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# **Practical guide for Scenario Analysis in line with the TCFD recommendations 2nd edition**

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**Ministry of the Environment, Government of Japan  
Climate Change Policy Division  
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## Contents (Practice Examples supported by Ministry of the Environment, Government of Japan )

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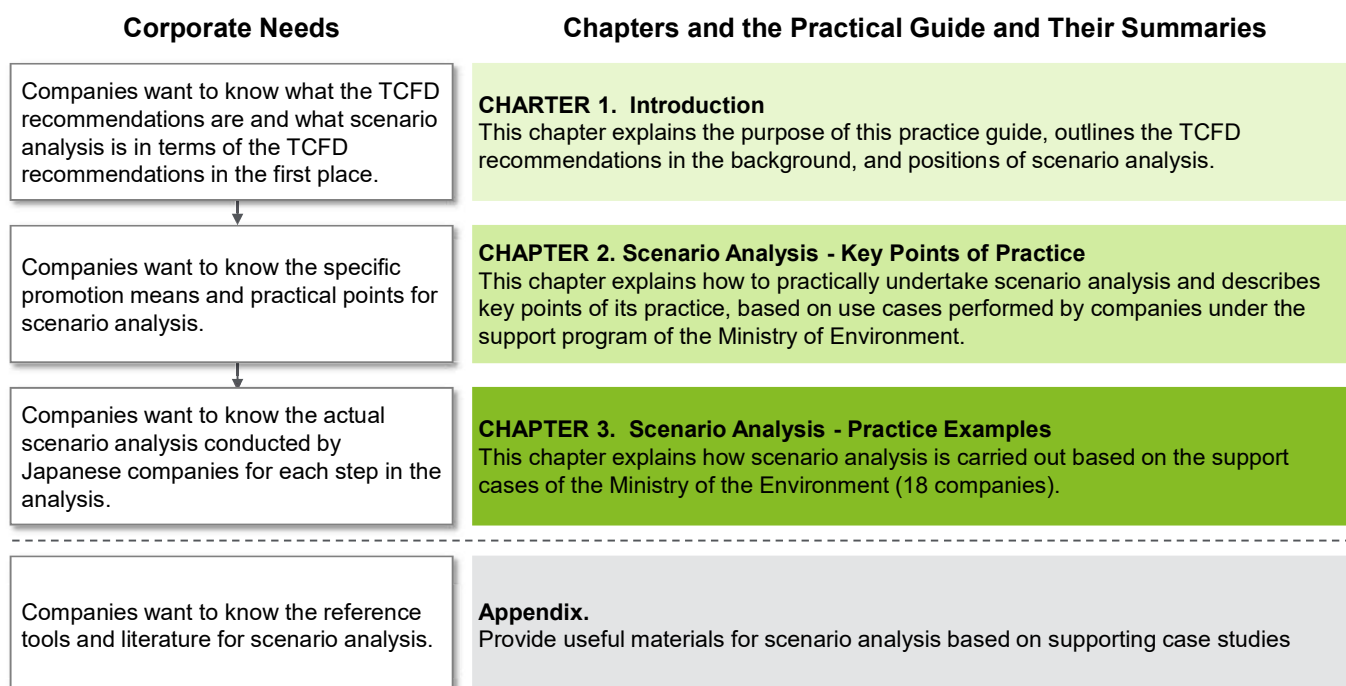
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## [Structure and Use of this Practical Guide]

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



- 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 and FY2019.

# 1. Introduction

## 1-1. Purpose of this Practical Guide

## 1-2. Positioning of scenario analysis on the TCFD recommendations

### Chapter 1. Introduction

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

1-1

### [Challenges for companies in implementing scenario analysis] Respond to the challenges of scenario analysis with “Practical Points” and “Practical Examples by Sector”

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- There are roughly 4 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.**
- 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: First, 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.
- 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. Introduction

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1-3

### **【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)

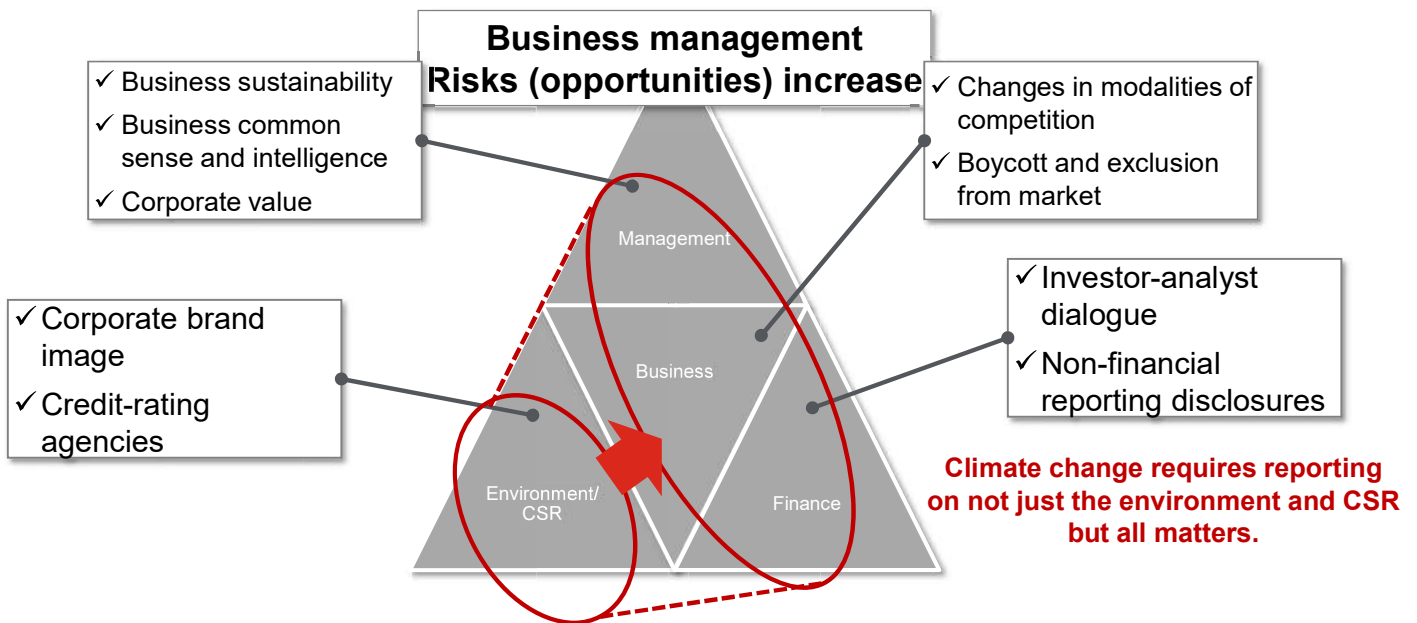


There are three broad channels through which climate change **can affect financial stability**:

- **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.**

## 【Climate Change and Corporate Management】

Climate change can present clear risks and opportunities for business management

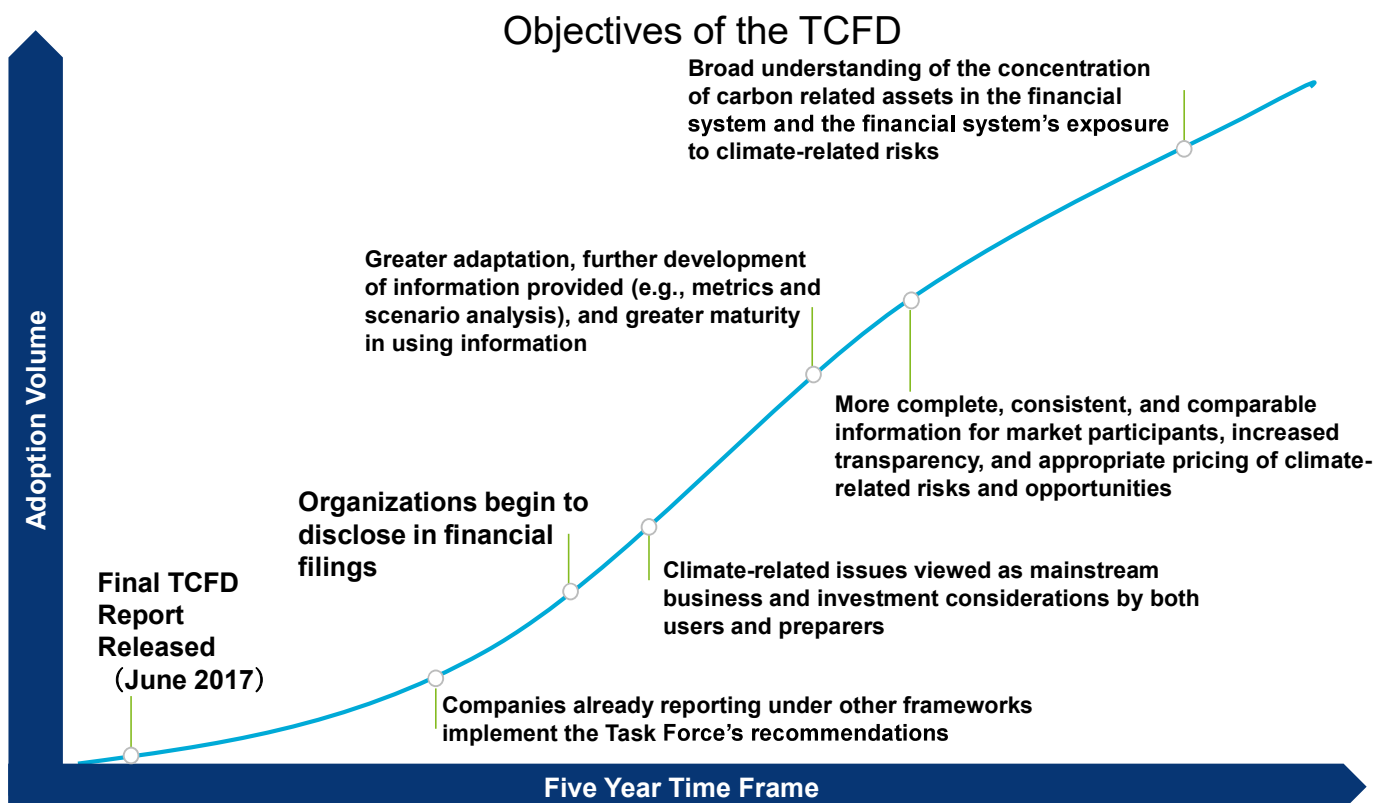


The environment and CSR department has responded to the climate change, however, there is a growing need for a company to respond to the issues as a whole, as climate-related issues can be risks and opportunities in the field of “corporate value”, “business sales”, and “fund raising.”

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## 【Objectives of the TCFD】

The TCFD recommendations expect companies to gradually adopt the recommendations.










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

1-6

# Status of the TCFD recommendations in Each Country

## Institutionalization of TCFD in Europe and China. Working on TCFD recommendations can be global standard

### Recent Trends in Each Country Based on TCFD

 EU	<b>EU revised its directive to comply with the TCFD recommendations</b>
	<ul style="list-style-type: none"> <li>Published a draft revision in March 2019 toward the "revision of guidelines for non-financial reporting directive"</li> <li>On June 20, 2019, the draft revision of the guidelines and supplementary materials was announced. TCFD compliant (June 2019)</li> </ul>
 United Kingdom	<b>UK requests its regulators to support the TCFD recommendations</b>
	<ul style="list-style-type: none"> <li>The UK Green Finance Taskforce, established by the government to transition to a low-carbon society</li> <li>Aiming to disclose information in line with TCFD of all listed companies and large asset owners by 2022.</li> </ul>
 Canada	<b>Compiled recommendations on sustainable financing, including TCFD</b>
	<ul style="list-style-type: none"> <li>Expert Panel established by the Ministry of the Environment and Climate Change and the Ministry of Finance</li> <li>Publication of the Final Report on the Issues and Recommendations on Institutionalization of Sustainable Finance, etc. (June 2019)</li> <li>In addition, banks and other financial institutions and CSA (Canada Standard Authority) are taking the lead in discussing a unique Canadian taxonomy (October 2019).</li> </ul>
 France	<b>Started standardizing and developing frameworks for non-financial data as a whole to disclose TCFD</b>
	<ul style="list-style-type: none"> <li>Economic and Finance Minister consulted the Accounting Standards Authority to develop extra-financial information disclosure frameworks to disclose information based on TCFD.</li> <li>Introduced a system to establish the Advisory Committee on Climate Change and Sustainable Finance composed of financial institutions, companies, and experts (July 2019)</li> </ul>
 China	<b>Scheduled revision of Environmental Reporting Guidelines</b>
	<ul style="list-style-type: none"> <li>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).</li> </ul>
 United States	<b>New York State department of Financial Services (DFS) has joined the Network for Greeting the Financial System (NGFS)</b>
	<ul style="list-style-type: none"> <li>New York State Department of Financial Services (DFS) participates in NGFS. NGFS considers an appropriate response to the climate-related risks on financial supervision, by publishing nonbinding recommendations in the integrated report in April 2019, including promotion of disclosure based on the TCFD recommendations (September 2019).</li> <li>However, the United States officially notified the United Nations of its decision to withdraw from the Paris Agreement, and the future outlook is uncertain (October 2019).</li> </ul>
 Japan	<b>Released guidance on TCFD disclosures</b>
	<ul style="list-style-type: none"> <li>METI released TCFD Guidance*1 by adding explanation to TCFD final report in order to promote disclosure by companies based on TCFD (December 2018).</li> <li>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).</li> <li>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).</li> </ul>

Developments toward institutionalization

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

## [Status of approval for TCFD]

**This is an initiative centered on the U.S. and Europe, and Japan ranks first in the world in terms of the number of people in favor of it**

- As of February 25, 2020, 46 countries, 1,056 companies, governments, multilateral institutions, private organizations, etc., expressed their support for TCFD. The Ministry of Environment on July 27, 2018, the Ministry of Economy, Trade and Industries on December 25, 2018, and Financial Agencies Services Agency on December, 2017 announced that it agreed to adopt the TCFD recommendations.
- As of June 2019, the total assets of financial institutions that have pledged their approval exceeded US\$118 trillion, and thereafter increased (from the 2019 Status Report)

### Number of Japanese Companies Presenting Support (as of February 25, 2020)

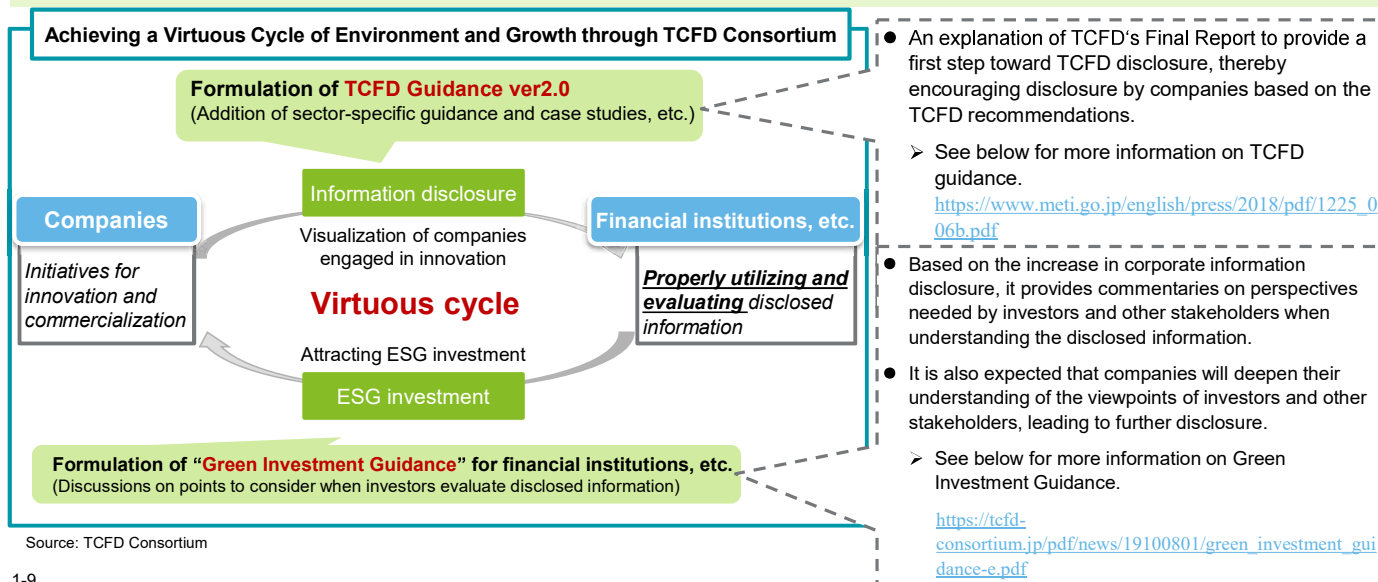
Industries and Groups		Number of companies
Financial (61)		61
Non-Financial(161)	Energy	17
	Transportation	10
	Materials and Buildings	38
	Agriculture, Food, and Forest Products	9
	Trading, Retail	13
	Electronics, Machinery, Telecommunications	45
	Consumer Goods, Pharmaceutical	10
Services	19	

Source: TCFD Consortium-provided materials

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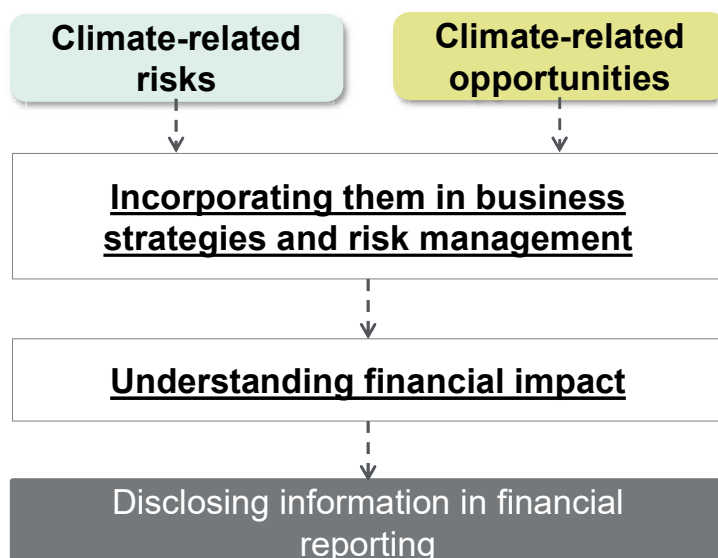
## Outline of TCFD Consortium

- 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 the future, TCFD Consortium will **consider formulating TCFD Guidance ver2.0** which was originally formulated by the Ministry of Economy, Trade and Industry in December 2018.



