#2			Global	Several areas	Japan	
Energy mix	Coal generation by region (China, USA, India, Western Europe, Australia, Japan, Canada, ROW)	TWh per year	'20 / '30 / '40 / '50		O	O	p.61
	Coal generation by region (China, USA, India, Western Europe, Australia, Japan, Canada, ROW)	TWh per year	'40	O			p.61
	Industry fuel mix, IPR FPS and comparator scenarios (Coal (unabated) , Coal CCS, Gas (unabated), Gas CCS, Oil, Biomass, Heat, Electricity, Hydrogen) (IPR FPS, IEA NPS, IEA SDS)	%	'40	O			p.68
	Iron and steel sector energy mix (Coal (unabated) , Coal CCS, Gas (unabated), Gas CCS, Oil, Biomass, Heat, Electricity, Hydrogen) (IPR FPS, IEA NPS, IEA SDS)	EJ per year	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.69
	Cement sector energy mix (Coal (unabated) , Coal CCS, Gas (unabated), Gas CCS, Oil, Biomass, Heat, Electricity, Hydrogen) (IPR FPS, IEA NPS, IEA SDS)	EJ per year	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.69
	Biomass demand by sector (Industry, Agriculture, Electricity, Transport)	EJ per year	'20 / '30 / '40 / '50	O			p.72
	CCS power generation in the SDS scenario (Coal with CCS, Gas with CCS, Share of CCS)	TWh, %	'20 / '25 / '30 / '35 / '40	O			p.73
	Coal-fired power generation in the SDS scenario (Coal with CCS-China, Coal with CCS-ROW, Coal total)	TWh	'17/ '25 / '30 / '35 / '40		O		p.73
	Zero-carbon power, Nuclear capacity and renewable power generation	TWh			O	O	Policy Forecasts
Price of key commodities /products	Food Price Index (2020=100)	(Index)	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.38, 82
	Share of food in household expenditure	%	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.38, 82
	Bioenergy Price Index (2020=100)	(Index)	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.39, 74, 84
Policy	phase-out of coal in electricity globally	-			O	O	Policy Forecasts
	ICE sales bans	-			O	O	Policy Forecasts
	Carbon Capture and Storage (CCS) and industry decarbonisation	-			O	O	Policy Forecasts
	Energy efficiency	-			O	O	Policy Forecasts
	Afforestation and reforestation	Mha		O			Policy Forecasts
	Restoration of degraded Land	Mha		O	O		Policy Forecasts
	Soil sequestration	-		O			Policy Forecasts

Sources：PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

【Parameters in PRI IPR 4/5】
Policy 2/2, CO2 emissions

Datasets		Unit	Timeframe	Country / region			Corresponding page
#1	#2			Global	Several areas	Japan	
Policy	Dietary shifts	-		O	O		Policy Forecasts
	Mitigation potential	GtCO2e/ yr		O			Policy Forecasts
	Productivity	-		O			Policy Forecasts
	Enabling the Green Economy	-		O	O	O	Policy Forecasts
CO2 emissions	Global energy-related CO2 emissions (IPR FPS, IEA NPS, IEA SDS, IPCC P1)	GtCO2	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.15
	Global GHG Emissions (Land CO2, Land CH4, Land N2O, Industrial Process CO2, Energy net CO2 emissions , CH4 from gas production, Total)	GtCO2e	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.18, 88
	Global energy-related CO2 emissions (IPR FPS, IEA NPS, IEA SDS)	GtCO2	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.19
	Global GHG Emissions (Land CO2, Land CH4, Land N2O, Industrial Process CO2, Energy net CO2 emissions , CH4 from gas production, Total)	GtCO2	2020-2100 (every 5 years)	O			p.20
	Land use GHG emissions (CO2, CH4, N2O, Total Baseline Gt CO2e/year)(IPR FPS)	GtCO2e	2020-2100 (every 5 years)	O			p.21, 79
	Global GHG emissions (IPR SPF, IPCC P1, IPCC P2)	GtCO2e	'20 / '25 / '30 / '35 / '40 / '45 / '50	O			p.22, 89
	CO2 emissions by sector in 2040 (Power) (Low-carbon generation, Total electricity demand)	GtCO2	'40	O			p.26
	CO2 emissions by sector in 2040 (Transport) (Low carbon fuel share, Total fuel demand)	GtCO2	'40	O			p.26
	CO2 emissions by sector in 2040 (Industry) (Low carbon fuel share, Total fuel demand)	GtCO2	'40	O			p.26
	CO2 emissions by sector in 2040 (Buildings) (Low carbon fuel share, Total fuel demand)	GtCO2	'40	O			p.26
	Energy CO2 emissions by fuel (Coal, Oil, Natural Gas, Fossil CCS, Biomass CCS, Net CO2)	GtCO2	2020-2100 (every 5 year)	O			p.36, 90
	Emissions captured globally per year (Power (fossil), Power (biomass), Industry) (IEA 2C, IEA B2C, IPCC 2C avg, IPCC 1.5 avg, Shell Sky)	GtCO2	'20 / '30 / '40 / '50	O			p.75
	Regional land use emissions (Australia, Canada, Developing East Asia, United States, Western Europe, Africa, Brazil, Central and South America, Middle East, Mexico, China, Eurasian Economic Union, Former Soviet Union, India, Other developing Asia)	GtCO2e/ year	'20 / '25 / '30 / '35 / '40 / '45 / '50		O		p.80

Sources：PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

PRI The Inevitable Policy Response

【Parameters in PRI IPR 5/5】
Predictions on production and sales, Other

Datasets		Unit	Timeframe	Country / region			Corresponding page
#1	#2			Global	Several areas	Japan	
Predictions on production and sales	Passenger vehicles by powertrain (ICE, ULEV)	milion vehicles	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.28, 63
	ICE passenger vehicles	billion	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.29, 46
	Passenger vehicles stock by powertrain, IPR FPS and BNEF scenarios (ICE, ULEV)	%	'40	○			p.64
	Truck travel by powertrain (ICE, ULEV)	Billion vehicle km	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.65
	Trucks stock share by powertrain, IPR FPS and BNEF scenarios	%	'40	○			p.66
Other	Cumulative afforested land	Mha	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.40, 81
	Total Forest Land	Mha	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.40, 81
	Crop Yields	tDM/ha	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.41
	Irrigated area	Mha	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.41
	Regional food price indices (2020=100)（Australia, Canada, Developing East Asia, United States, Western Europe, Africa, Brazil, Central and South America, Middle East, Mexico, China, Eurasian Economic Union, Former Soviet Union, India, Other developing Asia)	(Index)	'20 / '25 / '30 / '35 / '40 / '45 / '50		○		p.83
	Irrigated area by region (Australia, Canada, Developing East Asia, United States, Western Europe, Africa, Brazil, Central and South America, Middle East, Mexico, China, Eurasian Economic Union, Former Soviet Union, India, Other developing Asia)	Mha	'20 / '25 / '30 / '35 / '40 / '45 / '50		○		p.85
	Total cropland by region (Australia, Canada, Developing East Asia, United States, Western Europe, Africa, Brazil, Central and South America, Middle East, Mexico, China, Eurasian Economic Union, Former Soviet Union, India, Other developing Asia)	Mha	'20 / '25 / '30 / '35 / '40 / '45 / '50		○		p.86

Sources：PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

SSP Public Database Version2.0

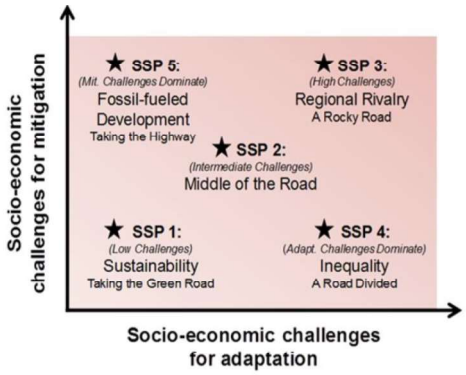
【SSP】
SSP was developed as a socio-economic scenario based on recent policies and socio-economic environment

The outline of SSP（Shared Socioeconomic Pathways）

- Based on the issues of the socio-economic scenario "SRES" related to the evaluation of existing climate change, National Institute for Environmental Studies（Japan）, PNNL（US）, PBL（Netherland）, IIASA（Austria）and Germany（PIK）has developed SSP*1
  - SPES has problems such as the old base year (1990) and the inability to reflect recent policies
  - SSP considers recent changes in the external environment such as recent policies, vital statistics, GDP, and urbanization *2, and has relevance to existing socio-economic scenarios such as "SERS" and "RCPs". Developed as a scenario. It consists of 5 scenarios

5 Scenario Composition of SSP

SSP	Scenario	Scenario Outline *3
SSP1	Sustainability	A scenario that assumes the realization of both international mitigation measures and adaptation measures related to climate change
SSP2	Middle of the Road	A scenario that assumes that the current socio-economic growth will continue
SSP3	Regional Rivalry	A scenario that assumes a situation where the country is divided and it is difficult to realize international mitigation measures and adaptation measures
SSP4	Inequality	A scenario that assumes an international economic society with widening disparities
SSP5	Fossil-fueled Development	A scenario that assumes that the international community will develop depending on fossil fuels



*1：https://www.nies.go.jp/whatsnew/20170221/20170221.html , *2：https://unfccc.int/sites/default/files/part1_iiasa_rogelj_ssp_poster.pdf
*3：https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 1/10】
IAM Scenarios Model：GDP, Population, Primary energy, Secondary Energy (Electricity)

Category			Unit	SSP					Remark
Large	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
GDP	GDP（PPP）	—	billionUS$2005/yr	○	○	○	○	○	
Population	Population	—	million	○	○	○	○	○	
Energy	Primary Energy	Total	EJ/yr	○	○	○	○	○	
Energy	Primary Energy	#N/A	EJ/yr	○	○	△	○	○	Some data (traditional, COS) is not available in SSP3
Energy	Primary Energy	Coal (Total / with CCS /without CCS)	EJ/yr	○	○	△	○	○	Some data（CCS）is not available in SSP3
Energy	Primary Energy	Oil (Total / with CCS / without CCS)	EJ/yr	○	△	△	○	△	Some data（CCS）is not available in SSP2,3,5
Energy	Primary Energy	Gas (Total / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data（CCS）is not available in SSP3
Energy	Primary Energy	Fossil (Total , with CCS, without CCS)	EJ/yr	○	○	△	○	○	Some data（CCS）is not available in SSP3
Energy	Primary Energy	Nuclear	EJ/yr	○	○	○	○	○	
Energy	Primary Energy	Non-Biomass Renewables	EJ/yr	○	○	○	○	○	
Energy	Primary Energy	Hydro	EJ/yr	○	○	○	○	○	
Energy	Primary Energy	Geothermal	EJ/yr	○	○		○	○	
Energy	Primary Energy	Other	EJ/yr	○	○		○		
Energy	Primary Energy	Solar	EJ/yr	○	○	○	○	○	
Energy	Primary Energy	Wind	EJ/yr	○	○	○	○	○	
Energy	Primary Energy	Secondary Energy Trade	EJ/yr			○			
Energy	Secondary Energy (Electricity)	Total	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Electricity)	Biomass(Total / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data（CCS）is not available in SSP3
Energy	Secondary Energy (Electricity)	Coal (Total / with CCS /without CCS)	EJ/yr	○	○	△	○	○	Some data（CCS）is not available in SSP3
Energy	Secondary Energy (Electricity)	Oil	EJ/yr	○	○	○	○	○	Some data（CCS）is not available in SSP3
Energy	Secondary Energy (Electricity)	Gas (Total / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data（CCS）is not available in SSP3
Energy	Secondary Energy (Electricity)	Geothermal	EJ/yr	○	○		○	○	
Energy	Secondary Energy (Electricity)	Hydro	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Electricity)	Non-Biomass Renewables	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Electricity)	Nuclear	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Electricity)	Solar	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Electricity)	Wind	EJ/yr	○	○	○	○	○	

 Source：SSP Public Database Version 2.0（As of February 2021）

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 2/10】
IAM Scenario Model：Secondary Energy, Final energy, Energy Service

Category			Unit	SSP					Remark
Large	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Energy	Secondary Energy (Gases)	Total	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Gases)	Biomass	EJ/yr		○		○	○	
Energy	Secondary Energy (Gases)	Coal	EJ/yr		○		○	○	
Energy	Secondary Energy (Gases)	Natural Gas	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Heat)	Total	EJ/yr		○		○	○	
Energy	Secondary Energy (Heat)	Geothermal	EJ/yr		○		○	○	
Energy	Secondary Energy (Hydrogen)	Total	EJ/yr	○	○		○	○	
Energy	Secondary Energy (Hydrogen)	Biomass(Total / with CCS/ without CCS)	EJ/yr	○	○		○	○	
Energy	Secondary Energy (Hydrogen)	Electricity	EJ/yr	○	○		○	○	
Energy	Secondary Energy (Liquids)	Total	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Liquids)	Biomass(Total / with CCS/ without CCS)	EJ/yr	△	○	△	○	○	Some data（CCS）is not available in SSP1,3
Energy	Secondary Energy (Liquids)	Coal (Total / with CCS /without CCS)	EJ/yr		○			○	
Energy	Secondary Energy (Liquids)	Gas (Total / with CCS/ without CCS)	EJ/yr		○				
Energy	Secondary Energy (Liquids)	Oil	EJ/yr	○	○	○	○	○	
Energy	Secondary Energy (Solids)	—	EJ/yr	○	○			○	
Energy	Final Energy	Total	EJ/yr	○	○	○	○	○	
Energy	Final Energy	Electricity	EJ/yr	○	○	○	○	○	
Energy	Final Energy	Gases	EJ/yr	○	○	○	○	○	
Energy	Final Energy	Heat	EJ/yr	○	○	○	○	○	
Energy	Final Energy	Hydrogen	EJ/yr	○	○		○	○	
Energy	Final Energy	Liquids	EJ/yr	○	○	○	○	○	
Energy	Final Energy	Solar	EJ/yr	○	○				
Energy	Final Energy (Solids)	Total	EJ/yr	○	○	○	○	○	
Energy	Final Energy (Solids)	Biomass (Total, Traditional)	EJ/yr	△	○	△	○	○	Some data（traditional）is not available in SSP1,3
Energy	Final Energy (Solids)	Coal	EJ/yr	○	○	○	○	○	
Energy	Final Energy	Industry	EJ/yr	○	○	○	○		
Energy	Final Energy	Residential and Commercial	EJ/yr	○	○	○	○		
Energy	Final Energy	Transportation	EJ/yr	○	○	○	○	○	
Energy	Energy Service (Transportation)	Freight	bn tkm/yr	○			○	○	
Energy	Energy Service (Transportation)	Passenger	bn pkm/yr	○			○	○	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

 Source：SSP Public Database Version 2.0（As of February 2021）

【Parameters in SSP Public Database Version2.0 3/10】
IAM Scenarios Model：Land Cover, Emissions (unharmonized)

Category			Unit	SSP					Remark
Large	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Land Cover	Built-up Area	—	million ha	○		○	○	○	
Land Cover	Cropland	—	million ha	○	○	○	○	○	
Land Cover	Forest	—	million ha	○	○	○	○	○	
Land Cover	Pasture	—	million ha	○	○	○	○	○	
Emissions (unharmonized)	BC	—	Mt BC/yr	○	○	○	○	○	
Emissions (unharmonized)	CH4	Total	Mt CH4/yr	○	○	○	○	○	
Emissions (unharmonized)	CH4	Fossil Fuels and Industry	Mt CH4/yr				○	○	
Emissions (unharmonized)	CH4	Land Use	Mt CH4/yr	○	○	○	○	○	
Emissions (unharmonized)	CO	—	Mt CO/yr	○	○	○	○	○	
Emissions (unharmonized)	CO2	Total	Mt CO2/yr	○	○	○	○	○	
Emissions (unharmonized)	CO2 (Carbon Capture and Storage)	Total	Mt CO2/yr	○	○		○	○	
Emissions (unharmonized)	CO2 (Carbon Capture and Storage)	Biomass	Mt CO2/yr	○	○		○	○	
Emissions (unharmonized)	CO2	Fossil Fuels and Industry	Mt CO2/yr	○	○	○	○	○	
Emissions (unharmonized)	CO2	Land Use	Mt CO2/yr	○	○	○	○	○	
Emissions (unharmonized)	F-Gases	—	Mt CO2-equiv/yr	○	○	○	○	○	
Emissions (unharmonized)	Kyoto Gases	—	Mt CO2-equiv/yr	○	○	○	○	○	
Emissions (unharmonized)	N2O	Total	kt N2O / yr	○	○	○	○	○	
Emissions (unharmonized)	N2O	Land Use	kt N2O / yr	○	○	○	○	○	
Emissions (unharmonized)	NH3	—	Mt NH3/yr	○	○	○	○	○	
Emissions (unharmonized)	NOx	—	Mt NO2/yr	○	○	○	○	○	
Emissions (unharmonized)	OC	—	Mt OC/yr	○	○	○	○	○	
Emissions (unharmonized)	Sulfur	—	Mt SO2/yr	○	○	○	○	○	
Emissions (unharmonized)	VOC	—	Mt VOC/yr	○	○	○	○	○	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

【Parameters in SSP Public Database Version2.0 4/10】
IAM Scenarios Model：Emissions(harmonized), Climate

Category			Unit	SSP					Remark
Large	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Emissions (harmonized)	BC	—	Mt BC/yr			○		○	
Emissions (harmonized)	CH4	Total	Mt CH4/yr			○		○	
Emissions (harmonized)	CH4	Fossil Fuels and Industry	Mt CH4/yr			○		○	
Emissions (harmonized)	CH4	Land Use	Mt CH4/yr			○		○	
Emissions (harmonized)	CO	—	Mt CO/yr			○		○	
Emissions (harmonized)	CO2	Total	Mt CO2/yr			○		○	
Emissions (harmonized)	CO2	Fossil Fuels and Industry	Mt CO2/yr			○		○	
Emissions (harmonized)	CO2	Land Use	Mt CO2/yr			○		○	
Emissions (harmonized)	F-Gases	—	Mt CO2-equiv/yr			○		○	
Emissions (harmonized)	Kyoto Gases	—	Mt CO2-equiv/yr			○		○	
Emissions (harmonized)	N2O	—	kt N2O/yr			○		○	
Emissions (harmonized)	NH3	—	Mt NH3/yr			○		○	
Emissions (harmonized)	NOx	—	Mt NO2/yr			○		○	
Emissions (harmonized)	OC	—	Mt OC/yr			○		○	
Emissions (harmonized)	Sulfur	—	Mt SO2/yr			○		○	
Emissions (harmonized)	VOC	—	Mt VOC/yr			○		○	
Climate	Concentration	CO2	ppm	○	○	○	○	○	
Climate	Concentration	CH4	ppb	○	○	○	○	○	
Climate	Concentration	N2O	ppb	○	○	○	○	○	
Climate	Forcing	Total	W/m2	○	○	○	○	○	
Climate	Forcing	CO2	W/m2	○	○	○	○	○	
Climate	Forcing	CH4	W/m2	○	○	○	○	○	
Climate	Forcing	N2O	W/m2	○	○	○	○	○	
Climate	Forcing	Kyoto Gases	W/m2	○	○	○	○	○	
Climate	Forcing	F-Gases	W/m2	○	○	○	○	○	
Climate	Forcing	Aerosol	W/m2	○	○	○	○	○	
Climate	Temperature	Global Average	℃	○	○	○	○	○	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 5/10】
IAM Scenarios Model：Agricultural Indicators, Economic Indicators, Technological Indicators

Category			Unit	SSP					Remark
Large	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Agricultural Indicators	Demand	Crops	million t DM/yr	○	○	○			
Agricultural Indicators	Demand	Crops (Energy)	million t DM/yr			○		○	
Agricultural Indicators	Demand	Livestock	million t DM/yr	○	○	○		○	
Agricultural Indicators	Production	Crops (Energy)	million t DM/yr	○	○	○	○	○	
Agricultural Indicators	Production	Crops (Non-Energy)	million t DM/yr	○	○	○	○	○	
Agricultural Indicators	Production	Livestock	million t DM/yr	○	○	○	○	○	
Economic Indicators	Consumption	—	billion US$2005/yr	○	○	○		○	
Economic Indicators	Price (Carbon)	—	US$2005/t CO2	○	○		○	○	
Technological Indicators	Capacity (Electricity)	Total	GW	○	○	○	○	○	
Technological Indicators	Capacity (Electricity)	Biomass	GW	○	○	○	○	○	
Technological Indicators	Capacity (Electricity)	Coal	GW	○	○	○	○	○	
Technological Indicators	Capacity (Electricity)	Gases	GW	○	○	○	○	○	
Technological Indicators	Capacity (Electricity)	Geothermal	GW		○	○	○	○	
Technological Indicators	Capacity (Electricity)	Hydro	GW	○	○	○	○	○	
Technological Indicators	Capacity (Electricity)	Nuclear	GW	○	○	○		○	
Technological Indicators	Capacity (Electricity)	Oil	GW	○	○	○	○		
Technological Indicators	Capacity (Electricity)	Other	GW	○					
Technological Indicators	Capacity (Electricity)	Solar (Total, CSP, PV)	GW	○	○	△	△	○	Some data（CSP, PV）is not available in SSP3,4
Technological Indicators	Capacity (Electricity)	Wind (Total, Offshore, Onshore)	GW	○	○	△	△	△	Some data（Offshore, Onshore）is not available in SSP3,4,5