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## 【Requirement of the TCFD Recommendations】 The TCFD recommendations disclosure of information related to climate change that poses financial risks and opportunities



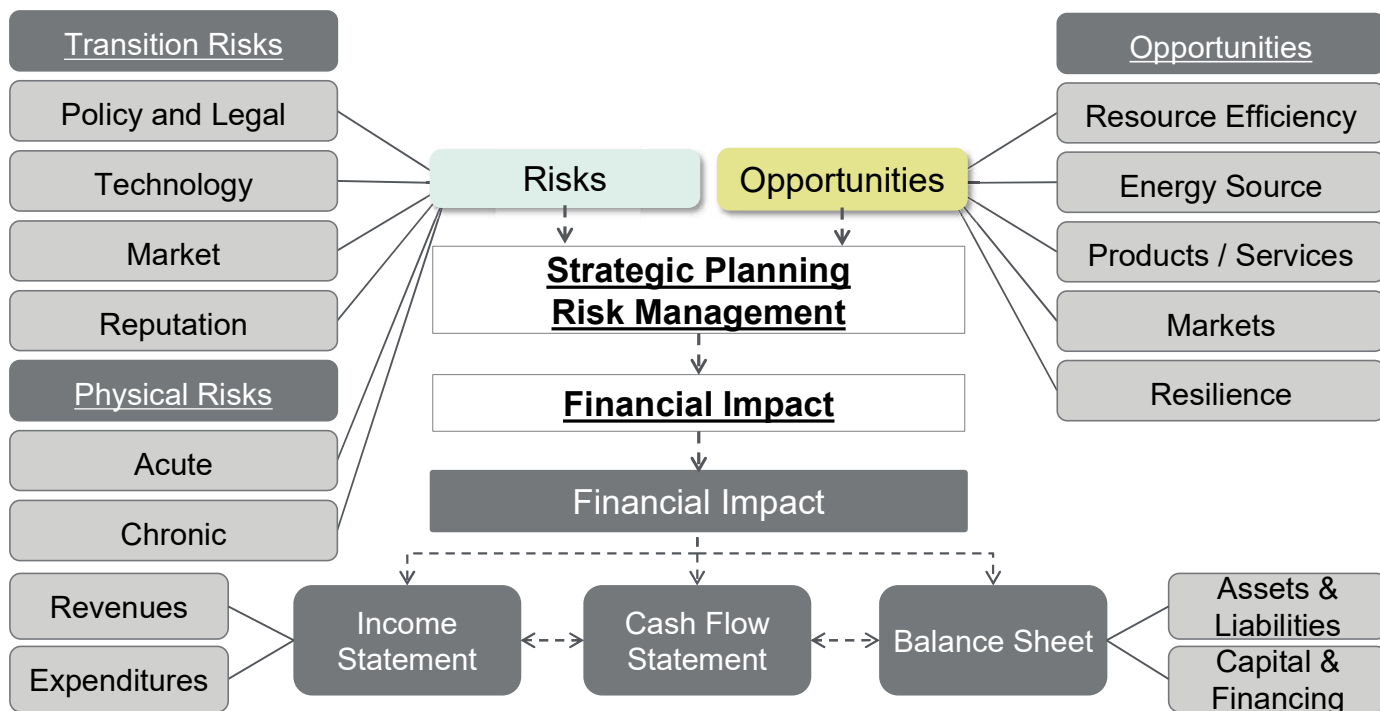
The TCFD recommendations request all companies to (i) use different climate-related scenarios, including a 2°C or lower scenario to (ii) assess their climate-related risks and opportunities, (iii) incorporate such risks and opportunities in their business strategies and risk management, and (iv) understand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



**[Financial Impact]**

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

Climate-Related Risks, Opportunities, and Financial Impacts



Source: prepared by the Ministry of 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
<b>Transition Risks</b>	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
<b>Physical Risks</b>	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 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	<ul style="list-style-type: none"> <li>Use of more efficient models of transport</li> <li>Use of more efficient production and distribution processes</li> <li>Use of Recycling</li> <li>Move to more efficient buildings</li> <li>Reduced water usage and consumption</li> </ul>	<ul style="list-style-type: none"> <li>Reduced operating costs (e.g., through efficiency gains and cost reductions)</li> <li>Increased production capacity, resulting in increased revenues</li> <li>Increased value of fixed assets (e.g., highly rated energy-efficient buildings)</li> <li>Benefits to workforce management and planning (e.g., improved health and safety, employee satisfaction) resulting in lower costs</li> </ul>
	Energy Source	<ul style="list-style-type: none"> <li>Use of lower-emission sources of energy</li> <li>Use of supportive policy incentives</li> <li>Use of new technologies</li> <li>Participation in carbon market</li> <li>Shift toward decentralized energy generation</li> </ul>	<ul style="list-style-type: none"> <li>Reduced operational costs (e.g., through use of lowest cost abatement)</li> <li>Reduced exposure to future fossil fuel price increases</li> <li>Reduced exposure to GHG emissions and therefore less sensitivity to changes in cost of carbon</li> <li>Returns on investment in low-emissions technology</li> <li>Increased capital availability (e.g., as more investors favor lower-emissions producers)</li> <li>Reputational benefits resulting in increased demand for goods/services</li> </ul>
	Products and Services	<ul style="list-style-type: none"> <li>Development and/or expansion of low emission goods and services</li> <li>Development of climate adaptation and insurance risk solutions</li> <li>Development of new products or services through R&amp;D and innovation</li> <li>Ability to diversify business activities</li> </ul>	<ul style="list-style-type: none"> <li>Increased revenue through demand for lower emissions products and services</li> <li>Increased revenue through new solutions to adaptation needs (e.g., insurance risk transfer products and services)</li> <li>Better competitive position to reflect shifting consumer preferences, resulting in increased revenues</li> </ul>
	Markets	<ul style="list-style-type: none"> <li>Access to new markets</li> <li>Use of public-sector incentives</li> <li>Access to new assets and locations needing insurance coverage</li> </ul>	<ul style="list-style-type: none"> <li>Increased revenues through access to new and emerging markets (e.g., partnerships with governments, development banks)</li> <li>Increased diversification of financial assets (e.g., green bonds and infrastructure)</li> </ul>
	Resilience	<ul style="list-style-type: none"> <li>Participation in renewable energy programs and adaptation of energy-efficiency measures</li> <li>Resource substitutes/diversification</li> </ul>	<ul style="list-style-type: none"> <li>Increased market valuation through resilience planning</li> <li>Increased reliability of supply chain and ability to operate under various conditions</li> <li>Increased revenue through new products and services</li> </ul>

Source: prepared by the Ministry of 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

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## [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	<ul style="list-style-type: none"> <li>Oil and Gas</li> <li>Coal</li> <li>Electric Utilities</li> </ul>	Assessment and potential impacts of <u>legal compliance, operating costs, changes in risks and opportunities; changes in regulations and shift in consumer and investor preferences; and changes in investment strategy</u>
Transportation	<ul style="list-style-type: none"> <li>Air Transport, Maritime Transportation</li> <li>Land Transportation (Rail Transportation, Trucking Services)</li> <li>Automobiles</li> </ul>	Assessment and potential impacts of <u>financial risks of enhanced regulations and new technology on existing factories and equipment; R&amp;D investment in new technologies; opportunities for use of new technologies to lower emissions standards and regulations on higher fuel efficiency</u>
Materials and Buildings	<ul style="list-style-type: none"> <li>Metals and Mining</li> <li>Chemicals</li> <li>Construction Materials, Capital Goods</li> <li>Real Estate Management and Development</li> </ul>	Assessment and potential impacts of <u>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</u>
Agriculture, Food, and Forest Products	<ul style="list-style-type: none"> <li>Beverages, Foods</li> <li>Agriculture</li> <li>Paper and Forest Products</li> </ul>	Assessment and potential impacts of <u>GHG emissions reductions; recycling and waste management; business of food and textile products with lower GHG emissions, and shifts in consumer preferences</u>

Source: prepared by the Ministry of 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

1-14

**[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
<b>Areas in detail</b>	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
<b>Recommended Disclosures</b>	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 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

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**[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 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

1-16

## [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 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

1-17

## [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 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

1-18

## [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 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

1-19

## Materiality of Scenario Analysis ①

Disclosure through scenario analysis is recommended to assess the impacts of climate-related risks and opportunities. Developed technical supplement for scenario analysis

Usefulness of scenario analysis

- Scenario analysis can be useful as a tool for an organization to strategically tackle challenges in the long run that are highly uncertain
- **Disclosure should also include assumptions for critical scenarios for sectors where climate-related risks are a concern.** Scenario analysis requires skill and effort, but it also benefits the organization.

Target	Applicable range of scenarios
<b>Transition risk</b>	<ul style="list-style-type: none"> <li>■ IEA WEO SDS/ETP 2DS/IEA WEO STEPS/IEA WEO NPS (2°C Target Achievement Scenario versus No Scenario)</li> <li>■ Deep decarbonization Pathways Project (2°C target achieved)</li> <li>■ IRENA REmap (doubling the renewable energy ratio by 2030)</li> <li>■ Greenpeace Advanced Energy [R] evolution (2°C Target Achieved)</li> </ul>
<b>Physical risk</b>	<ul style="list-style-type: none"> <li>■ RCPs (Representative Concentration Pathway) Scenarios adopted by IPCC: RCP8. 5, RCP6. 0, RCP4. 5, RCP2. 6</li> </ul>

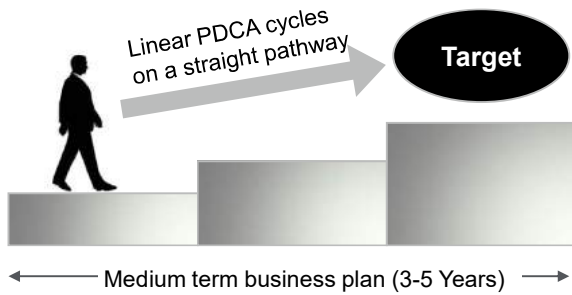
Source: Climate-Related Financial Disclosure Task Force, Recommendations by the Climate-Related Financial Disclosure Task Force (Final), 2017, pp. 25-29. Prepared by the Ministry of the Environment based on the Task Force on Climate-Related Financial Information Disclosure, "Utilization of Scenario Analysis in Climate-Related Risks and Opportunities Disclosure," Auxiliary Guidance on Pages 2017, 21 & 25. Scenarios listed on IEA WEO are updated based on the most recent publicly available report.

1-20

## Materiality of Scenario Analysis ②

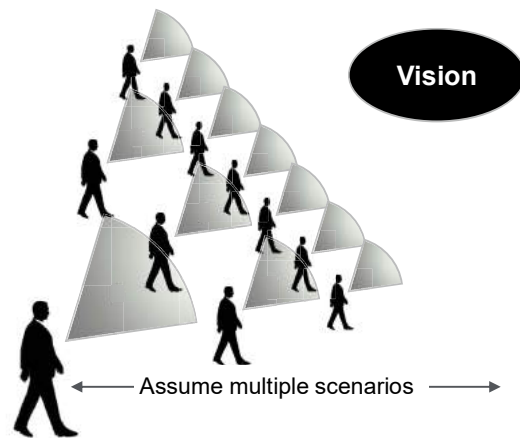
### Scenario analysis enables strategic planning and internal/external dialogue in response to future uncertainties

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 place without any subjective viewpoints on future
- Management can demonstrate business resilience

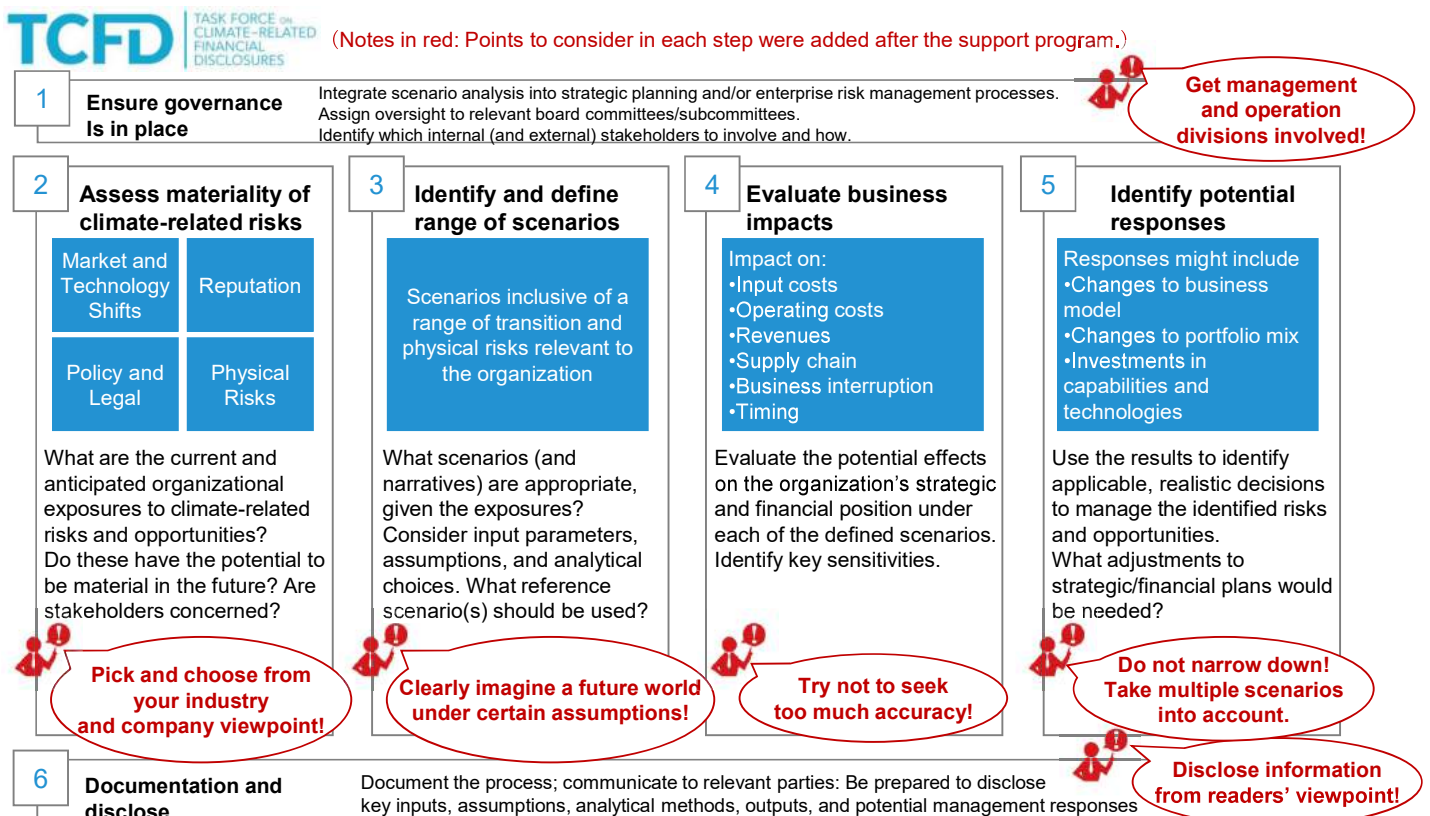
## 2. Scenario Analysis - Key Points of Practice

- 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

### 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 Environment.

### 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.

## 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

### 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 Environment.

2-2

### [When starting a Scenario Analysis ①]

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

Preparation ①	Preparation ②	Preparation ③	Preparation ④
<p><b>Gain management's understanding</b></p> <p>Make sure management understands the materiality of TCFD (Recognizes the recommendations and instructs that they be complied with)</p>	<p><b>Establish execution team</b></p> <p>Create an execution team for scenario analysis</p>	<p><b>Choose target for analysis</b></p> <p>Set a target scope for the scenario analysis</p>	<p><b>Setting the analysis time axis</b></p> <p>Choose time horizon to conduct scenario analysis that looks beyond X years in the future</p>



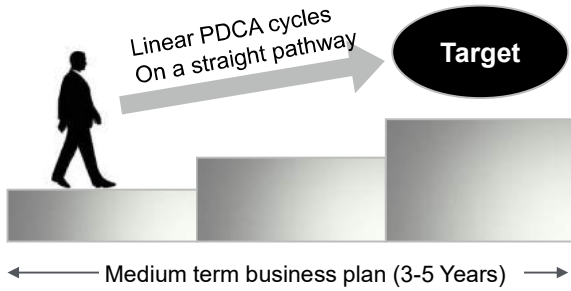
**Point** How to provide input to management in terms of climate change

2-3



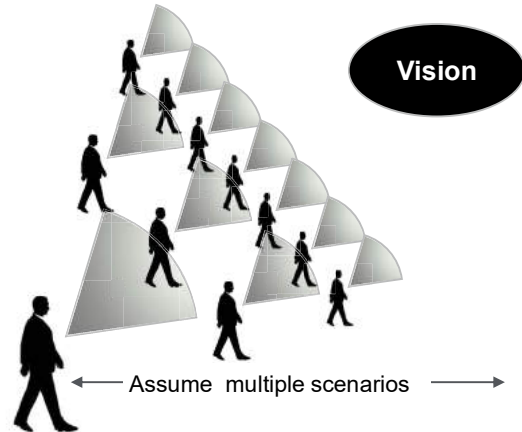
Companies conduct scenario analysis regularly (recognition of a broad range of risks and identification of potential responses). It is crucial for management to understand that investors expect companies to conduct scenario analysis on climate change.

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...



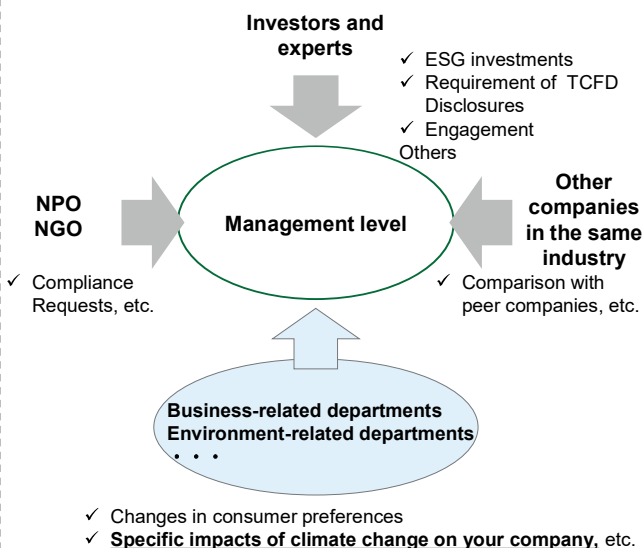
- Business management can flexibly respond to future change
- The discussion takes place without any subjective viewpoints on future
- Management can demonstrate business resilience



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. As part of the Ministry of the Environment's support programs, selected companies held scenario analysis report meetings for management. These meetings are effective in gaining and deepening management's understanding.

Input from multi-stakeholders



- Requests from multi-stakeholders for climate change response accelerated
- There are some cases in which top management hears directly, but there are also cases in which there is still significant distance.
- 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**.
- As an input source for support projects by the Ministry of the Environment It is essential **to hold briefings of impact of climate change (results of scenario analysis) for management, and** these briefings have been proven to be highly effective.

[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**

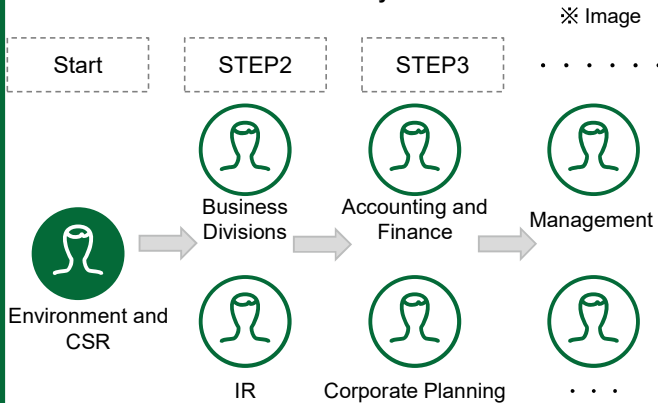
Preparation ②

## Create an execution team for scenario analysis

Some companies from the program noted the significance of internal involvement when conducting scenario analysis. It is essential to form a team where divisions are involved from the very beginning so that they think of climate change as “a company risk”

### Pattern A

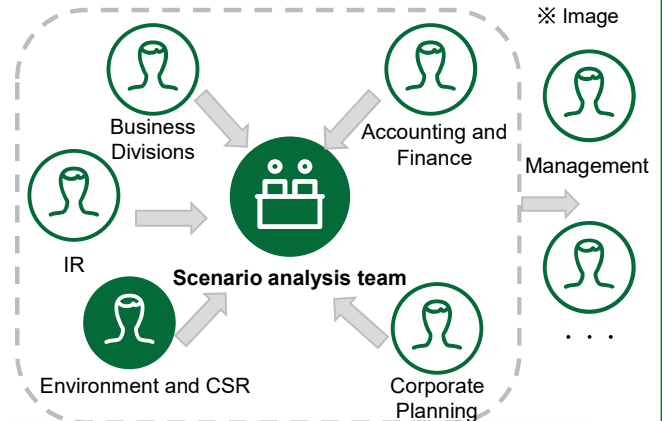
Get relevant divisions and departments involved in the course of scenario analysis



- 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



- 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

Preparation ③

## Choose target for analysis

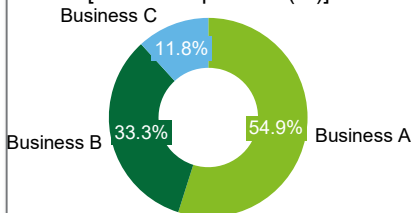
By defining the scope in terms of sales composition, relation to climate change, and difficulty of data collection, companies can conduct scenario analysis in accordance with their business model.

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

Proposal for selection ①

Identify scope of business based on **sales composition ratio**

[Sales composition (%)]

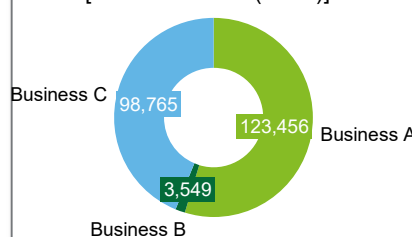


Let's analyze business A and business B, which have a large sales composition

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**

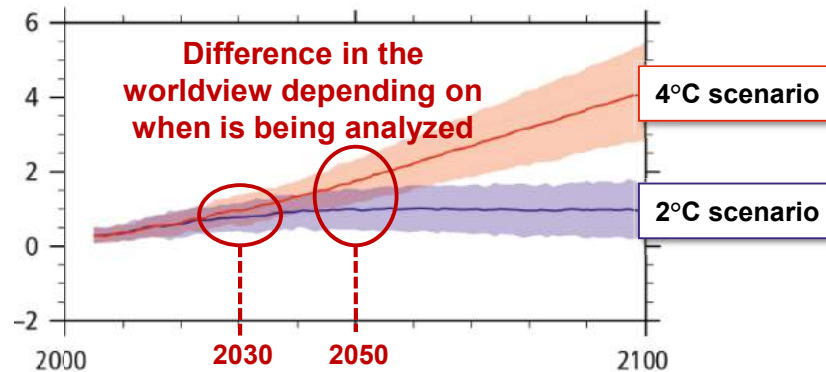
[CO2 emissions (tCO2)]

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.

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	<ul style="list-style-type: none"> <li>• <u>Abundant data available for reference</u></li> <li>• <u>Relatively easy to link with business plans</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Possibility that the impact of physical risk is small and that the impact on the company will be low</u></li> </ul>
2050	<ul style="list-style-type: none"> <li>• <u>Physical risks are emerging.</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Cooperation may be difficult (cannot involve the company) because there is distance from the time horizon of the business plan</u></li> </ul>

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

2-8

## 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**

### Chapter 2 Scenario Analysis - Key Points of Practice

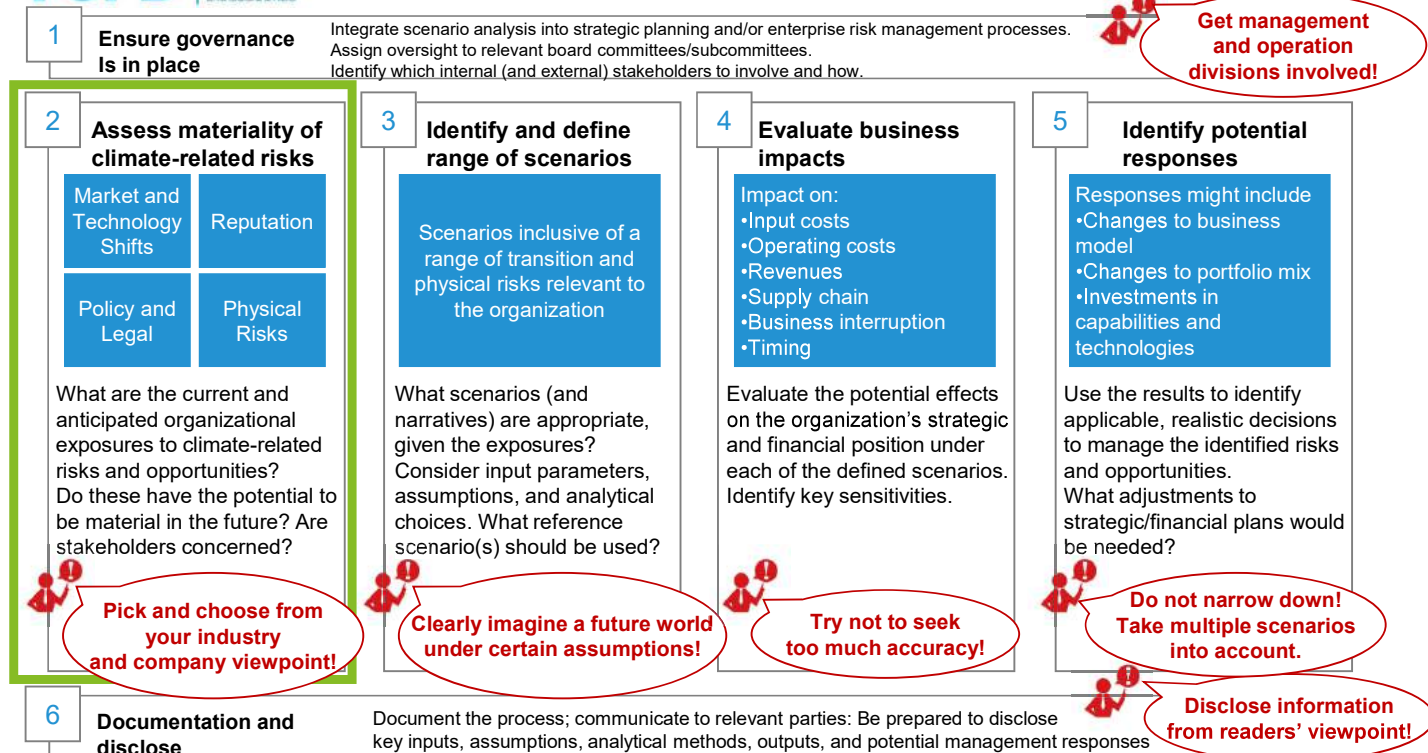


This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of Environment.

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



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



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.

2-10

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



Risks and Opportunities	Business Impact			Assess ment
	Small classification	Index	Discussion: Opportunities	
Transition Risk	Carbon price	Revenue	➢ The introduction of carbon price is expected to reduce the demand for fossil fuels (to reduce the demand for petroleum parts), which will have a medium-scale impact on PL.	Large
	Carbon emission targets/policies of each country (including subsidies)	Revenue	➢ Regulatory tightening affects orders for fossil-fuel-derived parts, affecting PL.	
	In the energy mix Change	Revenue	➢ Large impact on PL due to changes in fossil fuel-derived power generation rate, which affects plant orders	
	Energy Demand	Revenue	➢ Significant impact on PL due to decrease in demand for gasoline and decrease in orders for petroleum refineries	
	Spread of low-carbon technologies	Revenue	➢ Smaller plant size and diversification of customers and regions reduced business opportunities.	
Other	Developing next-generation technologies	Revenue Spending	➢ Influence on PL due to the spread of electric vehicles, reduced demand for gasoline, etc. affecting the volume of orders received for petroleum plants.	Small to medium
	Changes in customer reputation, changes in investor reputation, rising mean temperatures, rising sea levels, and extreme weather conditions	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.	

Image

Note

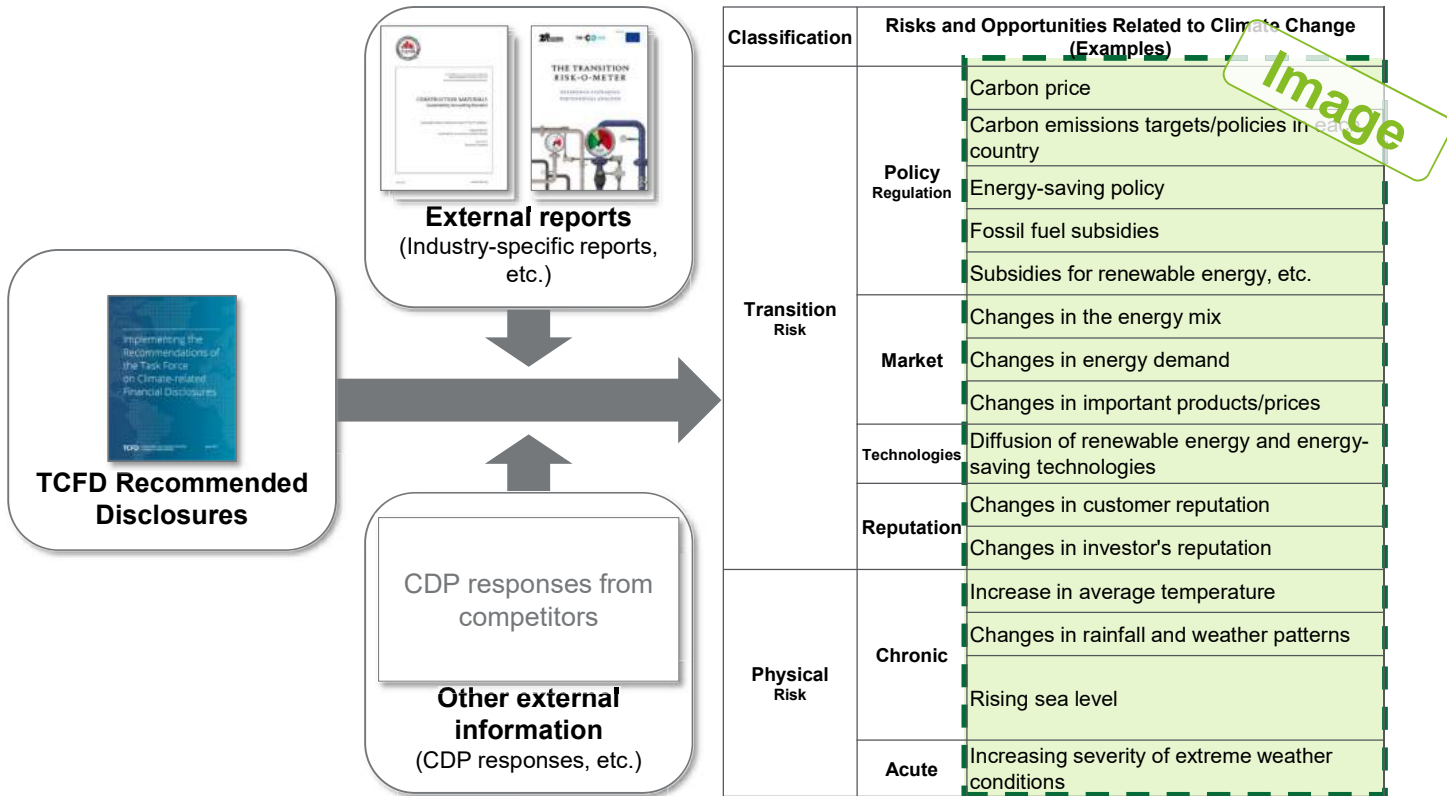
To what extent should the risk assessment be conducted?