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 6/10】
CMIP6 Emissions Model：BC, C2F6, CH4

Category		Unit	SSP					Remark
Large	Medium		SSP1	SSP2	SSP3	SSP4	SSP5	
BC	Agricultural Waste Burning	Mt BC/yr	○	○	○	○	○	
BC	Aircraft	Mt BC/yr	○	○	○	○	○	
BC	Energy Sector	Mt BC/yr	○	○	○	○	○	
BC	Forest Burning	Mt BC/yr	○	○	○	○	○	
BC	Grassland Burning	Mt BC/yr	○	○	○	○	○	
BC	Industrial Sector	Mt BC/yr	○	○	○	○	○	
BC	International Shipping	Mt BC/yr	○	○	○	○	○	
BC	Peat Burning	Mt BC/yr	○	○	○	○	○	
BC	Residential Commercial Other	Mt BC/yr	○	○	○	○	○	
BC	Transportation Sector	Mt BC/yr	○	○	○	○	○	
BC	Total	Mt BC/yr	○	○	○	○	○	
BC	Waste	Mt BC/yr	○	○	○	○	○	
C2F6	—	kt C2F6/yr	○	○	○	○	○	
CF4	—	kt CF4/yr	○	○	○	○	○	
CH4	Agricultural Waste Burning	Mt CH4/yr	○	○	○	○	○	
CH4	Agriculture	Mt CH4/yr	○	○	○	○	○	
CH4	Energy Sector	Mt CH4/yr	○	○	○	○	○	
CH4	Forest Burning	Mt CH4/yr	○	○	○	○	○	
CH4	Grassland Burning	Mt CH4/yr	○	○	○	○	○	
CH4	Industrial Sector	Mt CH4/yr	○	○	○	○	○	
CH4	International Shipping	Mt CH4/yr	○	○	○	○	○	
CH4	Peat Burning	Mt CH4/yr	○	○	○	○	○	
CH4	Residential Commercial Other	Mt CH4/yr	○	○	○	○	○	
CH4	Transportation Sector	Mt CH4/yr	○	○	○	○	○	
CH4	Total	Mt CH4/yr	○	○	○	○	○	
CH4	Waste	Mt CH4/yr	○	○	○	○	○	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 7/10】
CMIP6 Emissions Model：CO2, CO, HFC, N2O

Category		Unit	SSP					Remark
Large	Medium		SSP1	SSP2	SSP3	SSP4	SSP5	
CO2	AFOLU	Mt CO2/yr	O	O	O	O	O	
CO2	Aircraft	Mt CO2/yr	O	O	O	O	O	
CO2	Energy Sector	Mt CO2/yr	O	O	O	O	O	
CO2	Industrial Sector	Mt CO2/yr	O	O	O	O	O	
CO2	International Shipping	Mt CO2/yr	O	O	O	O	O	
CO2	Residential Commercial Other	Mt CO2/yr	O	O	O	O	O	
CO2	Solvents Production and Application	Mt CO2/yr	O	O	O	O	O	
CO2	Transportation Sector	Mt CO2/yr	O	O	O	O	O	
CO2	Total	Mt CO2/yr	O	O	O	O	O	
CO2	Waste	Mt CO2/yr	O	O	O	O	O	
CO	Agricultural Waste Burning	Mt CO/yr	O	O	O	O	O	
CO	Aircraft	Mt CO/yr	O	O	O	O	O	
CO	Energy Sector	Mt CO/yr	O	O	O	O	O	
CO	Forest Burning	Mt CO/yr	O	O	O	O	O	
CO	Grassland Burning	Mt CO/yr	O	O	O	O	O	
CO	Industrial Sector	Mt CO/yr	O	O	O	O	O	
CO	International Shipping	Mt CO/yr	O	O	O	O	O	
CO	Peat Burning	Mt CO/yr	O	O	O	O	O	
CO	Residential Commercial Other	Mt CO/yr	O	O	O	O	O	
CO	Transportation Sector	Mt CO/yr	O	O	O	O	O	
CO	Total	Mt CO/yr	O	O	O	O	O	
CO	Waste	Mt CO/yr	O	O	O	O	O	
HFC	—	Mt CO2-equiv/yr	O	O	O	O	O	
N2O	—	kt N2O/yr	O	O	O	O	O	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 8/10】
CMIP6 Emissions Model：NH3, NO2

Category		Unit	SSP					Remark
Large	Medium		SSP1	SSP2	SSP3	SSP4	SSP5	
NH3	Agricultural Waste Burning	Mt NH3/yr	O	O	O	O	O	
NH3	Agriculture	Mt NH3/yr	O	O	O	O	O	
NH3	Aircraft	Mt NH3/yr	O	O	O	O	O	
NH3	Energy Sector	Mt NH3/yr	O	O	O	O	O	
NH3	Forest Burning	Mt NH3/yr	O	O	O	O	O	
NH3	Grassland Burning	Mt NH3/yr	O	O	O	O	O	
NH3	Industrial Sector	Mt NH3/yr	O	O	O	O	O	
NH3	International Shipping	Mt NH3/yr	O	O	O	O	O	
NH3	Peat Burning	Mt NH3/yr	O	O	O	O	O	
NH3	Residential Commercial Other	Mt NH3/yr	O	O	O	O	O	
NH3	Transportation Sector	Mt NH3/yr	O	O	O	O	O	
NH3	Total	Mt NH3/yr	O	O	O	O	O	
NH3	Waste	Mt NH3/yr	O	O	O	O	O	
NO2	Agricultural Waste Burning	Mt NOx/yr	O	O	O	O	O	
NO2	Agriculture	Mt NOx/yr	O	O	O	O	O	
NO2	Aircraft	Mt NOx/yr	O	O	O	O	O	
NO2	Energy Sector	Mt NOx/yr	O	O	O	O	O	
NO2	Forest Burning	Mt NOx/yr	O	O	O	O	O	
NO2	Grassland Burning	Mt NOx/yr	O	O	O	O	O	
NO2	Industrial Sector	Mt NOx/yr	O	O	O	O	O	
NO2	International Shipping	Mt NOx/yr	O	O	O	O	O	
NO2	Peat Burning	Mt NOx/yr	O	O	O	O	O	
NO2	Residential Commercial Other	Mt NOx/yr	O	O	O	O	O	
NO2	Transportation Sector	Mt NOx/yr	O	O	O	O	O	
NO2	Total	Mt NOx/yr	O	O	O	O	O	
NO2	Waste	Mt NOx/yr	O	O	O	O	O	

Source：SSP Public Database Version 2.0（As of February 2021）

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 9/10】
CMIP6 Emissions Model：OC, SF6, Sulfur

Category		Unit	SSP					Remark
Large	Medium		SSP1	SSP2	SSP3	SSP4	SSP5	
OC	Agricultural Waste Burning	Mt OC/yr	O	O	O	O	O	
OC	Aircraft	Mt OC/yr	O	O	O	O	O	
OC	Energy Sector	Mt OC/yr	O	O	O	O	O	
OC	Forest Burning	Mt OC/yr	O	O	O	O	O	
OC	Grassland Burning	Mt OC/yr	O	O	O	O	O	
OC	Industrial Sector	Mt OC/yr	O	O	O	O	O	
OC	International Shipping	Mt OC/yr	O	O	O	O	O	
OC	Peat Burning	Mt OC/yr	O	O	O	O	O	
OC	Residential Commercial Other	Mt OC/yr	O	O	O	O	O	
OC	Transportation Sector	Mt OC/yr	O	O	O	O	O	
OC	Total	Mt OC/yr	O	O	O	O	O	
OC	Waste	Mt OC/yr	O	O	O	O	O	
SF6	—	kt SF6/yr	O	O	O	O	O	
Sulfur	Agricultural Waste Burning	Mt SO2/yr	O	O	O	O	O	
Sulfur	Aircraft	Mt SO2/yr	O	O	O	O	O	
Sulfur	Energy Sector	Mt SO2/yr	O	O	O	O	O	
Sulfur	Forest Burning	Mt SO2/yr	O	O	O	O	O	
Sulfur	Grassland Burning	Mt SO2/yr	O	O	O	O	O	
Sulfur	Industrial Sector	Mt SO2/yr	O	O	O	O	O	
Sulfur	International Shipping	Mt SO2/yr	O	O	O	O	O	
Sulfur	Peat Burning	Mt SO2/yr	O	O	O	O	O	
Sulfur	Residential Commercial Other	Mt SO2/yr	O	O	O	O	O	
Sulfur	Transportation Sector	Mt SO2/yr	O	O	O	O	O	
Sulfur	Total	Mt SO2/yr	O	O	O	O	O	
Sulfur	Waste	Mt SO2/yr	O	O	O	O	O	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

SSP Public Database Version2.0

【Parameters in SSP Public Database Version2.0 10/10】
CMIP6 Emissions Model：VOC

Category		Unit	SSP					Remark
Large	Medium		SSP1	SSP2	SSP3	SSP4	SSP5	
VOC	Agricultural Waste Burning	Mt VOC/yr	O	O	O	O	O	
VOC	Aircraft	Mt VOC/yr	O	O	O	O	O	
VOC	Energy Sector	Mt VOC/yr	O	O	O	O	O	
VOC	Forest Burning	Mt VOC/yr	O	O	O	O	O	
VOC	Grassland Burning	Mt VOC/yr	O	O	O	O	O	
VOC	Industrial Sector	Mt VOC/yr	O	O	O	O	O	
VOC	International Shipping	Mt VOC/yr	O	O	O	O	O	
VOC	Peat Burning	Mt VOC/yr	O	O	O	O	O	
VOC	Residential Commercial Other	Mt VOC/yr	O	O	O	O	O	
VOC	Solvents Production and Application	Mt VOC/yr	O	O	O	O	O	
VOC	Transportation Sector	Mt VOC/yr	O	O	O	O	O	
VOC	Total	Mt VOC/yr	O	O	O	O	O	
VOC	Waste	Mt VOC/yr	O	O	O	O	O	

* Extract parameters for which Global values can be obtained
* GDP and population are data for each 5 years from 2010 to 2100, and other parameters are data for 2005 and 2010 to 2100 for each 5 years.

Source：SSP Public Database Version 2.0（As of February 2021）

Appendix.

Appendix1. Parameter list

Appendix2. Physical risk assessment tools

Appendix3. Examples of scenario analysis

Appendix.