Source: This Practical Guide (example of Chiyoda Corporation: 3-31)

2-11

## [Stage 1: List risk items]

### List risk and opportunity categories for targeted business areas



2-12

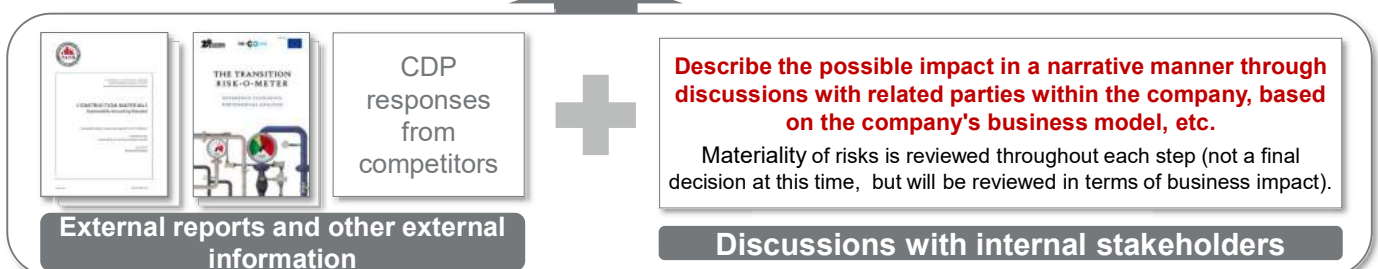
## [Stage 2: Identify potential impacts on business]

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

Major stakeholder	Risks and Opportunities	Business impact		Access point
		Discussion: Risks	Discussion: Opportunities	
Transition Risk	Carbon price	<ul style="list-style-type: none"> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> </ul>	Shareholder
	Carbon emissions targets/policies of each country (including subsidies)	<ul style="list-style-type: none"> <li>Regulatory tightening affects orders for fossil-fuel-derived plants, affecting PL.</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> </ul>	
	Changes in the energy mix	<ul style="list-style-type: none"> <li>Large impact on PL due to changes in fossil fuel-derived power generation rate, which affects plant orders.</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> <li>Increased demand for green energy creates new business opportunities.</li> </ul>	
	Energy Demand	<ul style="list-style-type: none"> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia).</li> <li>New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities.</li> </ul>	
Other	Spread of low-carbon technologies	<ul style="list-style-type: none"> <li>Influence on PL due to the spread of electric vehicles, reduced demand for gasoline, etc. affecting the volume of orders received for petroleum plants.</li> </ul>	<ul style="list-style-type: none"> <li>Promoting LNG and natural gas as low-carbon fuels creates business opportunities in new markets (increased exports and imports in North America and Asia).</li> <li>New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities.</li> </ul>	Shareholder
	Developing next-generation technologies	<ul style="list-style-type: none"> <li>Popularization of decarbonizing materials (bio-plastics, etc.) reduces the market size of petroleum products and has a large impact on orders for petroleum refineries.</li> </ul>	<ul style="list-style-type: none"> <li>New opportunities could emerge in low-carbon energy markets, such as hydrogen, CCU and bio-based chemical industries and decentralized utilities.</li> </ul>	
Other	Changes in customer reputation, changes in investor reputation, rising issues (rising sea levels, rising temperatures, rising sea levels, and extreme weather conditions)	<ul style="list-style-type: none"> <li>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.</li> <li>Construction delays caused by adverse weather conditions have an impact on PL due to increased construction costs, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Investors' evaluation improves due to orders received for projects aimed at realizing a low-carbon society such as renewable energy.</li> <li>Expected increase in demand for plant related to natural disasters, etc.</li> </ul>	Shareholder

**It is important to consider not only the company's risks but also its opportunities.**

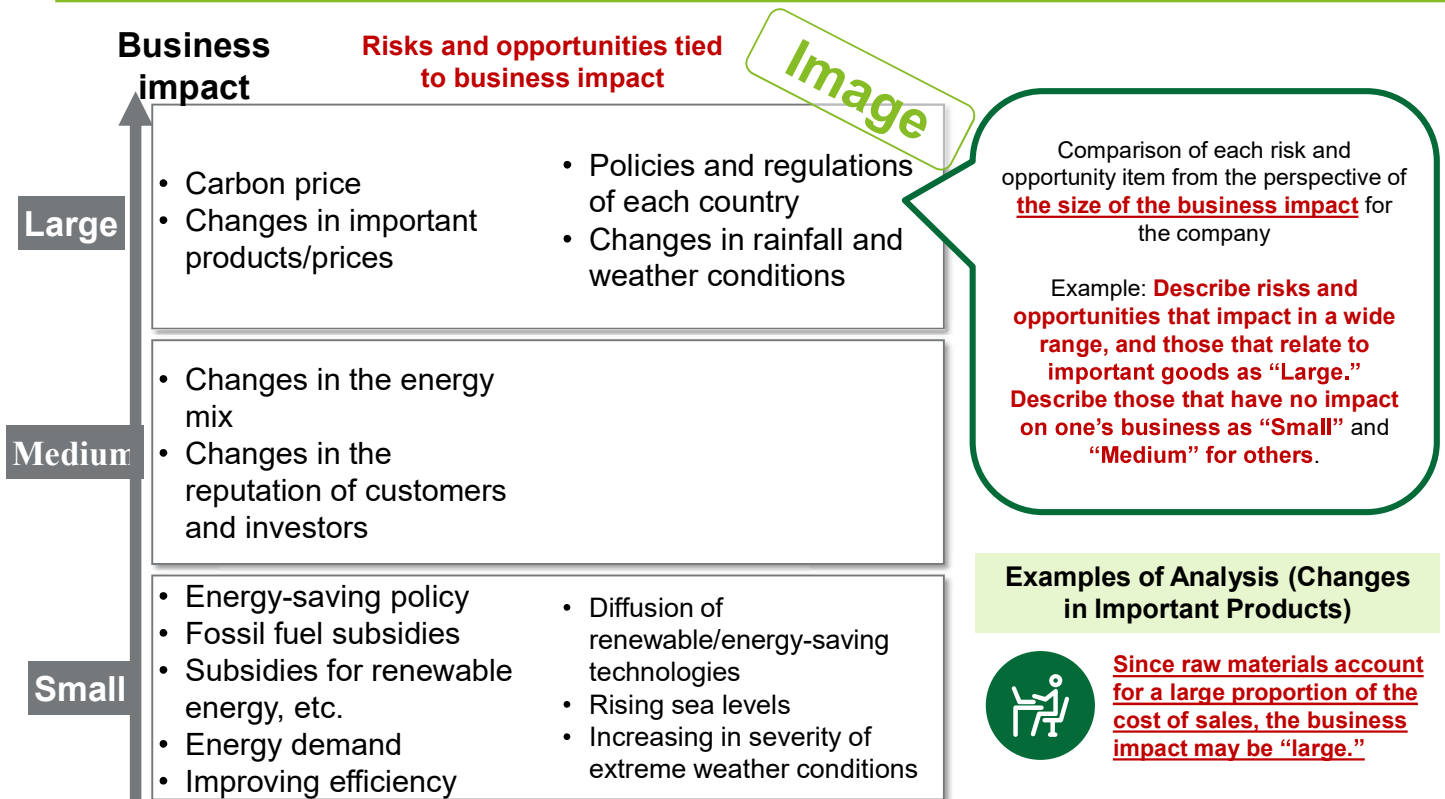
**Separate and examine risks and opportunities**



Source: This Practical Guide (example of Chiyoda Corporation: 3-31)

2-13

**[Stage3: Materiality assessment of climate-related risks]**  
**Conduct risk assessment based on scale of impact (large to small)**



2-14



**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			
	Procur ement	Transpo rtation	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

2-15

## 2. Scenario Analysis - Key Points of Practice

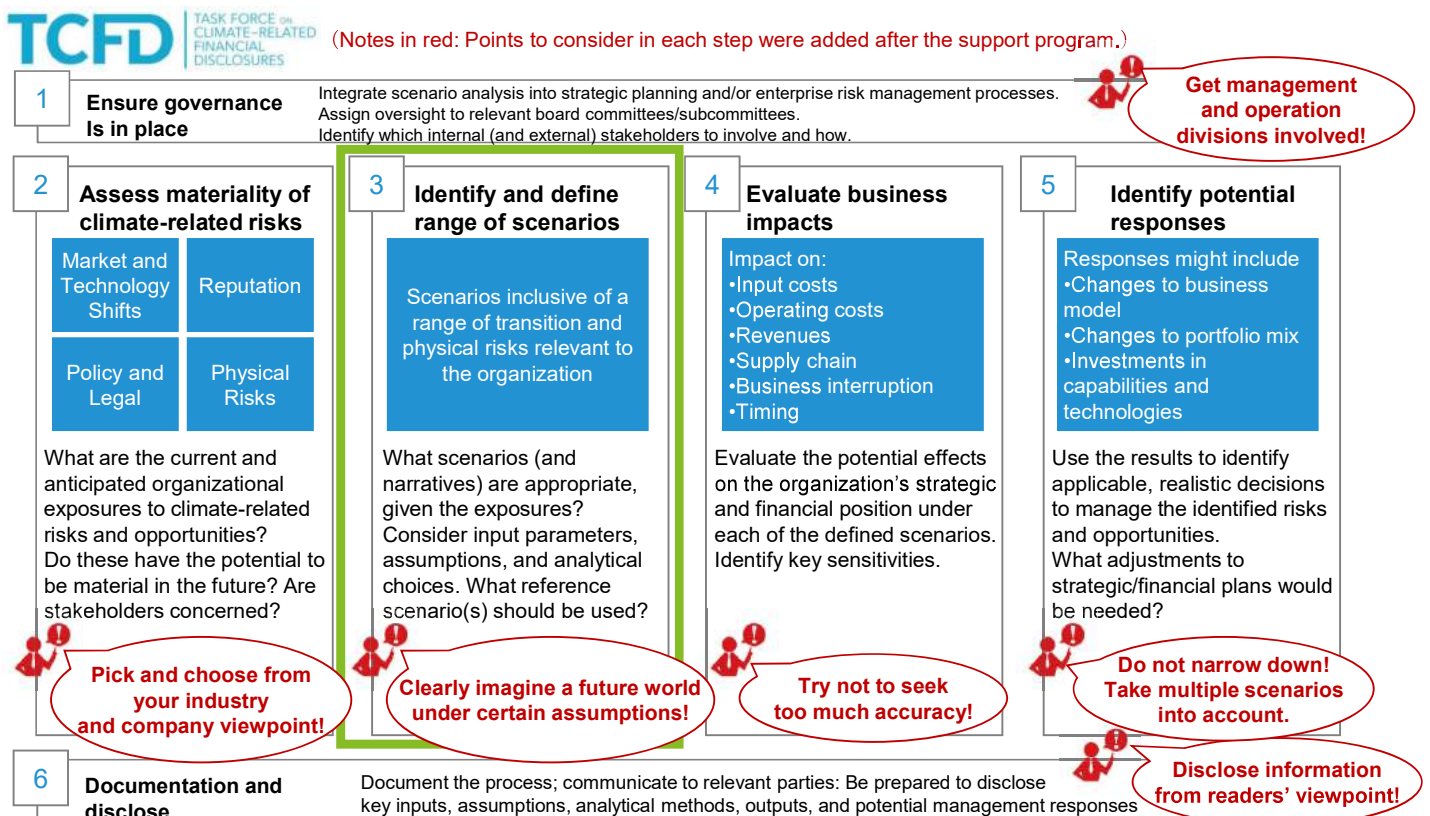
- 2-1. For beginning scenario analysis
- 2-2. STEP2. Assess materiality of climate-related risks
- 2-3. STEP3. Identify and define range of scenarios**
- 2-4. STEP4. Evaluate business impacts
- 2-5. STEP5. Identify potential responses

### 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 Environment.

2-16

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

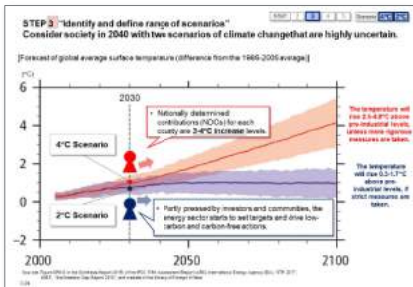
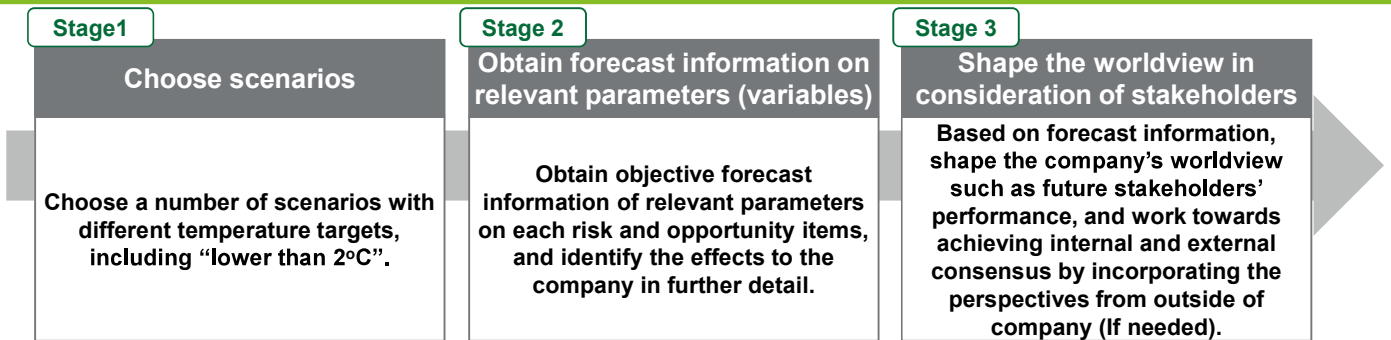


Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

2-17

# [Overview]

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



**STEP 3 "Identify and define range of scenarios" IEAs and Other Assumptions based on Scientific Grounds**

	Present (2019)	2040	2100	Source
Carbon price	Yes	Yes	\$140 (US)	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)
Carbon price	Yes	Yes	Yes	IEA, NREL/DOE (2018)

**STEP 3 "Identify and define range of scenarios"**  
In the 4°C scenario, the world will see an increased share of renewable energy, while the Company will continue following the present path towards further expansion.

- A carbon policy effort towards a low-carbon society
  - Global development of renewable energy
  - Enhanced investment in power generation efficiency
  - Adoption of carbon taxes to speed transition
- Preparedness for fossil fuels
  - Investment in coal and gas power generation
  - Investment in oil and gas power generation
  - Investment in natural gas power generation
- Investment in the power and PPA markets
  - Investment in renewable energy
  - Investment in power generation
  - Investment in power generation
- A sustainable increase in electricity demand
  - Investment in power generation
  - Investment in power generation
  - Investment in power generation

While keeping the portfolio on an extension of the present path, enhance the business continuity plan (BCP) to respond to physical risks. Encourage active disclosures and dialog to secure reputation.

**Note**  
**What kind of scenarios should be chosen?**

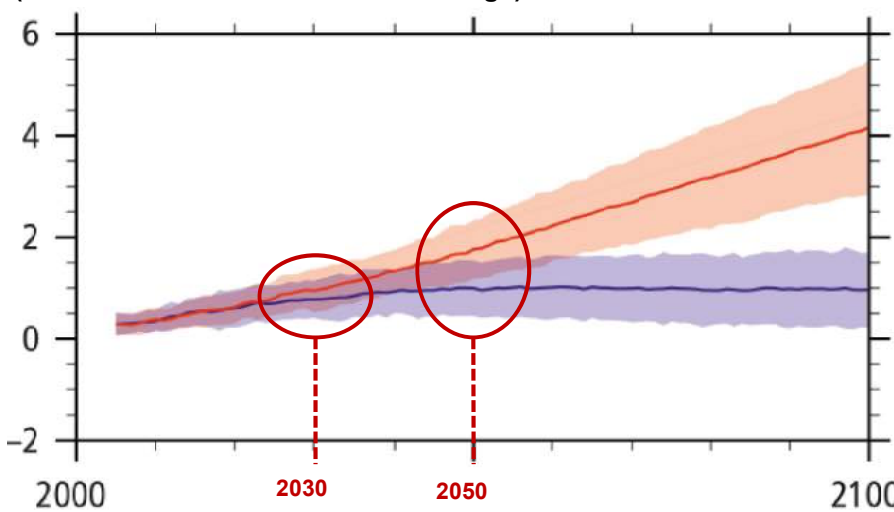
**Note**  
**How to coordinate the worldview with each business division?**

Source: This Practical Guide (example of ITOCHU Corporation: 3-24, 3-25, 3-26)  
2-18

## [Stage1: Choose scenarios]

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

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



**4°C scenario:**  
The temperature will rise 3.2-5.4°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

**Almost the same temperature changes would occur in the 2°C and 4°C scenarios by 2030. Differences between scenarios widen in the years after 2030.**

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





## What kinds of scenarios should be chosen?

Scenario analyses in line with the TCFD recommendations advise that several scenarios, including “below 2°C”, should be chosen. It is desirable to choose scenarios with different temperature targets and worldviews in order to minimize the possibility of unexpected “surprises.” It is essential to choose scenarios that fit the sector and situation of the company, with consideration of the characteristics and parameters of each scenario.

Name - Features	IEA WEO (World Energy Outlook)	SSP (Shared Socioeconomic Pathways)					PRI IPR (Inevitable Policy Response)
	<ul style="list-style-type: none"> <li>Describes forecasts of the energy market for middle to long term</li> <li>✓ Describes forecast information (qualitative and quantitative) on energy</li> </ul>	<ul style="list-style-type: none"> <li>Describes socioeconomic scenario considering the current policy response and context</li> <li>✓ Describes macroeconomic information for each scenario</li> </ul>					
		SSP1	SSP2	SSP3	SSP4	SSP5	
RCP 8.5	CPS(Current Policies Scenario)	—	—	—	—	○	—
RCP 6.0	STEPS(Stated Policies Scenario)	○	○	○	○	○	FPS(Forecast Policy Scenario)
RCP 4.5	—	○	○	○	○	○	—
RCP 3.4	—	○	○	○	○	○	—
RCP 2.6	SDS(Sustainable Development Scenario)	○	○	○	○	○	—
RCP 1.9	—	○	○	○	—	△	—

Temperature zone

※RCP (Representative Concentration Pathways) is a representative pathway that has radiative forcing characteristics. Below figures are radiative forcing values (If RCP is 2.6, radiative forcing will rise to 2.6W/m<sup>2</sup> by the end of 21<sup>st</sup> century, comparing to the value before industrialization.)

○ : With climate models for RCPs  
△: No model

⇒ See Appendix for an outline of the various scenarios and examples of parameters.

Source: IEA Website, Riahi et al. (2017), PRI Home Paper

2-20



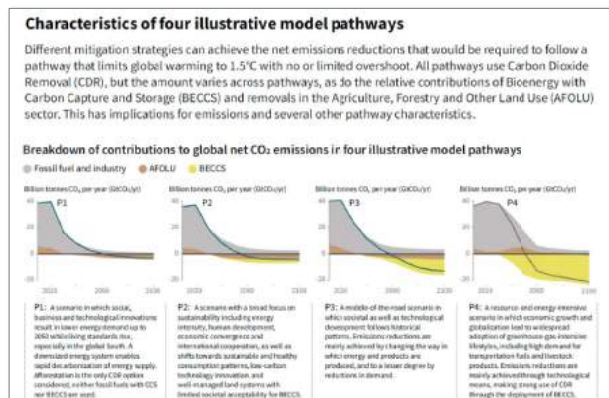
## Column: 1.5°C Scenario

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**

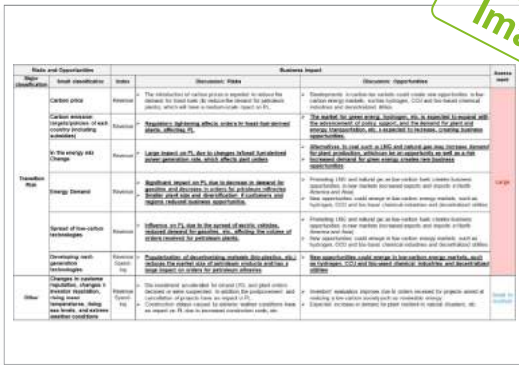
Source: Global Warming of 1.5°C (IPCC)

2-21

# [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



Risk/Opportunity	Issue	Business Impact
Carbon price	The introduction of carbon pricing is expected to reduce the demand for fossil fuels. In addition, the demand for carbon credits is expected to increase significantly.	Decreased demand for fossil fuels, increased demand for carbon credits, and increased demand for carbon capture and storage (CCS) technology.
Energy demand	Energy demand is expected to increase significantly, particularly in emerging markets.	Increased demand for energy, particularly in emerging markets, leading to increased demand for energy infrastructure and technology.
Renewable energy	Renewable energy is expected to become a major source of energy, particularly in developed countries.	Increased demand for renewable energy technology and infrastructure, leading to increased demand for renewable energy sources.



### Parameters list



Parameter	Value	Unit	Scenario	Notes
Global Energy Demand	110 EJ	Exajoules	2020-2050	Based on IEA WEO 2019
Renewable Energy Share	30%	Percentage	2050	Based on IEA WEO 2019
Carbon Price	50 \$/tCO2e	Dollars per tonne	2050	Based on IEA WEO 2019



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



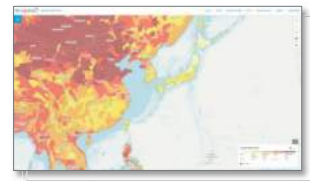
#### Scenario Report

(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.

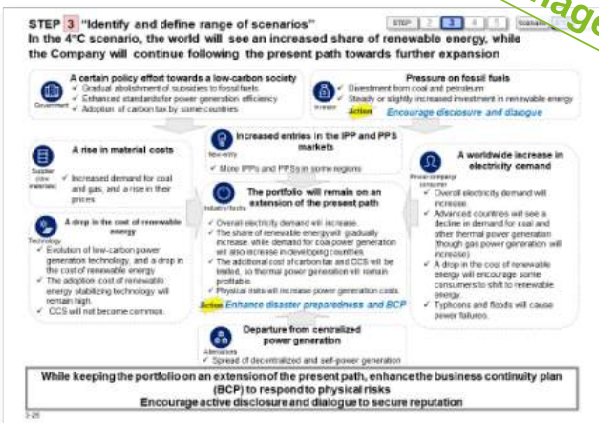
Source: This Practical Guide (example of Chiyoda Corporation: 3-31, 3-32)

# [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)

### 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

**STEP 3: "Identify and define range of scenarios"**  
In the 4°C scenario, the world will see an increased share of renewable energy, while the Company will continue following the present path towards further expansion.

- A certain policy effort towards a low-carbon society**
  - ✓ Gradual abandonment of subsidies for fossil fuels
  - ✓ Enhanced standards for power generation efficiency
  - ✓ Adoption of carbon tax by some countries
- Pressure on fossil fuels**
  - ✓ Deterioration from coal and petroleum
  - ✓ Steady or slightly increased investment in renewable energy
  - ✓ Encourage disclosure and dialogue
- Increased entries in the IPP and PPS markets**
  - ✓ More IPPs and PPSs in some regions
  - ✓ The portfolio will remain on an extension of the present path
- A worldwide increase in electricity demand**
  - ✓ Diversified electricity demand will increase
  - ✓ Advanced countries will see a decline in demand for coal and other thermal power generation (though gas power generation will increase)
  - ✓ A drop in the cost of renewable energy will encourage some consumers to shift to renewable energy
  - ✓ Typhoons and floods will cause power failures
- Departure from centralized power generation**
  - ✓ Spread of decentralized and self-power generation

While keeping the portfolio on an extension of the present path, enhance the business continuity plan (BCP) to respond to physical risks. Encourage active disclosure and dialogue to secure reputation.

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

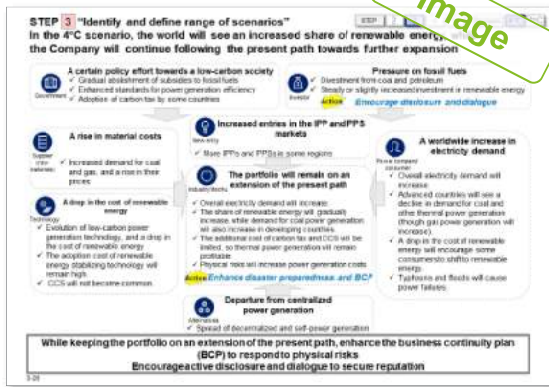
Source: This Practical Guide (example of ITOCHU Corporation: 3-26)



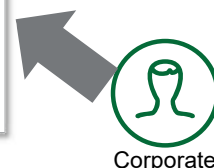
## How to coordinate worldview with each business division?

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



Business Divisions



Corporate Planning

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

- ✓ 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?

- ✓ 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 ITOCHU Corporation: 3-26)

2-24

## 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

### Chapter 2 Scenario Analysis - Key Points of Practice



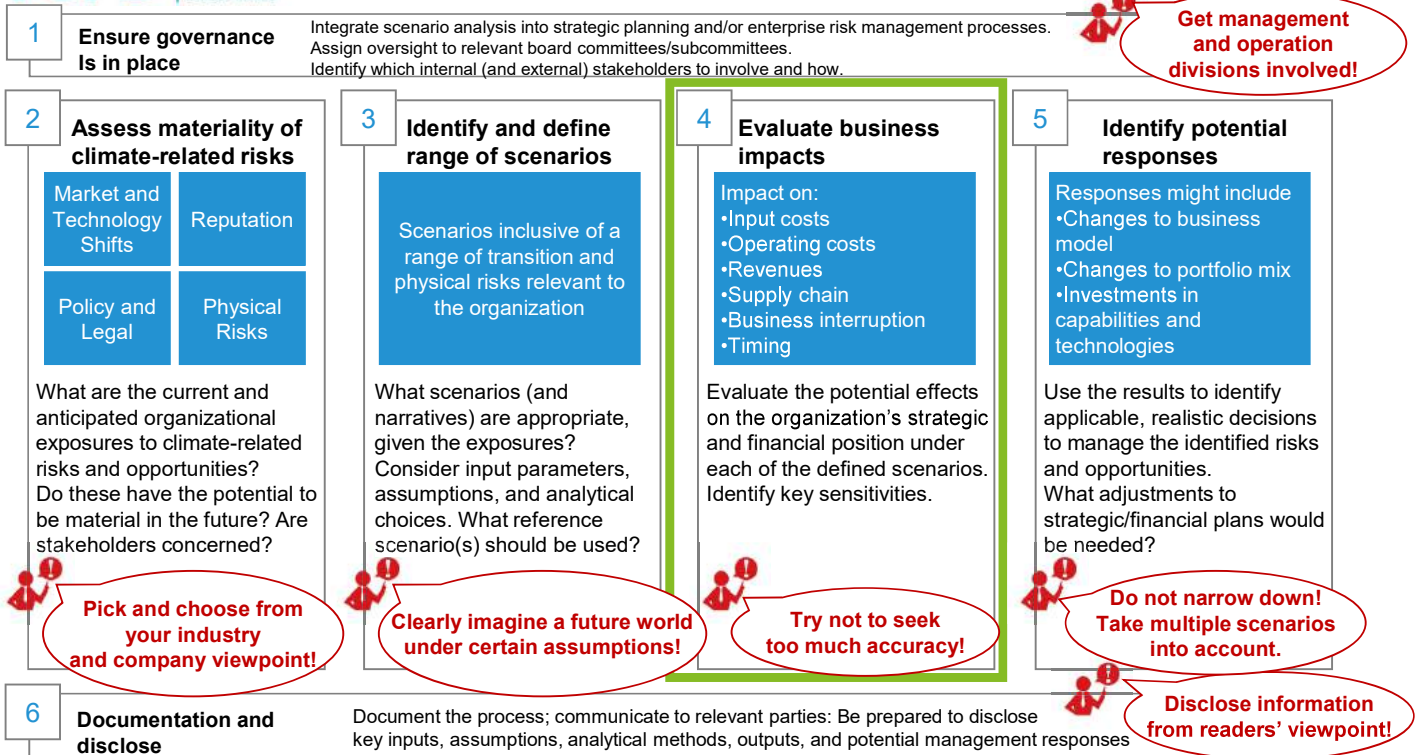
This chapter explains how to practically undertake scenario analysis and describes key points of its practice, based on use cases performed by companies under the support program of the Ministry of Environment.

2-25

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



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

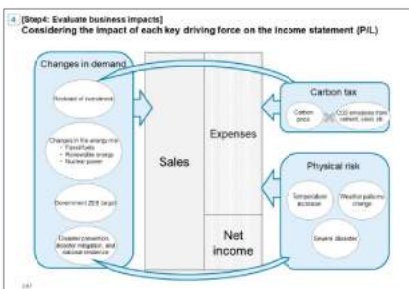
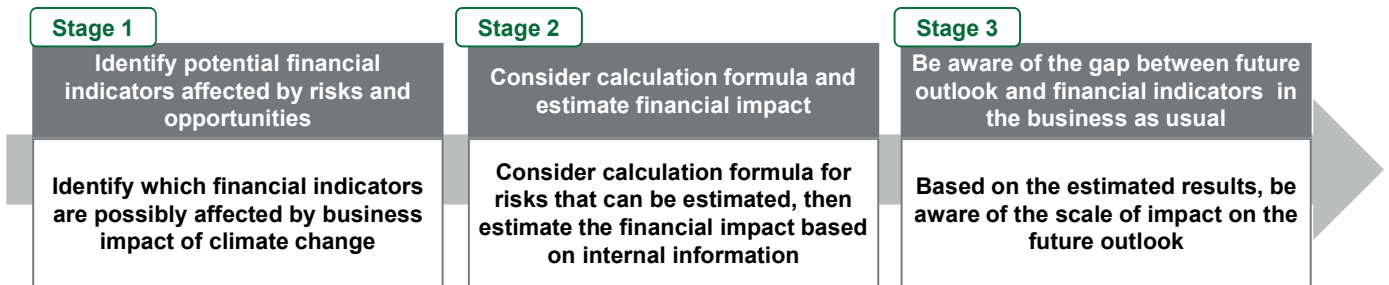


Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

2-26

## [Overview]

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



World in the 4°C scenario, population growth and other factors will increase traffic volume. The Company will use high-efficiency and LNG vessels to deal with inflated fuel costs.

Scenario	Revenue	Operating Costs	Net Income
2020	100	80	20
2030	120	90	30
2040	140	100	40



! Note

What kind of internal data can be used for estimation?