Provide useful materials for scenario analysis based on supporting case studies

Physical risk assessment tools referred in TCFD report

Tools at a global level	
WRI Aqueduct Atlas	■ Risk mapping tool that helps companies, investors, governments, and other users understand where and how water risks and opportunities are emerging worldwide
WBCSD Water Tool	■ A multifunctional resource for identifying corporate water risks and opportunities, including a workbook, a mapping functionality, and Google earth compatibility ■ Organizations can compare sites based on water availability, sanitation, population, and biodiversity
Global Agro- Ecological Zones	■ Based on he Global Agro-Ecological Zones (GAEZ) methodology for assessing agricultural resources and potential ■ Users can understand forecast changes in yields, production, and other outputs due to climate change.
Tools at a local / national level	
UK Climate Impact Programme	■ Gathered historical climate records and future climate projections ■ Climate projections cover low-, medium- and high- emissions scenarios and can be viewed through an online user interface and associated briefing report
US Interagency Archive of Downscaled Climate Data and Information	■ Provides an archive of simulated historical and future climatology and hydrology ■ Maintained at Lawrence Livermore National Lab by a consortium of federal and non-federal partners.. Information available from this archive is free and open to all
Management and Impacts of Climate Change (France)	■ Meteo-France is the primary provider of climate projections out to 2100, covering temperature, precipitation, and wind speeds, aligned with the IPCC's RCPs ■ Projections are provided for the medium term (2021-2050) and long term (2071-2100)

※Similar resources are available in other countries including, but not limited to, Australia, Canada, Germany, Japan, the Netherlands, and South Africa

Source：TCFD "The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities" p.28-29

Physical risk tools used in this project (excerpt)

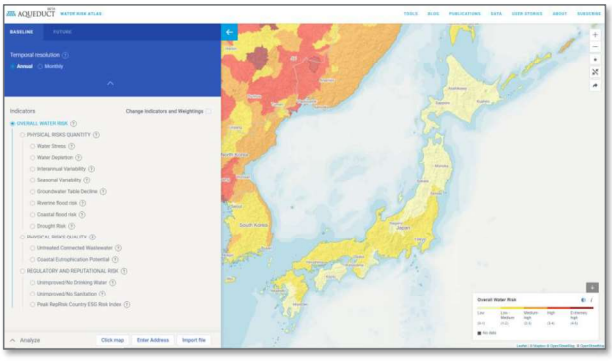
#	Issuing agency	Tool name	URL	Subject Area	Explanation Related Page
1	**World Resources Institute (WRI)**	**Aqueduct Water Risk Atlas**	https://www.wri.org/aqueduct	**Global**	4-56
2	**AP-PLAT**	**Climate Impact Viewer**	https://adaptation-platform.nies.go.jp/en/ap-plat/	**Asia**	4-58
3	**World Bank**	**Climate Change Knowledge Portal**	http://sdwebx.worldbank.org/climateportal/	**Global**	4-57
4	**A-PLAT**	**Web GIS**	https://a-plat.nies.go.jp/webgis/index.html	**Japan**	4-59, 4-60
5	**European Commission**	**European Climate Adaptation Platform (Climate-ADAPT)**	http://climate-adapt.eea.europa.eu/	**EU**	— ※ European Adaptation Platform
6	**IPCC TGICA**	**IPCC Data Distribution Centre**	http://www.ipcc-data.org/	**Global**	— ※ Database of the Intergovernmental Panel on Climate Change (IPCC)

WRI AQUEDUCT Water Risk Atlas

AQUEDUCT Water Risk Atlas (WRI)

AQUEDUCT Water Risk Atlas

Issuing agency	**World Resource Institution**
Scenario	**Pessimistic / Business as usual / Optimistic**
Timeframe	**Baseline / 2030~2040**



Indicators

Indicators (Baseline)	
Physical risks (quantity)	• Water stress • Water Depletion • Interannual Variability • Seasonal Variability • Groundwater Table Decline • Riverine flood risk/Coastal flood risk • Drought Risk
Physical risks (quality)	• Untreated Connected Wastewater • Coastal Eutrophication Potential
Regulatory and reputational risk	• Unimproved / No Drinking Water • Unimproved / No Sanitation • Peak RepRisk Country ESG Risk Index

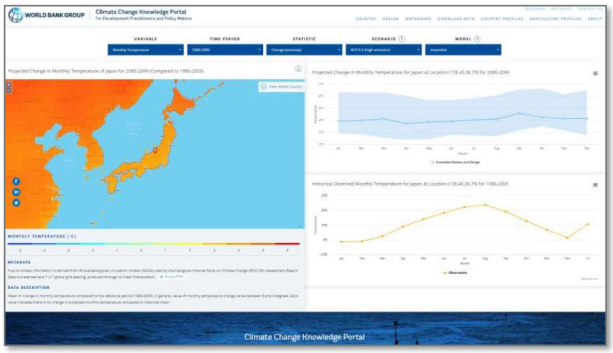
Indicators (2030-2040)
• Water Stress • Seasonal Variability • Water Supply • Water Demand

Source：AQUEDUCT Water Risk Atlas https://www.wri.org/applications/aqueduct/water-risk-atlas/#/?advanced=false&basemap=hydro&indicator=w_awr_def_tot_cat&lat=30&lng=-80&mapMode=view&month=1&opacity=0.5&ponderation=DEF&predefined=false&projection=absolute&scenario=optimistic&scope=baseline&timeScale=annual&year=baseline&zoom=3 (As of February 2021）

Climate Change Knowledge Portal (World Bank)

Climate Change Knowledge Portal

Issuing agency	World Bank
Scenario	RCP2.6 / 4.5 / 6.0 / 8.5
Timeframe	2020-2039 / 2040-2059 / 2060-2079/ 2080-2099



Indicators

Category	Details
Essential Climate Variables	• Monthly Temperature • Monthly Maximum Temperature • Monthly Minimum Temperature • Monthly Precipitation
Temperature Indicators	• Maxima of Daily Tmax • Minima of Daily Tmin • Summer Days (Tmax > 25℃) • Tropical Nights (Tmin > 20℃) • Frost Days (Tmin < 0℃) • Ice Days (Tmax < 0℃) • Hot Day (Tmax > 35℃) • Hot Day (Tmax > 40℃) • Heat Index 35
Agriculture Indicators	• Growing Season Length • Days of Consecutive Dry Spell • Days of Consecutive Wet Spell • Rainfall Seasonality
Drought/ Water Indicators	• Mean Drought Index • Severe Drought Likelihood • Monthly Rainfall Range • Annual Rainfall Range

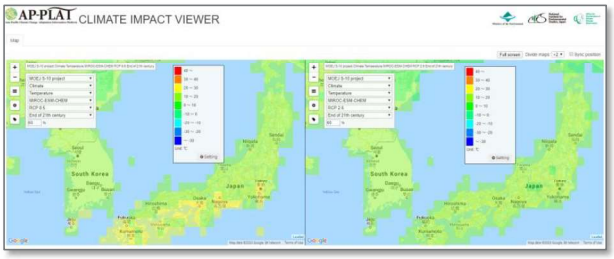
Category	Details
Precipitation Indicators	• Days with Rainfall > 20mm • Maximum Monthly Rainfall (10-yr RL) • Maximum Monthly Rainfall (25-yr RL) • Days with Rainfall > 50mm • Rainfall of Very Wet Days • Maximum Daily Rainfall • Maximum 5-day Rainfall • Maximum Daily Rainfall (10-yr RL) • Maximum 5-day Rainfall • Maximum daily Rainfall (25-yr RL) • Maximum 5-day Rainfall (25-yr RL)
Energy Indicators	• Heating Degree Days • Cooling Degree Days • Days without Noticeable Wind
Health Indicators	• Probability of Heat Wave • Probability of Cold Wave • Warm Spell Duration index • Cold Spell Duration Index

Source：World Bank, Climate Change Knowledge Portal
https://www.wri.org/applications/aqueduct/water-risk-atlas/#/?advanced=false&basemap=hydro&indicator=w_awr_def_qan_cat&lat=30.06909396443887&lng=-（As of February 2021）

Climate Impact Viewer (AP-PLAT)

Climate Impact Viewer

Issuing agency	AP-PLAT
Scenario	RCP2.6 / 4.5 / 6.0 / 8.5
Timeframe	Current / Mid of 21th century / End of 21th century



Indicators

Category	Details
Climate	• Temperature • Precipitation
Water resources	• Falkenmark Index
Vegetation	• Net Primary Production • Vegetation carbon • Soil carbon pool • Net Biome Production • Soil erosion • Fire
Health	• Heat stress

The AP-PLAT Platform page introduces climate information for each region and country, which can be referred to.
https://ap-plat.nies.go.jp/platforms/index.html

Source：AP-PLAT, Climate Impact Viewer https://a-plat.nies.go.jp/ap-plat/asia_pacific/index.html（As of February 2021）

Appendix.

Appendix1. Parameter list

Appendix2. Physical risk assessment tools

Appendix3. Examples of scenario analysis

Appendix.

Provide useful materials for scenario analysis based on supporting case studies

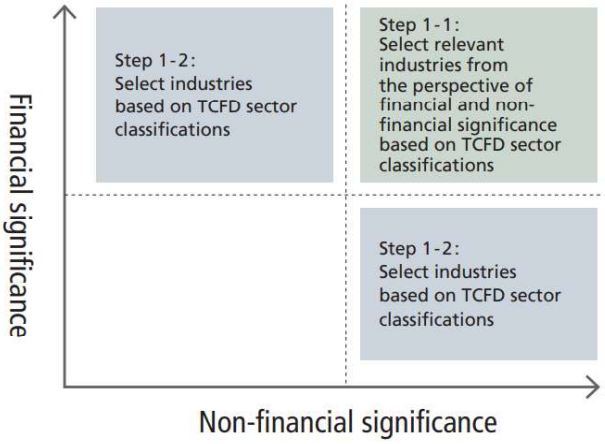
Extract examples of the disclosure of scenario analysis that can be used as “reference” for further implementation

	Analysis step	Stage	Examples of disclosure	
1	For beginning scenario analysis	Prep② What is the analysis implementation system	✓ Mitsubishi Corporation（Case①） ✓ Neuberger Berman（Overseas case Ⅰ） ✓ AES（Overseas case Ⅱ）	
		Prep③ Where is the scenario analysis range	✓ Mitsubishi Corporation（Case①）	
2	Assess materiality of climate-related risks	Stage2 How the risks and opportunities are described	✓ Kao Corporation（Case②） ✓ Kirin Group（Case③） ✓ Sekisui Chemical（Case④） ✓ Sumitomo Mitsui Trust Holdings（Case⑤）	✓ Aurizon（Overseas caseⅣ）
3	Identify and define range of scenarios	Stage1 Which scenarios are used	✓ Kao Corporation（Case②）	
		Stage3 How the future world views are described	✓ AES（Overseas case Ⅱ） ✓ Aurizon（Overseas caseⅣ）	
4	Evaluate business impacts	Stage2 How the business impacts are described	✓ Kirin Group（Case③） ✓ Sumitomo Mitsui Trust Holdings（Case⑤） ✓ JFE Holdings（Case⑥）	✓ AES（Overseas case Ⅱ） ✓ Unilever（Overseas caseⅢ） ✓ Mondi（Overseas case Ⅴ）
5	Identify potential responses	Stage2 How the future countermeasures are described	✓ Kao Corporation（Case②） ✓ Hitachi （Case⑦）	✓ Neuberger Berman（Overseas case Ⅰ） ✓ Unilever（Overseas caseⅢ）

[Example①: Mitsubishi Corporation]
Mitsubishi Corporation selects the subjects of analysis from the sectors of business that has a large financial / non-financial impact and from TCFD recommendations

Point ① **Choose subjects for analysis**

- ✓ Scenario analysis chooses industries in which businesses with significant financial and non-financial impacts belong.
- ✓ Furthermore, based on TCFD Recommendations, industries belonging to 4 sectors (energy, transportation, materials and buildings, agriculture, food and forestry products) that are considered to have particularly large impacts on climate change are selected as target industries.



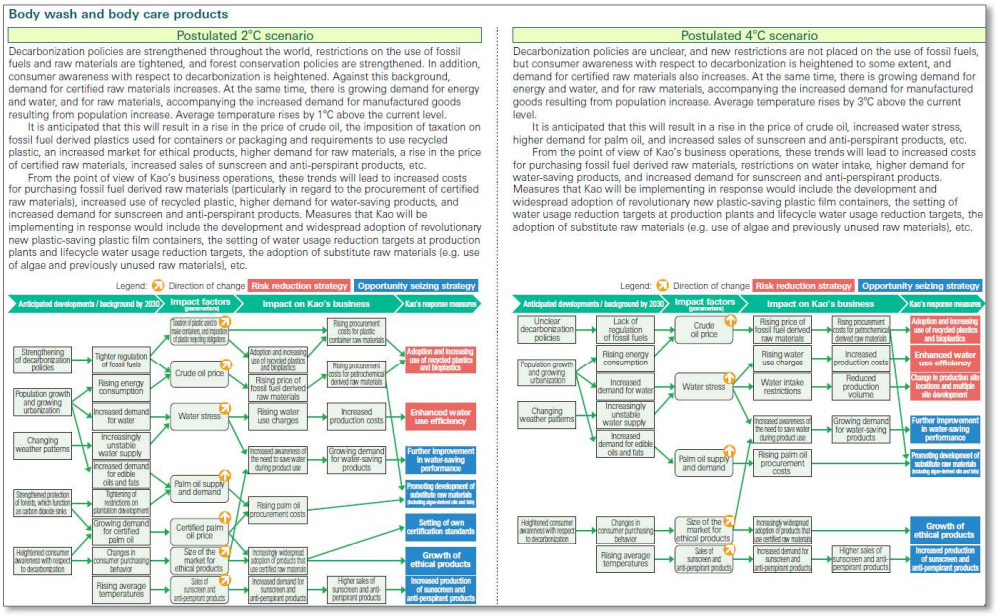
＊1: TCFD's four sector classifications

Sector	Main industries
Energy	Oil and gas, etc.
Transportation	Automobiles, passenger air, etc.
Materials and Buildings	Metals and mining, chemicals, etc.
Agriculture, Food and Forest Products	Food, agriculture, etc.

Source: Mitsubishi Corporation "ESG DATA BOOK 2019 "

【Case②:Kao Corporation】
Expand the logic tree for each business and each scenario. It covers the flow from risk enumeration to scenario definition, business impact, and response

Develop a logic tree in 2 ℃/ 4℃ scenarios for 3 industries
(cleaning agents, diapers, chemical / oil products)



Not only the response, but also the assumptions / background, influential factors, and business impact leading up to that point are clearly stated

Source：Kao Corporation "Kao Sustainability Data Book, Kirei Lifestyle Plan Progress Report 2020"

1 2 3 4 5

Agriculture, food and forestry products (Foods)

【Case③:Kirin Group】
Extensive resilience assessments quantitatively show the impact of climate change on major agricultural products

Resilience assessment of climate change impact

1 Assessment of resilience against climate change impacts

Assessment of water risk associated with agricultural yields/production regions

Brewing technologies that do not rely on barley in categories, such as happo-shu (low-malt beer) and new genres, enables the deployment of products using alternative sugars for barley in other countries and regions.
In the event that agricultural breeds that can adapt to climate change are developed, our mass plant propagation technologies can contribute to speedy expansion of acreage.
The insights gained through the activities to support farms obtain sustainability certification can be deployed for other crops.
Use of insights on diversified procurement from multiple agricultural production countries and regions.

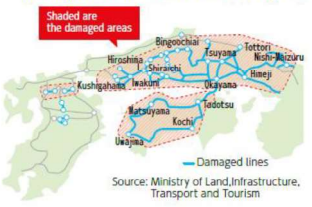
Assessment of water risk in domestic production sites and logistics routes

Rapid restructuring of logistics system based on lessons learned from the 2018 West Japan Torrential Rain Disaster.
No major impact from Typhoon Faxai and Typhoon Hagibis.

Assessment of impact of carbon pricing on electricity prices

Impact can be reduced by achieving GHG reduction targets.

2 Disruption of railway networks due to the West Japan Torrential Rain Disaster in July 2018



Source: Ministry of Land,Infrastructure, Transport and Tourism

Climate change impact on major agricultural products

1 Impact of climate change on major agricultural product yields/land suitable for cultivation

Agricultural products	Kirin Group Scenario3: 4℃, unwanted world, 2050			
	United States	Asia	Europe/Africa	Oceania
Barley		West Asia Yield▲/+ South Korea Yield+	Finland Spring wheat yield▲ Mediterranean coast (West) yield▲, (East) yield+ France Winter barley and spring barley: Both yields▲	Western Australia Yield▲▲
Hops			Czech Republic Yield▲	
Black tea		Sri Lanka Yields down in lowlands Little impact of temperature rise in highlands India (Assam region) For each 1° C temperature rise above average temperature of 28° C, yields down 3.8% India (Darjeeling region) Yield▲▲~▲▲▲Sources from tea industry, not academic papers)	Kenya Rise in altitude of suitable cultivation land &gor contraction of suitable cultivating land in Nandhi region and western Kenya Kenyan mountain regions will remain suitable for cultivation Malawi Chitipa district: Suitable land▲▲▲ Nkhata Bay district: Suitable land▲▲▲ Mulanje district: Suitable land+++ Thyolo district: Suitable land++	
Wine grapes	United States (California) Suitable land: ▲▲▲ Northwestern United States Suitable land: +++ Chile Suitable land: ▲▲	Japan (Hokkaido) Expansion of suitable land Enable cultivation of Pinot Noir Japan (Central Honshu) Suitable land expanded on the one hand, but high-temperature damage also caused	Northern Europe Suitable land: +++ Mediterranean coast Suitable land: ▲▲▲ Spain Production volumes▲to▲▲ Western Cape, South Africa Suitable land: ▲▲▲	New Zealand Suitable land: +++ Southern coastal regions of Australia Suitable land: ▲▲▲ Outside southern coastal regions of Australia Suitable land: ▲▲
Coffee beans	Brazil Suitable land for Arabica: ▲▲▲ Suitable land for Robusta: ▲▲▲	Southeast Asia Suitable land for Arabica: ▲▲▲ Suitable land for Robusta: ▲▲▲	East Africa Suitable land for Arabica: ▲▲ Suitable land for Robusta: ▲▲	
Corn	Southwestern United States Yield ▲▲ United States (Iowa in mid-West) Yield ▲~▲▲ Brazil, Argentine Yield ▲~▲▲	China Yield ▲▲		

Legend: Negative/positive impact of less than 10% ▲/+ From 10% to less than 50% ▲▲/++ 50% or more ▲▲▲/+++

Resilience is shown by assessing risks in raw material procurement and logistics supply chains and taking countermeasures

Quantitatively evaluate the impact of climate change in each region on 6 agricultural products from less than 10% to 50% or more

Source：Kirin Group, “Environmental Report 2020”

1 2 3 4 5

Materials and Buildings (Chemicals)

【Case④: Sekisui Chemical 】
Conducted risk assessments in five areas and mentioned the timeframes that are expected to have an impact. Qualitatively implement analysis of business risks and opportunities and examination of countermeasures