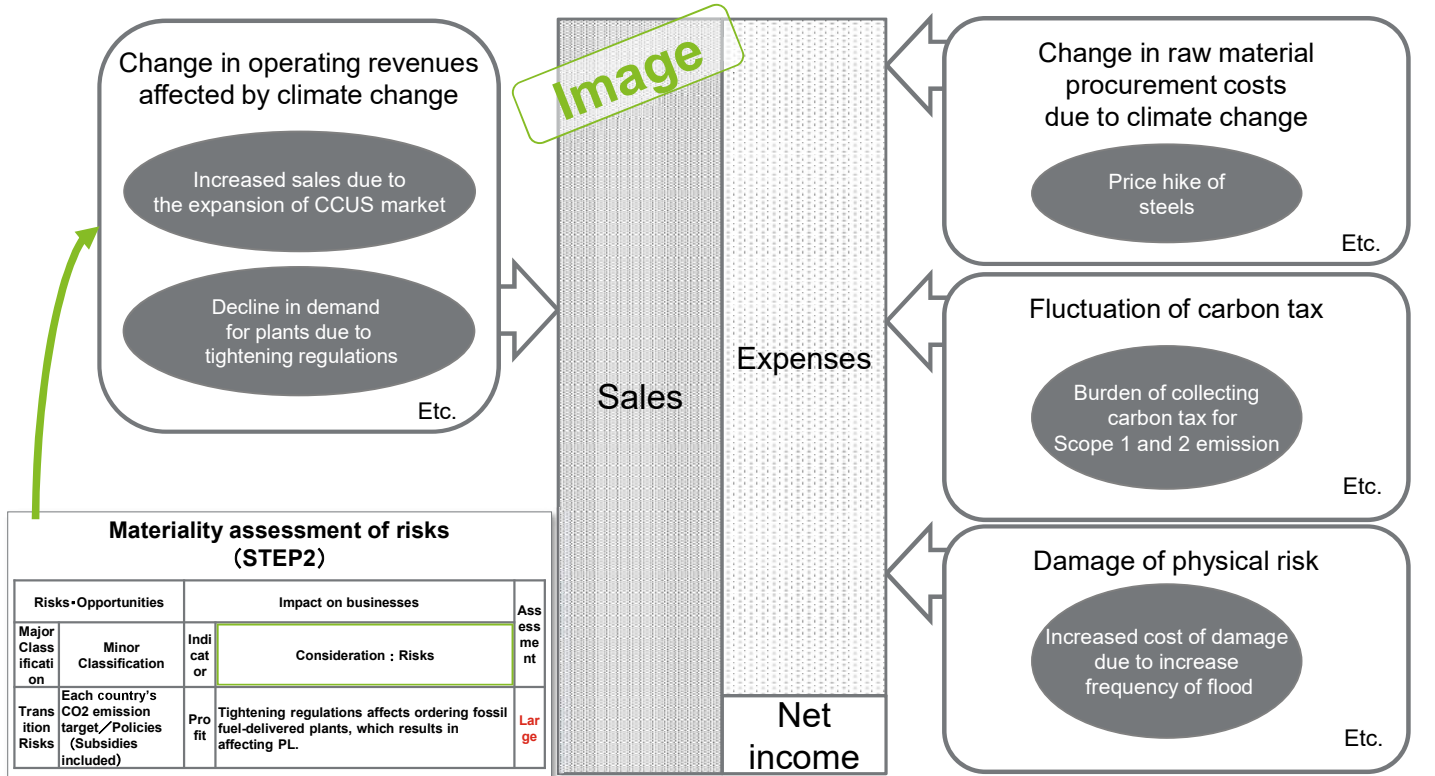
! Note

How do we treat data that cannot be quantitatively estimated?

Source: This Practical Guide (examples of Kajima Corporation: 3-67, Mitsui O.S.K. Lines, Ltd.: 3-46, ITOCHU Corporation: 3-28)

2-27

**[Stage1: Identify potential financial indicators affected by risks and opportunities]**  
 Identify which financial indicators of P/L and B/S are affected by risks and opportunities



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

Business impact

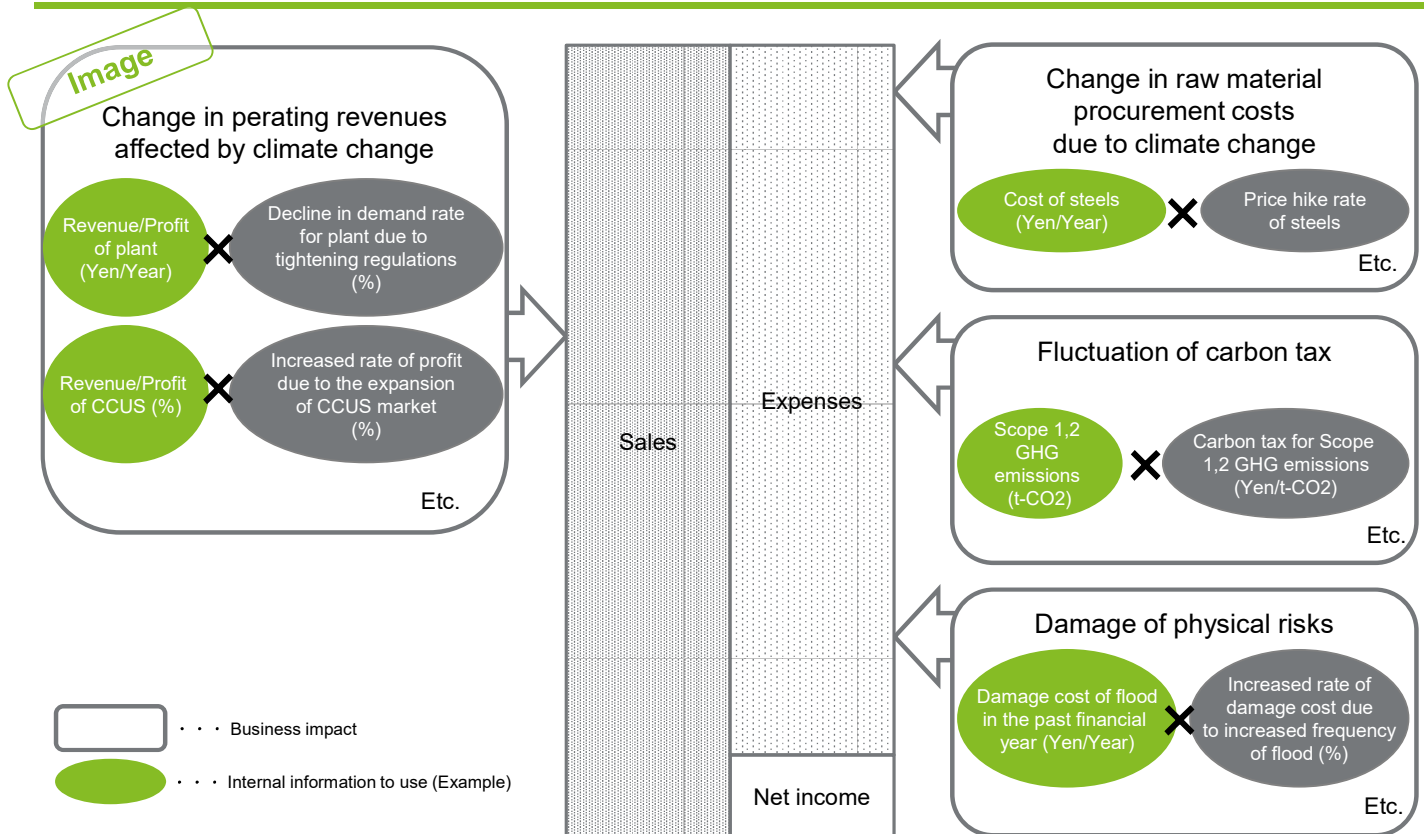
**! What kind of internal data can be used for estimation?**

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	<b>Current and future sales and operating income by business segment</b> (Targets for net sales and operating income)	<ul style="list-style-type: none"> <li>✓ Refer to the company's <b>long-term management targets, etc.</b></li> <li>✓ In the absence of relevant information, it is possible to calculate the current value using CAGR (annual growth rate), etc.</li> </ul>
	<b>Sales forecasts and targets for related products in the future</b> (By product)	<ul style="list-style-type: none"> <li>✓ <b>Hearings from business divisions, corporate planning, etc.</b></li> <li>✓ If owned, also collect <b>information on future market conditions normally used by relevant departments.</b></li> </ul>
Cost Structure	<b>Current operating costs</b> (Electricity and fuel prices, electricity and fuel consumption, etc.)	<ul style="list-style-type: none"> <li>✓ <b>Hearings from business divisions, corporate planning, etc.</b></li> </ul>
	<b>Information on the cost structure of raw materials</b> (Amount of raw materials used, procurement cost, etc.)	<ul style="list-style-type: none"> <li>✓ <b>Hearings from business divisions, corporate planning, etc.</b></li> <li>✓ If owned, also collect <b>information on future market conditions normally used by relevant departments.</b></li> </ul>
	<b>Current and future GHG emissions</b> (Scope 1 and 2, Scope3 if needed)	<ul style="list-style-type: none"> <li>✓ Refer to the company's <b>environment-related targets, etc.</b></li> </ul>

**[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**



2-30

**! 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.

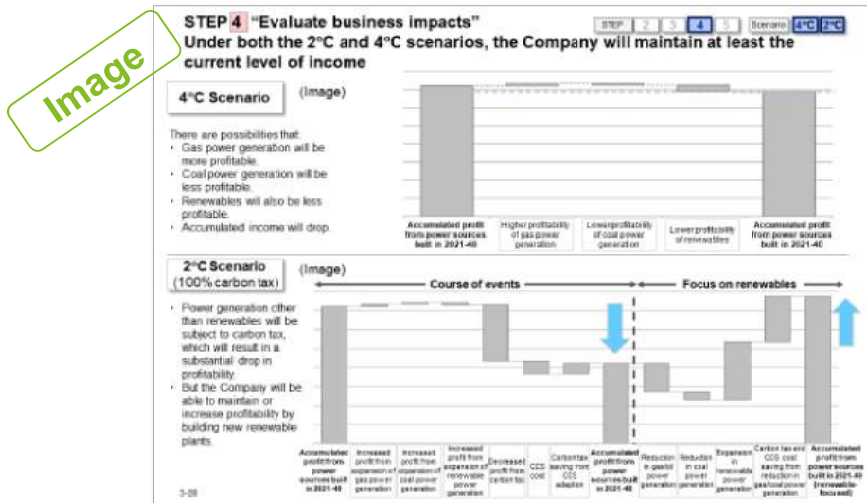
**Continuous internal monitoring**

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

2-31

**[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**



**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 ITOCHU Corporation: 3-28)

2-32

## 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

### 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 Environment.

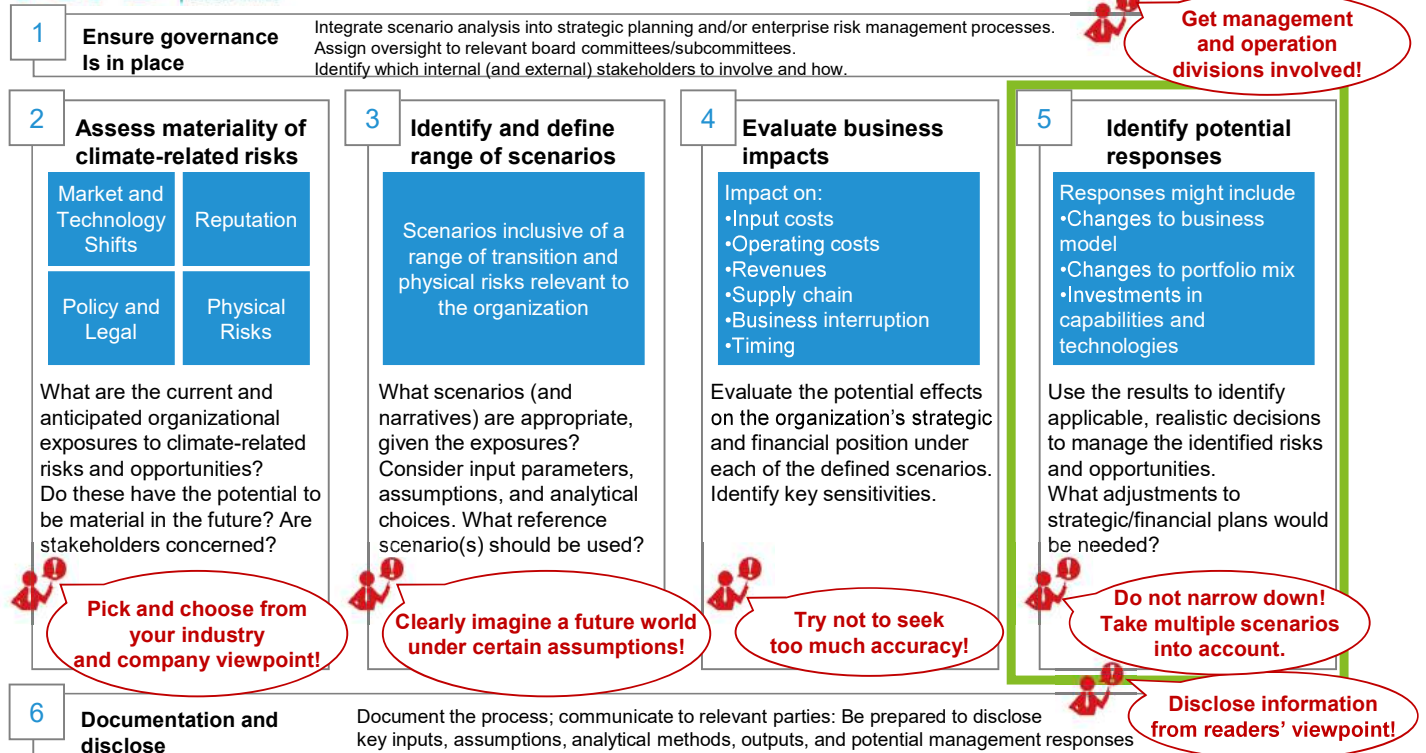
2-33

## Identify potential responses:

Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities.



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

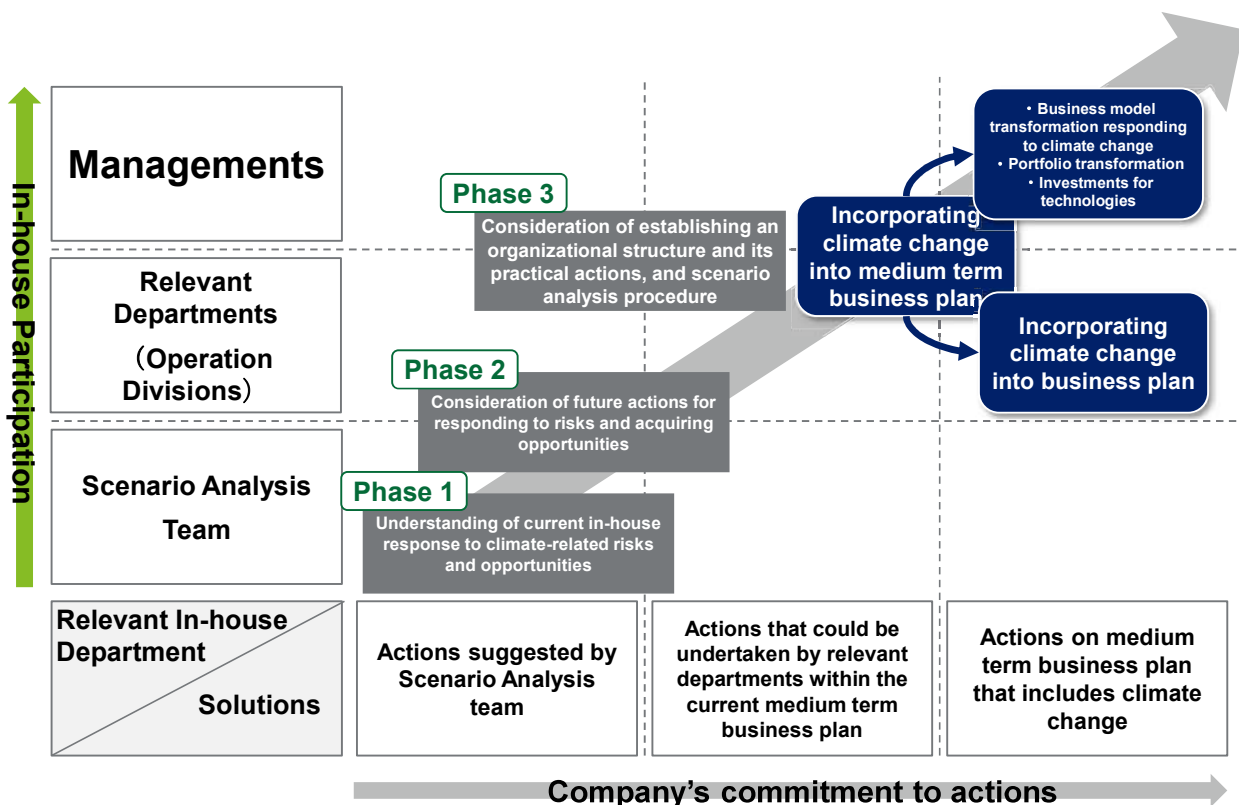


Sources: The Task Force on Climate related Financial Disclosures, "Technical Supplement The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities", June 2017.