Type		Climate change risks	Financial Impact	Business risks	Business opportunities	Response / Actions by SEKISUI
Transition	Policy regulations	Carbon tax hike	Large	<Medium- to long-term> ・Increase in energy procurement costs ・Decrease in sales due to adding costs to product prices	<Medium- to long-term> ・Acquire business opportunities by differentiating through early response ・Stabilization of energy costs by introducing renewable energy	・Develop plans to promote converting purchased power to renewable energy, using ESG investment framework ・Improve effectiveness through public commitments such as SBT certification and RE100 membership
		Energy saving/ low carbon regulations	Large	<Short-term> ・Increase in capital investment to strengthen energy conservation and renewable energy <Medium- to Long-term> ・Increase in introduction costs for renewable energy certificates, etc.	<Short term> ・Increased sales from energy conservation/storage/ creation businesses ・Increased sales from CO_2-regulation compliant products	・Establish ESG investment framework ・Develop new energy creation technologies (Ex.: perovskite solar cells) ・Review green procurement standards as appropriate ・Standardize housing with ZEH specifications
		Policy	Large	<Short-term> ・Increase in renewable energy procurement and waste treatment costs <Medium- to long-term> ・Lose market share from loss of differentiation due to mandating of low-carbon products such as ZEH	<Short-term> ・Increased need for technologies to reduce CO_2 during waste incineration <Medium- long-term> ・Increase in sales of new homes due to expansion of ZEH market due to from mandatory ZEH specs	・Develop technology for creating ethanol from garbage (Ex.: BR) ・Utilize purchased power after FIT (Ex.: Smart Heim Denki) ・Expand products that enhance sustainability (800 billion yen by 2022)
		Litigation	Medium	<Medium- to Long-term> ・Lawsuits against companies using fossil fuels	<Medium- long-term> ・Increase in business opportunities due to consumer trust earned from commitments to society	・Disclose environmental vision and 2050 GHG emissions reduction targets ・Improve scores in various external rating systems
	Technology	Replacement to low carbon products	Medium	<Short-term> ・Increase in re-certification costs due to change of low-carbon materials <Medium-term> ・Changeover to lower carbon materials and processes	<Short- to medium-term> ・Increase in business opportunities for Environment-Contributing Products that contribute to low carbonization	・Use LCA evaluations in planning, development and marketing ・Use LCA evaluations in marketing ・Explore development of products using bio-derived materials
	Markets	Change in consumer behavior	Medium	<Long-term> ・Decrease in sale of new cars	<Long-term> ・Increase in profitability from shift to higher-performance products ・Expansion of market for ICT-related products	・Develop highly heat-resistant, high durability and other high performance products ・Develop lightweight PV, heat dissipating products
		Market Uncertainty	Medium	<Long-term> ・Investments to stabilize power supply for dispersed renewable energies	<Long-term> ・Increase in sales of products to support a more dispersed society	・Sale of energy self-sufficient stand-alone housing ・Development of resource circulation technologies (Ex.: BR)
	Reputation	Changes in consumer preferences	Medium	<Long-term> ・Decrease in sales due to increased preference for "sharing" over "owning"	<Long-term> ・Creation of new businesses to meet consumer preferences	・Begin services utilizing housing big data (Ex.: SMART HEIM Denki)
		Industry criticism	Large	<Medium- to long-term> ・Investor valuation decline for companies that do not decarbonize	<Short- to medium-term> ・Secure stable financing by demonstrating compatibility with resource circulation	・Utilization of purchased electricity after FIT
Physical	Acute	Frequent typhoons	Large	<Short-term> ・Damage such as increase in plant shutdowns and decrease in sales ・Increase in flooding/flood control costs ・Decrease in sales due to supply chain disruption	<Short-term> ・Increase in needs for resilient infrastructure ・Increase in sales of products for areas with a high level of water-related risks	・Understand water risks and implement countermeasures ・Develop highly durable infrastructure ・Accelerate infrastructure renewal in developed nations (Ex.: SPR method) ・Expand infrastructural business in developing nations ・Develop disaster response products (Ex.: drinking water storage systems)
		Heavy rain/ droughts	Large	<Medium- to Long-term> ・Increase in insurance costs	・increase in needs for equipment/facilities for disaster preparedness	
	Chronic	Changes in rainfall patterns	Medium	<Short-term> ・Increase in costs for restructuring supply chain	<Short-term> ・Increase in sales of heat insulating/heat shielding products	・Encourage changes on the part of raw material suppliers in accordance with procurement standards ・Globally disperse production bases ・Strengthen backup manufacturing systems in accordance with increase in illnesses
		Sea level rise	Medium	<Medium- to long-term> ・Increase in heat stroke/other illnesses related to warming	<Medium- to long-term> ・Increase in needs for pharmaceutical products/ diagnostic drugs that contribute to treatments	
		Rise in average temperatures	Medium	・Increase in cooling costs		

Analysis of how long risks and opportunities will become apparent in three stages: short-term (less than 3 years), medium-term (less than 3-6 years), and long-term (6 years or more)

Source：Sekisui Chemical “TCFD REPORT 2020”

【Case⑤:Sumitomo Mitsui Trust Holdings】

Give credit ratings to the power sectors that have large amount of carbon-related, and quantitatively show the amount of increase in credit costs by physical risks while mentioning the logic

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Finance

■ **Risk/opportunity evaluation in the major sectors**

Heat Map

Sector	Transition risk	Physical risk	Opportunity	Exposure
Petroleum, gas, and coal	High	Medium	Medium	Medium
Electric power	High	Medium	Medium	High
Marine transportation	Medium	Medium	Medium	High
Railway transportation	Low	Low	Low	Medium
Automotive and parts	Medium	Medium	Medium	Medium
Property management and development*	Low	High	Medium	High
Chemicals	Medium	Medium	Medium	Medium
Paper and forest products	Medium	High	Medium	Low
Personal mortgage loans	Low	High	Medium	High

*Personal mortgage loans not included

Considering the results of qualitative evaluation of risks and opportunities and exposure, electricity is selected as the target for analysis of transition risk and personal mortgages are selected for analysis of physical risk.

■ **Transition Risk: Changes in credit ratings for the power sector**

	STEPS scenario	SDS scenario
No investment in renewable energy power generation	Credit rating worsens by 2–3 notches	Credit rating worsens by 2–3 notches
Active investment in renewable energy power generation	No changes observed in credit rating	No changes observed in credit rating

Credit rating is evaluated unchanged when aggressively investing in renewable energy generation

■ **Physical risk: Changes in credit costs for personal mortgages**

1. Measuring Changes in Property Value Owing to Floods
Based on an analysis of the correlation between flood events in Japan and subsequent changes in property market prices, we calculated the rate of decline in property value caused by a flood disaster, as well as property value taking into account baseline property valuations and the probability of floods occurring under a climate change scenario.

2. Clear Indication of Impact on Overall Portfolio
As changes in valuations for each property in the mortgage loan portfolio affect the portfolio's LtV ratio*, a decline in the LtV ratio clearly demonstrated a climate change risk.
*Loan to Value ratio

Current property valuation × ❶ Rate of change in property value owing to flood disaster × Probability of floods occurring during remaining repayment period = ❷ Property value impacted by climate change (floods)

We calculated that credit costs on mortgage loans at SuMi TRUST Bank would increase by around ¥7.0 billion by the year 2100 compared to the end of March 2020 based on the probability of floods occurring and the rate of change in property value caused by flood damage in either scenario. We think the financial impact of physical risks in mortgage loans at SuMi TRUST Bank is limited.

After referring to the logic of cost calculation and quantitatively showing the amount of increase in credit cost due to flooding, the impact is evaluated as limited.

Source: Sumitomo Mitsui Trust Holdings, "TCFD REPORT 2020/2021"

【Case⑥:JFE Holdings】

Qualitatively assessing the identified risk / opportunity factors (using arrows). It also mentions the stakeholder's perspective on the group.

1 2 3 4 5

Materials

	Societal changes and responses to changes		Expectations and concerns of stakeholders towards the JFE Group		Evaluation results
2°C scenario Important factor ❶ Decarbonization in steel production processes	Rising societal demands for decarbonization towards steel production processes	Implementation of innovative technologies that achieve large-scale decarbonization Implementation of carbon pricing	• Significant contribution through innovative technologies • Increase in investment in the implementation of innovative technologies • Increase in operation costs due to the introduction of carbon pricing	Opportunities Risks	Development and implementation of innovative technologies on top of existing technologies Investment in the implementation of innovative technologies is possible Cost competitiveness is maintained when carbon pricing is implemented worldwide
2°C scenario Important factor ❷ Increase in demand for the effective use of steel scraps	Increased focus on electric furnace method, which emits low levels of carbon	Rising expectations toward electric furnace steel Increase in scrap generation	• Replacement of converter steel with electric furnace steel • Increase in JFE Group's production of electric furnace steel	Opportunities	Restrictions on the amount of scrap provided, increase in production of converter steel Increase in production of electric furnace steel and the need for electric furnace engineering Expansion of the scrap logistics business
2°C scenario Important factor ❸ Change in demand for steel for automobiles and others	Change in automobile needs	Increase of EV motors Decrease of internal combustion engines Reduction of weight and the increased use of multi-materials	• Increase in demand for electrical steel sheets for EV motors • Decrease in demand for special steel due to the decrease of internal combustion engines • Replacement of automobile steel due to the increased use of multi-materials	Opportunities	Increase in demand for electrical steel sheets due to more electric vehicles Increase in demand for special steel due to increase in automobile sales Increase in demand for high-tensile steel sheets for automobiles Refocus on the recyclability of steel
	Rising demands for eco-friendly raw materials	Demand for decarbonization and recyclability	• Demand for further decarbonization and recyclability in steel production	Risks	Limited impact of the increased use of multi-materials
2°C scenario Important factor ❹ Increase in demand for solutions promoting decarbonization	Shifting to decarbonization	Increase in demand for solutions promoting transition toward decarbonization Overseas development of energy conservation technologies	• Renewable-energy power generation plants • Low-carbon business (Eco Solution) in developing countries using Best Available Technology (BAT) developed and commercialized in Japan	Opportunities	Integrated constructions and operations of renewable energy (biomass, geothermal, and solar power) plants Integrated constructions and operations of waste incinerators and plastic recycling plants Integrated constructions of CCU and CCS facilities Overseas development of low carbon businesses

Source: JFE Holdings, "JFE GROUP REPORT 2020"

【Case⑦:Hitachi】

Explaining the world view of scenarios for multiple businesses that are greatly affected by climate change, mentioning countermeasures and opportunities that utilize in-house technology, and showing resilience to climate change

1 2 3 4 **5**

Electric and Electronic

Explain the world view of the scenario for each of the six businesses

Target businesses	Railway systems	Power generation and power grids	IT systems	Industrial equipment	Automotive systems	Construction machinery
The business environment and major risks and opportunities under the 4°C scenario	Risks: The high frequency of natural disasters will exacerbate damage to production facilities, worsen working environments, and disrupt supply chains, leading to delays in deliveries and the procurement of parts Opportunities: Transport systems more resilient to natural disasters can be developed. Competitiveness can be enhanced by providing added value in such forms as energy-saving railcars and adaptability to new technologies.	Risks: The high frequency of natural disasters will increase damage to power generation and transmission/distribution facilities, hamper efforts to restore power transmission/distribution, and disrupt supply chains, leading to delays in deliveries and the procurement of parts Opportunities: Energy demand will grow as warmer weather leads to increased use of air conditioning. Demand will increase for disaster-resilient power generation and transmission/distribution technologies.	Risks: Natural disasters will exacerbate damage to production facilities, worsen working environments, and disrupt supply chains, leading to delays in deliveries and the procurement of parts Opportunities: Demand will increase for social and public systems that help reduce damage from natural disasters and for IT systems required as part of a BCP	Risks: Natural disasters will exacerbate damage to production facilities, worsen working environments, and disrupt supply chains, leading to delays in deliveries and the procurement of parts Opportunities: Efforts to accommodate IoT products will lead to higher demand for remote control and remote maintenance during natural disasters	Risks: Natural disasters will exacerbate damage to production facilities and disrupt supply chains, leading to delays in deliveries and the procurement of parts. A breakdown in one link of the supply chain will have an increasingly severe impact on production overall. Opportunities: Demand will grow for technologies to enhance the efficiency of internal combustion engines	Risks: Natural disasters will exacerbate damage to production facilities, worsen working environments, and disrupt supply chains, leading to delays in deliveries and the procurement of parts Opportunities: Infrastructure projects to prevent and mitigate disasters and support recovery efforts will increase
Non-environmental market factors (neither the 2°C nor 4°C scenario)	• Economic growth will lead to urbanization and population growth around the world, driving the railway business globally as an efficient form of public transport for large numbers of passengers, regardless of climate conditions. Market size in Japan will remain flat, but the Asian market overall will see substantial growth. • Long-distance transport will decline going forward as the global pandemic restricts travel and encourages remote work. The decline in demand, though, will not be as severe as that for air transport. • Competition will grow as major railway manufacturers in various countries will expand their business to meet global demand	• Economic growth, urbanization, and population growth will push up demand for energy, especially electricity, mainly in developing countries • Energy supply and demand will diversify due to various factors, such as CO_2 emissions, environmental burden, economic performance, safety, and supply stability • Digital technology will be further applied to enhance the stability and efficiency of the power supply	• Further digitization globally will exponentially increase the volume of data circulated, accumulated, and analyzed. Experience with the global pandemic will prompt a shift to remote, noncontact, and online formats, both in our life and work, and boost demand for solutions that facilitate such a shift. • New services and businesses utilizing big data, IoT, AI, and other digital technology will expand rapidly	• Digitalization, infrastructure renewal, population decline, and worker shortages will expand the automation market in industrial countries • As the global pandemic forces people to stay at or work from home, demand will grow for factory automation enabling a handful of workers to operate a factory • The industrial market in emerging economies will grow due to a rise in production plants	• Economic growth, urbanization, population growth, and infrastructure development like road construction will expand the global market for automobiles as a flexible and personal means of transport • The global pandemic may temporarily dampen passenger vehicle sales due to restrictions on people's movement, but commercial vehicle sales appear to be rising as need for goods delivery increases • Non-environmental functions like autonomous driving and advanced safety features that promote safety, security, and comfort will drive competitiveness	• Worker shortages will be addressed through further labor savings, automation, remote work, and the development of safety-related products and solutions • Products, services, and solutions (such as CO_2-free machines/attachments suited for work at dismantling sites, in narrow spaces, and underground) will be further developed to meet the needs of smart infrastructure building amid rapid urbanization • Emerging economies with expanding markets represent both increased sale opportunities and intensifying competition with emerging manufacturers • There is a need for stronger total supply chain management to accommodate shifting demand and for enhanced resilience of the business portfolio
Responses to future business risks (business opportunities)	Response to business risks under 2°C or 4°C scenario • Continue to strengthen the railway business, as global demand for railways will increase under either scenario • Specifically, develop and market more energy-saving railcars and battery-powered railcars for non-electrified sections. Strengthen railway services through digital utilization, such as dynamic headway (flexible operation in response to passenger demand), and new mobility services like MaaS. • Given the increasing frequency of natural disasters, take risk aversion into account when deciding the location and equipment layout of a new plant. Keep an eye on the supply chain in strengthening our ability to respond to business disruption risks in accordance with our BCPs.	Response to business risks under 2°C or 4°C scenario • Continue to enhance response to relevant markets in view of expected higher demand for non-fossil energy under either scenario • Strengthen the provision of grid solutions, digital service solutions, and energy platforms that can accommodate the increased use of renewable energy and diversification of energy supply and demand management • Given the increasing frequency of natural disasters, develop technologies for disaster-resilient renewable energy systems and disruption-resistant power transmission/distribution systems. Take risk aversion into account when deciding the location and equipment layout of a new production plant. Keep an eye on the supply chain in strengthening our ability to respond to business disruption risks in accordance with our BCPs.	Response to business risks under 2°C or 4°C scenario • Continue to develop innovative digital technologies, nurture necessary human capital, and enhance digital service solutions that generate new value in view of expected growth in society's demand and markets for digital services under either scenario • Specifically, enhance competitiveness by providing energy-saving and high-efficiency IT solutions that contribute to zero-emissions; platforms for expanded environment-related financial services for decarbonization businesses; social and public systems to prevent natural disasters, reduce damage, and enhance resilience; and IT systems for BCPs • Given the increasing frequency of natural disasters, strengthen our ability to respond to business disruption risks in accordance with our BCPs	Response to business risks under 2°C or 4°C scenario • Under either scenario, continue developing energy saving, high efficiency products that use IoT technology. Focus particularly on connected products with communication features. Miniaturized, high-efficiency, low-loss products can also help reduce CO_2 emissions. • Given the increasing frequency of natural disasters, take risk aversion into account when deciding the location and equipment layout of a new plant. Keep an eye on the supply chain in strengthening our ability to respond to business disruption risks in accordance with our BCPs.	Response to business risks under 2°C scenario • Promote R&D of electrification technology and other alternative toohnologies to enhance response to new markets, such as for electric vehicles Response to business risks under 4°C scenario • Promote R&D and product development in existing technologies, including internal combustion engines, to not only improve energy efficiency but increase such non-environmental value as safety, security, and comfort • Given the increasing frequency of natural disasters, take risk aversion into account when deciding the location and equipment layout of a new plant. Keep an eye on the supply chain in strengthening our ability to respond to business disruption risks in accordance with our BCPs.	Response to business risks under 2°C scenario • Advance product development with an eye on trends in electrification and low/no carbon fuel to minimize development and product costs • Build a system covering the entire value chain to work with and support the education of maintenance staff engaged in new technologies to accommodate customer requests for servicing and rentals Response to business risks under 4°C scenario • Promote the development and manufacture of innovative products and solutions that enable a speedy recovery from disasters • Given the increasing frequency of natural disasters, take risk aversion into account when deciding the location and equipment layout of a new plant. Keep an eye on the supply chain in strengthening our ability to respond to business disruption risks in accordance with our BCPs.
Financial information (sales volume of each target sector)	Impact on part of ¥580.3 billion in railway systems business sales (FY 2019)	Impact on part of ¥399.2 billion in Energy Sector sales (FY 2019)	Impact on part of ¥2,099.4 billion in IT Sector sales (FY 2019)	Impact on part of ¥424 billion in Industry Sector's industrial products business sales (FY 2019)	Impact on part of ¥811.6 billion in automotive business (Hitachi Automotive Systems) sales (FY 2019)	Impact on part of ¥931.3 billion in construction machinery business (Hitachi Construction Machinery) sales (FY 2019)

We believe that by paying close attention to market trends and developing our business flexibly and strategically, we have high climate resilience [illegible]

Note: The above scenario analyses are not future projections but attempts to examine our resilience to climate change. How the future unfolds may be quite different from any of these scenarios.

References to countermeasures and opportunities that utilize in-house technology

By presenting an overview of the world view in multiple scenarios and a flexible strategy for climate change for the six businesses that are greatly affected by climate change, it is possible to appeal that they have resilience to climate change

Source：Hitachi, "Sustainability Report 2020"

【Overseas case Ⅰ：Neuberger Berman】

Examine the potential impacts of climate change under the control of the CRO / COO. They also use the results of scenario analysis for engagement and portfolio adjustment

1 2 3 4 **5**

Finance

The Head of ESG Investing works with the CIOs and the CRO to ensure appropriate climate expertise and analytical capabilities are in place to support portfolio managers and research analysts in understanding the potential implications of climate change for security analysis and portfolio construction.

The COO and CRO play an especially active role in managing the firm's business operations and resiliency to climate-related risks. This includes improvements to the firm's operational efficiencies and carbon footprint or adaptation and mitigation actions with respect to both transition and physical risk.

Under the control of COO and CRO, consider the resilience of the farm regarding the potential impact of climate-related risks, including efforts to address transition risks and physical risks

Furthermore, we can use this analysis to identify which holdings are priority engagement candidates across the firm based on their climate value-at-risk and Neuberger Berman's economic exposure. Of our top 15 equity holdings with the highest economic climate value-at-risk exposure as of 12/31/2019, we engaged with 12 of these in 2019 (highlighted in blue). For example, we engaged numerous times with the board and management of Utility A over the last year, including advocating for a much more rapid phase-out of coal power plants in an effort to decarbonize the generation fleet. As a result of these discussions and pressure from other shareholders, the company retired seven coal plants in two years, decreasing CO_2 emissions 42% off a 2010 baseline.[2] The company has committed to retire an eighth coal plant by year-end 2022 and is investing in an energy transition strategy via battery storage projects and solar.[3]

Use scenario analysis results to prioritize engagement candidates

The conclusions drawn from this analysis can be used by portfolio managers to more accurately price securities in their investment selection process. Additionally, portfolio managers can use this information in the construction of more resilient portfolios that can help protect client value over the long term.

It can also be used by the portfolio manager's Investment selection process for more accurate securities pricing.
Used for portfolio construction

Source：Neuberger Berman "2020 Climate-related Corporate Strategy", "2019 Environmental, Social and Governance Annual Report"

【Overseas case Ⅱ : AES】

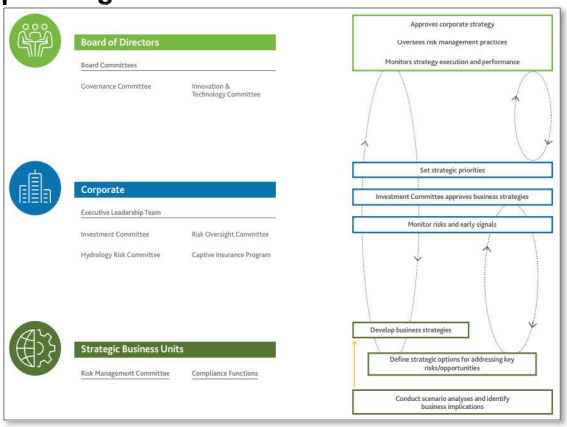
Assuming future business areas, analysis are conducted in multiple departments, and the scenario analysis is even in the CEO message. It also explains the scenarios and calculation process in detail

1 2 3 4 5

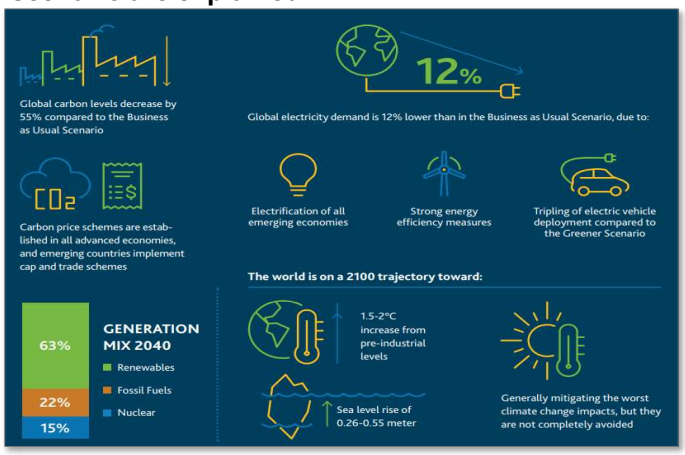
Energy

> The impacts of climate change and policy responses are dynamic. As a company with operations in 15 countries, we have developed a portfolio and growth strategy that is resilient across a number of possible scenarios pertaining to both physical and transition climate-related risks. This report implements recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and provides additional analysis for stakeholders into the strength and resilience of our portfolio – whether we are navigating policies that limit global warming to 2°C or withstanding the possible physical impacts of a world that fails to achieve that goal.