2-34

## 【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.



2-35



# [Overview]

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



Initiatives for Future Scenarios and Examples of Future Measures (Risk Response) FUJIFILM

Response area	Current Initiatives	Example of future countermeasures
Carbon/Climate	Reduce CO2 emissions by 30% by FY2030 compared to FY2013, and 50% by FY2050 compared to FY2013. Promote energy saving and use of renewable energy.	Reduce CO2 emissions by increasing internal Carbon Pricing. Promote investment in eco-technology. Promote investment in eco-technology. Promote investment in eco-technology.
Plastics Regulation	Reduce plastic waste by 50% by FY2030 compared to FY2013. Promote use of recycled plastic.	Development of eco-technology. Development of eco-technology. Development of eco-technology.
Developing next-generation technologies	Investment in R&D for next-generation technologies. Promotion of innovation and talent development.	Investment in R&D for next-generation technologies. Promotion of innovation and talent development.
Increasing severity of extreme weather conditions (Flood damage)	Strengthen disaster prevention measures. Promote disaster prevention measures.	Strengthen disaster prevention measures. Promote disaster prevention measures.

1. [Step1: Identify potential responses] For items with large business impact, future countermeasures were examined. It is necessary to promote technological development that meets market needs.

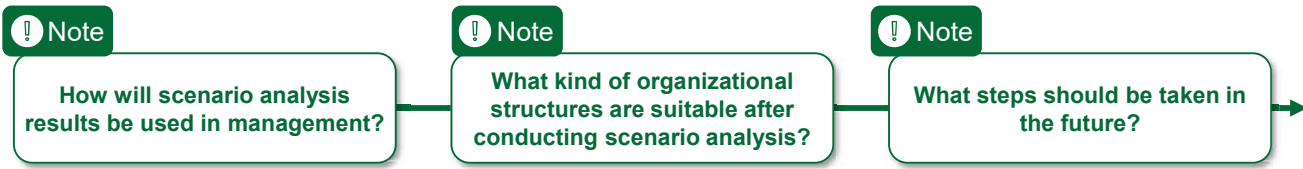
Response area	Current Initiatives	Example of future countermeasures
Related to Carbon Tax and Emission Allowance	Carbon tax introduction. Carbon tax introduction.	Promote activities to reduce CO2 during construction. Development and promotion of production of low-carbon materials. Securing renewable energy.
Technological development in response to new technologies	Investment in R&D for next-generation technologies. Promotion of innovation and talent development.	Detection of focus areas based on energy risk. Development of engineering and construction technologies for renewable energy facilities. Pursuit of ZEM (zero-emission) and similar. Development of labor-saving construction technology.
Responding to Severe Extreme Weather	Disaster prevention measures. Promotion of disaster prevention measures.	Promotion of technical development related to disaster prevention, disaster mitigation, and disaster response. Development and utilization of hazard maps incorporating artificial intelligence. Construction that contributes to the strengthening of natural resilience including buildings and structures.

3. Definition of Countermeasures

Future challenges

- We make scenarios and set their backgrounds for forward-looking assessments, and only analyze the transition-related opportunities. Issues to be addressed going forward include upgrading and building a system.

Points of Attention and Issues	
Enhancement of scenario analysis	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.



Source: This Practical Guide (examples of FUJIFILM Holdings Corporation: 3-116, Kajima Corporation: 3-69, Development Bank of Japan Inc.: 3-20)

## [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

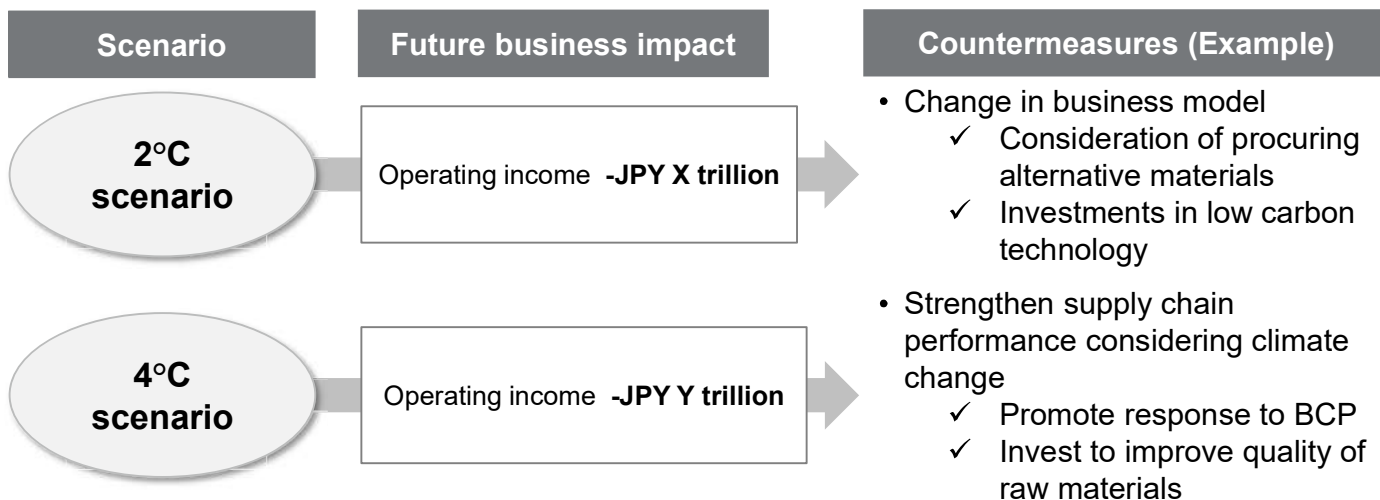
Risks and Opportunities	Status of the company's own response	Status of responses by competitors		
		Company X	Company Y	Company Z
Policies/Target	Organizing the status of the company's own responses	Benchmark Survey of Competitors' Responses		
Risk A				
Risk B				
Opportunity C				
Market				
Risk D				
Opportunity E				
Opportunity F				
...				

Image

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**



**It will become important to plan resilient countermeasures that can be used in any situation**

2-38

**[Phase 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**

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	<ul style="list-style-type: none"> <li>✓ Dissemination of the results of scenario analysis within the company (including managements)</li> <li>✓ Gaining an agreement from managements on the needs for establishing an organizational structure in order to promote countermeasures</li> </ul>	-	<ul style="list-style-type: none"> <li>✓ Interviews with experts on important risks and opportunities for which there is little information</li> </ul>
~ 1 year	<ul style="list-style-type: none"> <li>✓ Establishing an organizational structure in order to promote countermeasures through explaining to relevant department</li> </ul>	<ul style="list-style-type: none"> <li>✓ Cooperating with relevant department and take practical actions aligned with existing business plans that is relatively easy to implement</li> <li>✓ Beginning practical consideration with relevant department for new actions</li> </ul>	<ul style="list-style-type: none"> <li>✓ <b>Establishment of a monitoring system for scenario analysis</b></li> <li>✓ Monitoring</li> </ul>
As needed (timings may differ for each company)	<ul style="list-style-type: none"> <li>✓ <b>Incorporating climate change into medium term business plan</b></li> <li>✓ Encourage dialogue with stakeholders on climate change to create markets</li> <li>✓ Introduction of internal carbon pricing as a mechanism to promote low-carbon investment</li> </ul>		

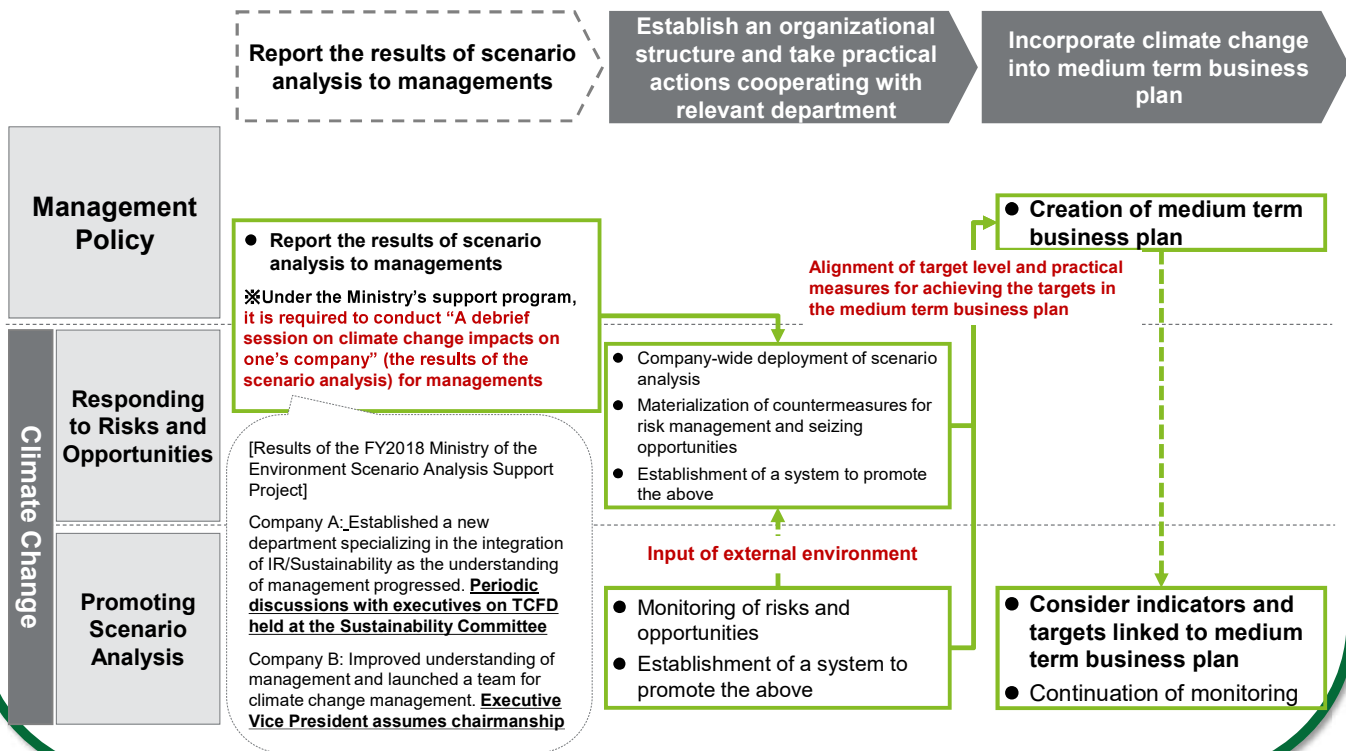
*Image*

**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**

2-39

## 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



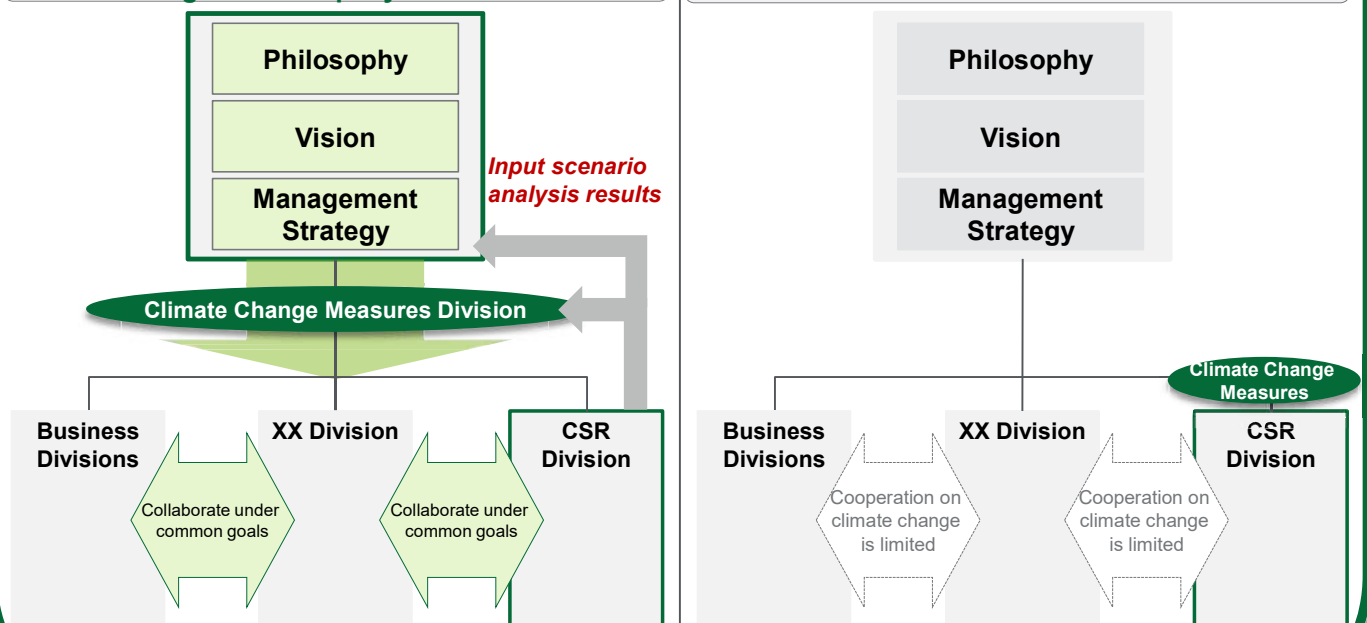
2-40

## 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

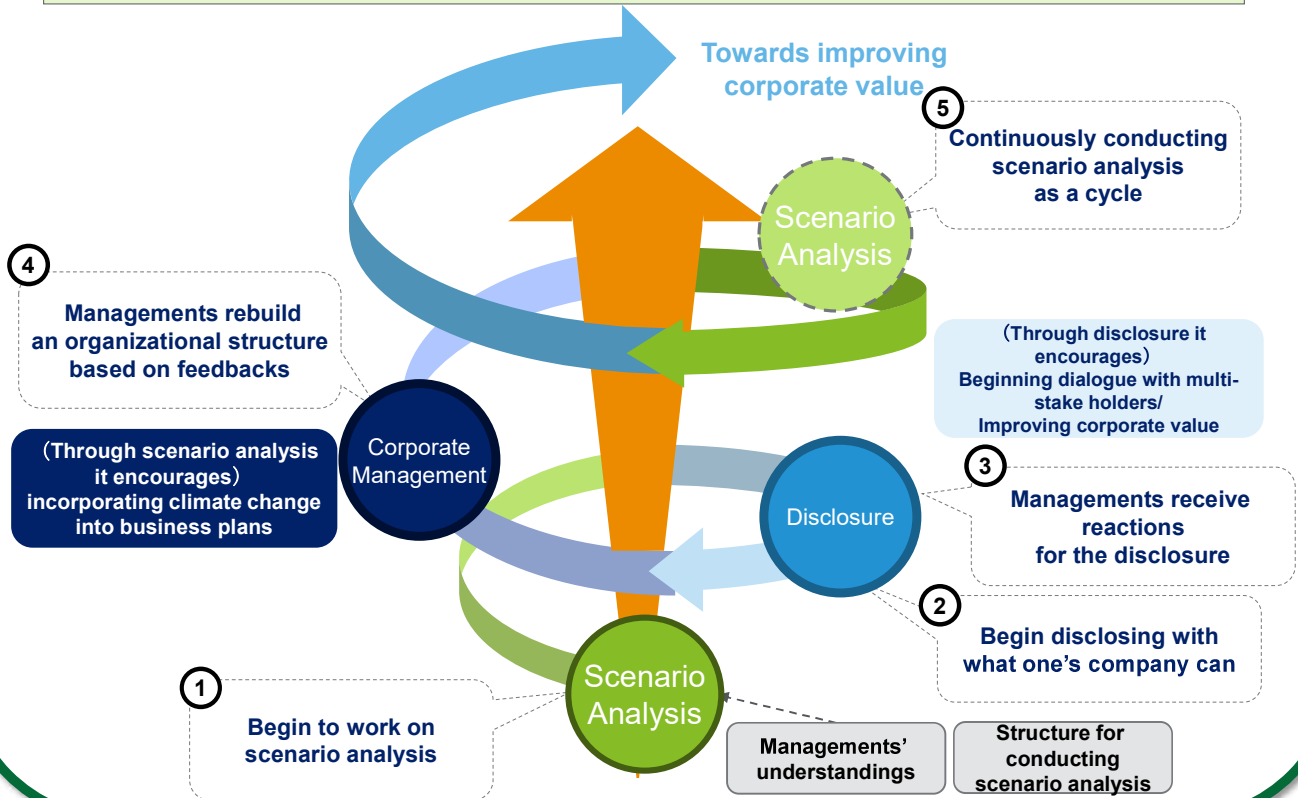
Remain as limited initiatives by some divisions