In the CEO message, scenario analysis and the link between analysis and long-term planning were mentioned



The details of the assumed world view for each scenario are explained



Under a system that also incorporates management, they are considered and managed by multiple departments based on the level of risk

Source : AES "AES Climate Scenario Report"

【Overseas case Ⅲ : Unilever】

Comprehensive and qualitative description of business impact. In addition, as a countermeasure, we are promoting M & A strategies and supply chain initiatives

1 2 3 4 5

General consumer goods

> The main impacts of the 2°C scenario were as follows:
> - Carbon pricing is introduced in key countries and hence there are increases in both manufacturing costs and the costs of raw materials such as dairy ingredients and the metals used in packaging.
> - Zero net deforestation requirements are introduced and a shift to sustainable agriculture e.g. Climate Smart Agriculture, puts pressure on agricultural production, raising the price of certain raw materials.
>
> The main impacts of the 4°C scenario were as follows:
> - Chronic and acute water stress reduces agricultural productivity in some regions, raising prices of raw materials.
> - Increased frequency of extreme weather (storms and floods) causes increased incidence of disruption to our manufacturing and distribution networks.
> - Temperature increase and extreme weather events reduce economic activity, GDP growth and hence sales levels fall.

Qualitatively describe the impact of the 2 ° C / 4 ° C scenario on the impact on the entire business, and express resilience.
In addition, qualitatively describe the effect on yield of soybeans and black tea as an important product

Changing consumer preferences

> To capitalise on the future revenue opportunities, our M&A strategy aims to acquire new businesses which serve specific consumer segments such as sustainability conscious consumers. A number of our recent acquisitions, including Pukka Herbs, Sundial, Mae Terra, Seventh Generation, and OLLY Nutrition, are recognised as B Corps – meaning they have met stringent environmental and social criteria as laid out in the B Corp impact assessment. For example, Seventh Generation advocates for renewable energy and is taking action to decarbonise its own business and Pukka Herbs has its own science-based zero carbon goal.

We plan to acquire new sustainable businesses through M & A strategies regarding changes in customer behavior

Future policy and regulation

> Despite our efforts over the past decade, commodity-driven deforestation remains a serious challenge in many parts of the world. We're taking a number of steps to eliminate deforestation from agricultural commodity supply chains. Firstly, we are transforming our own supply chains by making sure the palm oil, soy, paper and board, and tea we buy is both traceable and certified as sustainable. Secondly, we are working with governments and other partners to ensure that deforestation gets the political attention and financial resources it needs. In particular, we are focused on helping reduce deforestation in key regions of South-East Asia, South America, and West and Central Africa. We're also using our networks and relationships to help tropical forest countries access large-scale, performance-based payments for emissions reductions from forests.

In addition to transforming our own supply chain for palm oil, soybeans, paper, and tea, we are working with governments to promote deforestation reduction

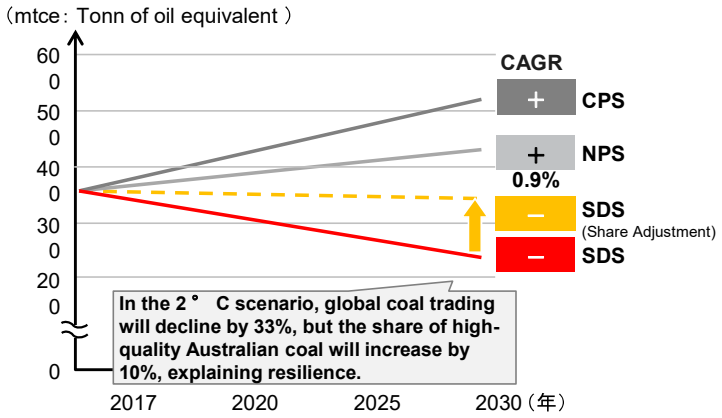
Source : Unilever "Unilever Annual Report and Accounts 2019"

【Overseas caseⅣ: Aurizon】
Understand the risks and opportunities for your own business, including the supply chain. It also describes the parameters of the scenario and details the world view

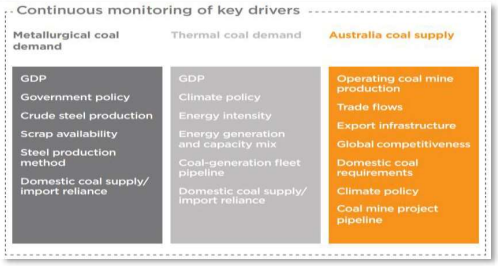
RISK	DESCRIPTION	RISK TYPE	POTENTIAL IMPACT TO BUSINESS	STRATEGIC PLANNING, RISK MITIGATION AND OPPORTUNITIES	METRICS
Climate change resilience and adaptation	Current and future disruption arising from increased severity and/or frequency of extreme weather events (higher temperatures, strong winds, flooding and associated erosion, bushfires and others).	Physical: Acute & Chronic Risk level: Moderate to High	May result in loss of revenue due to extreme weather events affecting mining, transport and port activities across the supply chain. May result in higher costs associated with ensuring asset availability, or to address damage to assets. Time horizon: Short-, medium- and long-term	› Continue to design infrastructure to recover quickly from flooding and extreme weather events, including the positioning of inventory such as ballast, flood rock, rail and formation material. › Reduce blanket heat-triggered speed restrictions through more localised real-time monitoring of track temperatures. › Improve engagement with customers on the estimated recovery timelines by providing an initial range that is narrowed as certainty increases. › Ensure an adaptive design approach to improve infrastructure resilience. › Engage with land use planning and policymakers regarding incentivisation of low-impact transport modes and enabling infrastructure (e.g. electrified rail) to ensure consistent treatment of transport systems within policy.	› Current/projected temperatures through our Network's Remote Monitoring System, the Bureau of Meteorology, and CSIRO.

Describe the risks and opportunities for your own business including the supply chain.
Each item is also evaluated on the axis of short-term, medium-term, and long-term impact occurrence times

Coal exports from Australia (Compared to 2017)



Based on the IEA scenario, set parameters and define the world view of the scenario. Also identify key indicators to monitor



Source: Aurizon "2020 SUSTAINABILITY REPORT"

【Overseas case Ⅴ: Mondi】
Quantitatively describe the amount of financial impact of risks and opportunities. It also explains the expected business background and calculation process

Climate-related risks

Quantifying our climate-related risks

Regulatory changes
Reduced EU Emissions Trading System (ETS) allowances in period IV may result in the need to purchase additional GHG credits

The majority of Mondi's European sites (nine out of 13 material operations) fall under the EU ETS. Currently our operations have sufficient allowances to comply with the EU ETS regime. However, the EU government has published benchmarking figures for the period 2020+ which significantly limit the CO_2 allowances of EU paper and pulp producers, including Mondi. The potential financial implication of the EU ETS allowances is in the range of €1–10 million annually (based on an average price of €35/tonne CO_2). We have calculated this worst-case scenario by identifying the gap between our mills' current annual GHG emissions and the expected GHG allowances projection to 2025.

Supply chain impacts
Extreme weather conditions leading to drought, fire, erosion and pests, and disease may reduce tree growth yields in our plantations in South Africa

Increased severity of extreme weather events may have a negative financial impact on our operations through decreased harvesting capacity in forests, for example due to decreased rainfall and wood fibre supply chain disruptions. Extreme weather conditions may also impact forests and plantations through:

→ sustained higher temperatures which can lead to stronger winds and increased windfalls;
→ plantations being vulnerable to changes in rainfall patterns and erosion caused by heavy rain; and
→ higher temperatures which may increase vulnerability of forests to pests and disease.

With droughts expected to happen more frequently, we estimate the potential financial impact of wood fibre yield losses in our South African plantations could be up to €13 million annually.

Chronic changes in precipitation
Water scarcity may put constraints on water resources used for production in our mills

Extended water shortages are a concern, especially in South Africa. Our mill at Richards Bay uses water abstracted from the Goedertrouw Dam on the uMhlathuze river, which is already under pressure from urban development. During the recent extended drought in South Africa, we reduced specific water consumption through operational measures, closed loops and recycling. Future challenges around water availability may require further investment in water recycling in the production process and lead to increased costs. Preliminary investigations indicate that reduced production is not a significant risk and the potential financial impact is estimated at less than €5 million annually.

Climate-related opportunities

Quantifying our climate-related opportunities

Reduced operating costs through energy efficiency
Focus on improved energy efficiency by establishing an international energy experts' network

We have invested around €700 million in modernising energy plants and improving energy efficiency across our mills since 2013. Our internal energy experts' network meets regularly to focus on increasing profitability and competitiveness through cost optimisation, energy efficiency improvements and structured knowledge sharing. We have a clear opportunity to improve energy efficiency across our recently acquired operations. Our energy experts support the technical teams of acquired operations to implement energy efficiency measures.

To calculate the energy efficiency opportunity, we estimate a 1% annual reduction in energy consumption, which could deliver a potential saving of around €5 million annually.

Avoided GHG emissions and secondary raw materials
Instead of incinerating by-products from pulp production, low-carbon, biomass-based chemicals can be sold as secondary raw materials

The selling price of by-products from the kraft pulping process is rising as industry in general becomes more interested in these renewable secondary raw materials.[7] Mondi is able to extract about 5–10 kg of turpentine per tonne of pulp produced from pines. This equates to a potential to produce by-product turpentine to the value of more than €10 million annually. Taking into account the investments required to realise this volume of turpentine (estimated at around €1 million) and operating and energy costs, the opportunity is valued at around €7 million annually.

Reduced operating costs through resource efficiency
Reduced water use translates into reduced operating costs and secures our licence to operate

While we have realised many internal water recycling and reuse options, we still have investment opportunities to reduce our water use. The financial impact of this opportunity comes from avoiding external waste water treatment costs and the steadily increasing costs of fresh water. We have estimated potential annual savings of €1 million, with important additional benefits in terms of securing production and avoiding potential restrictions of operations and production capacity due to water shortages or other restrictions.

Read our CDP climate change disclosure 2019

7 For example, turpentine can be used as a solvent for thinning oil-based paints, for producing varnishes, and as a raw material for the chemical industry

Quantitatively evaluate the impact of risk / opportunity on the financial impact of the entire business
It also describes calculation assumptions and processes

Source: Mondi "Sustainable Development report 2019"

Ministry of the Environment, Government of Japan
Climate Change Policy Division

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