2-41

## 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).



### 3. Scenario Analysis - Practice Examples

#### Chapter 3. Scenario Analysis - Practice Example

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

#### 【Examples 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.	—	—	3-7, 3-8	3-7
Non-Financial	Energy	ITOCHU Corporation	—	—	3-22	3-24
		Chiyoda Corporation	—	—	—	3-30
	Transportation	Mitsui O.S.K. Lines, Ltd.	—	—	—	3-39
		Japan Airlines Co., Ltd.	—	—	—	3-50
		Mitsubishi Motors Corporation	—	—	—	3-55, 3-58
	Buildings/ Forest Products	Kajima CORPORATION	—	—	3-61	3-63
		Sumitomo Forestry Co., Ltd.	—	—	—	3-74
		Tokyu Fudosan Holdings Corporation	—	—	3-86	3-86
	Construction Materials	LIXIL Group Corporation	—	—	3-93, 3-94	3-94
	Materials	FUJIFILM Holdings Corporation	—	—	3-106	3-108
		Furukawa Electric Co., Ltd.	—	—	3-118,3-119	3-122
	Food	Kagome CO.,LTD.	—	—	3-131	3-133
		Calbee, Inc.	—	—	3-148	3-150
		Meiji Holdings Co., Ltd.	—	—	3-157	3-157
	Electronic Equipment	KYOCERA Corporation	—	—	—	3-175
	Retailing	Seven & i Holdings Co., Ltd.	—	—	3-186	3-189
Consumer Products	Lion Corporation	—	3-199	3-199	3-202	

## 【Examples 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.	3-10	3-10	3-10
Non-Financial	Energy	ITOCHU Corporation	3-23	3-23	3-23
		Chiyoda Corporation	3-31	3-31	3-31
	Transportation	Mitsui O.S.K. Lines, Ltd.	3-38	3-38	3-38
		Japan Airlines Co., Ltd.	3-49	3-49	3-49
		Mitsubishi Motors Corporation	3-56, 3-59	3-56, 3-59	—
	Buildings/ Forest Products	Kajima CORPORATION	3-62	3-62	3-62
		Sumitomo Forestry Co., Ltd.	3-72, 3-73	3-72, 3-73	3-72, 3-73
		Tokyu Fudosan Holdings Corporation	3-87	3-87	3-87
	Construction Materials	LIXIL Group Corporation	3-95	3-95	3-95
	Materials	FUJIFILM Holdings Corporation	3-107	3-107	3-107
		Furukawa Electric Co., Ltd.	3-121	3-121	3-121
	Food	Kagome CO.,LTD.	3-132	3-132	3-132
		Calbee, Inc.	3-148, 3-149	3-149	3-149
		Meiji Holdings Co., Ltd.	3-157 ~ 3-159	3-157 ~ 3-159	3-157 ~ 3-159
	Electronic Equipment	KYOCERA Corporation	3-174	3-174	3-174
Retailing	Seven & i Holdings Co., Ltd.	3-187, 3-188	—	3-187, 3-188	
Consumer Products	Lion Corporation	3-200, 3-201	3-200, 3-201	3-200, 3-201	

3-2

## 【Examples 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.	3-10 ~ 3-12	3-10 ~ 3-12	3-13 ~ 3-16
Non-Financial	Energy	ITOCHU Corporation	3-24	3-25	3-26, 3-27
		Chiyoda Corporation	3-30	3-32	3-33, 3-34
	Transportation	Mitsui O.S.K. Lines, Ltd.	3-39	3-40, 3-41	3-42 ~ 3-45
		Japan Airlines Co., Ltd.	3-50	—	3-51, 3-52
		Mitsubishi Motors Corporation	—	3-56, 3-59	3-55, 3-58
	Buildings/ Forest Products	Kajima CORPORATION	3-63	3-64	3-65, 3-66
		Sumitomo Forestry Co., Ltd.	3-74	3-81	3-75 ~ 3-80
		Tokyu Fudosan Holdings Corporation	—	—	3-88, 3-90
	Construction Materials	LIXIL Group Corporation	3-94	3-100	3-96 ~ 3-99
	Materials	FUJIFILM Holdings Corporation	3-108	3-108	3-109 ~ 3-112
		Furukawa Electric Co., Ltd.	3-120	3-122	3-123 ~ 3-125
	Food	Kagome CO.,LTD.	3-133	3-134	3-135 ~ 3-137
		Calbee, Inc.	3-150	3-151	3-152, 3-153
		Meiji Holdings Co., Ltd.	3-157	3-160	3-161, 3-162
	Electronic Equipment	KYOCERA Corporation	3-175	3-176	3-177 ~ 3-180
Retailing	Seven & i Holdings Co., Ltd.	3-189	3-190	3-191, 3-192	
Consumer Products	Lion Corporation	3-202	3-203	3-204 ~ 3-207	

3-3

## 【Examples 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.	—	3-17 ~ 3-19	—
Non-Financial	Energy	ITOCHU Corporation	—	—	3-28
		Chiyoda Corporation	3-35	3-35	—
	Transportation	Mitsui O.S.K. Lines, Ltd.	3-46, 3-47	—	3-46,47
		Japan Airlines Co., Ltd.	3-53	—	—
		Mitsubishi Motors Corporation	—	—	3-56, 3-59
	Buildings/ Forest Products	Kajima CORPORATION	3-67	—	3-68
		Sumitomo Forestry Co., Ltd.	—	—	3-83, 3-84
		Tokyu Fudosan Holdings Corporation	—	—	3-89, 3-91
	Construction Materials	LIXIL Group Corporation	3-101	—	3-102, 3-103
	Materials	FUJIFILM Holdings Corporation	—	—	3-113
		Furukawa Electric Co., Ltd.	—	—	3-126, 3-127
	Food	Kagome CO.,LTD.	3-138	3-138	3-139, 3-140
		Calbee, Inc.	—	3-154	3-154
		Meiji Holdings Co., Ltd.	3-163	—	3-163, 3-164, 3-170, 3-171
	Electronic Equipment	KYOCERA Corporation	—	—	3-181
Retailing	Seven & i Holdings Co., Ltd.	—	—	3-193, 3-194	
Consumer Products	Lion Corporation	3-208	—	3-209, 3-210	

3-4

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

Sector		Company	STEP5. Identify potential responses		
			Stage 1 Understanding company's current status on risk management	Stage 2 Considering 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
Financial	Banks	Development Bank of Japan Inc.	—	3-20	3-20
Non-Financial	Energy	ITOCHU Corporation	—	—	—
		Chiyoda Corporation	—	3-36	—
	Transportation	Mitsui O.S.K. Lines, Ltd.	—	—	—
		Japan Airlines Co., Ltd.	—	—	—
		Mitsubishi Motors Corporation	—	—	—
	Buildings/ Forest Products	Kajima CORPORATION	—	3-69, 3-70	—
		Sumitomo Forestry Co., Ltd.	—	—	—
		Tokyu Fudosan Holdings Corporation	—	—	—
	Construction Materials	LIXIL Group Corporation	—	3-104	—
	Materials	FUJIFILM Holdings Corporation	3-116	3-116	—
		Furukawa Electric Co., Ltd.	—	3-128	—
	Food	Kagome CO.,LTD.	—	3-141 ~3-144	—
		Calbee, Inc.	3-155	3-155	—
		Meiji Holdings Co., Ltd.	3-165, 3-172	3-165, 3-172	—
	Electronic Equipment	KYOCERA Corporation	—	3-182 ~ 3-184	—
Retailing	Seven & i Holdings Co., Ltd.	—	3-197	—	
Consumer Products	Lion Corporation	3-211	3-211	—	

3-5

# Financial Sector (Banks)

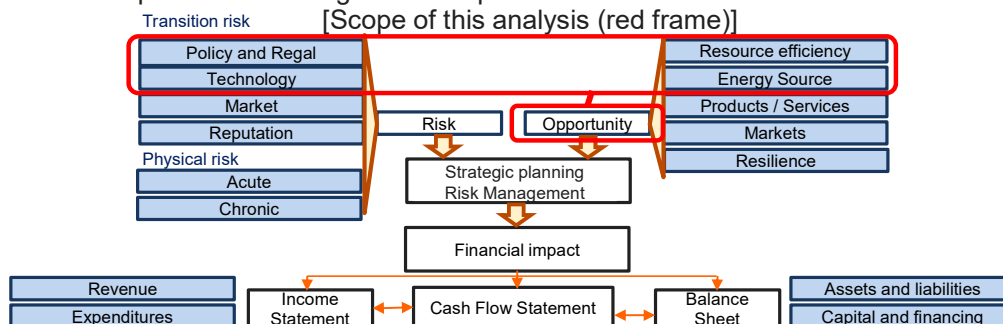
## ✓ Practice Example : Development Bank of Japan Inc.

3-6

### 1 [Overview]

#### Overview of our scenario analysis

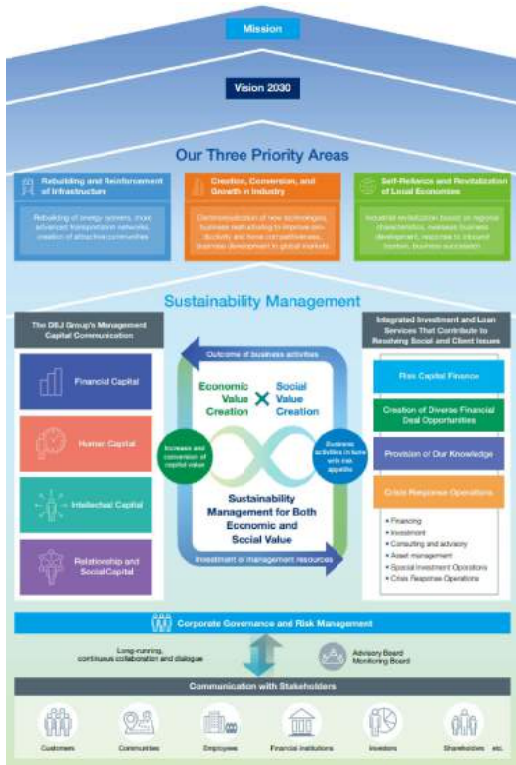
- Scenario analysis of transition risks and analysis of expected impact on loans and investments by 2050 (Principle)
  - ⇒ Focus on technological innovations and risks and opportunities due to policies and regulations aimed at realizing a low-carbon society and a decarbonized society.
- It is necessary 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 regarded as an investment opportunity, and the business impact is analyzed and evaluated by scenario from the viewpoint of technological development and dissemination.



3-7



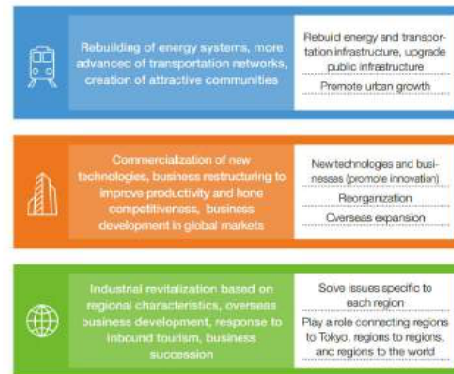
## Sectors to be analyzed



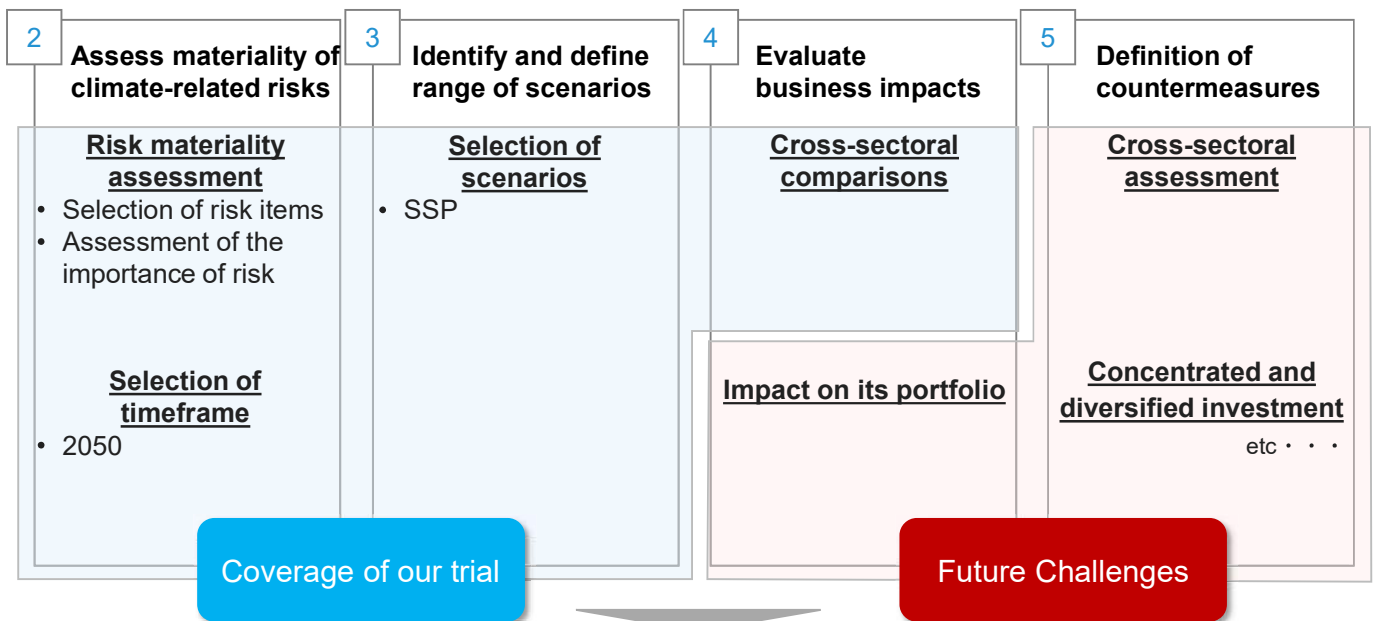
- We select 3 sectors (A, B, and C) from our “Three Priority Areas” (Materiality), taking into account the balance of money loans and other factors.
- Opinions from departments in the relevant sector are also reflected in the analysis.

### 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.



## Steps to implement scenario analysis



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

## 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	<p>➢ 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.</p>	<p>Large ~ Medium ~ Small</p>
Dissemination of renewable energy and energy-saving technologies	<p>Classify each risk item, and consider and assess the business impact and uncertainty associated with each item.</p>	
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°C, 2°C, and 4°C.

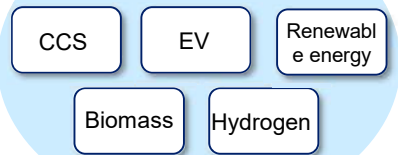


■ Afterwards, we will focus on "technology" as an investment opportunity, which is included in risk items. In order to consider the economic and social factors behind climate change, analysis was conducted using the SSP Scenarios.

### 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.



#### [SSP Scenarios]

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



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

## Selection of SSP scenarios

	Scenario name	IPCC temperature zone	Overview of the worldview	Focusing on achieving a decarbonized society	International cooperation
<p>Sustainable</p> <p>Conventional development</p>	SSP1	1.5°C	Decarbonized society worldwide	<ul style="list-style-type: none"> <li>✓ Policies for sustainability have been adopted, and a decarbonized society is highly likely to be realized. Optimization methods are applied to renewable energy.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Assuming a world in which international cooperation is advancing and the Paris Agreement is respected</li> </ul>
	SSP3	4°C	Nationalism/Regionalism caused by economic disparities	<ul style="list-style-type: none"> <li>✓ Policies on environmental issues are of low priority, and it is difficult to achieve a decarbonizing society.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Assuming a world that prioritizes domestic interests and values rather than international cooperation such as the Paris Agreement</li> </ul>
	SSP5-1	2°C	Fossil-fueled Low-carbon society	<ul style="list-style-type: none"> <li>✓ The society depended on fossil fuels, but low carbon will progress to some extent with the use of CCS and other technologies.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Assuming a worldview based on cooperation aimed at by the Paris Agreement</li> </ul>
	SSP5-2	4°C	Fossil-fueled conventional development society	<ul style="list-style-type: none"> <li>✓ Expecting growth depended on fossil fuels, it is difficult to achieve a decarbonizing society.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Assuming a worldview that does not presuppose cooperation aimed at by the Paris Agreement</li> </ul>

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

		SSP1	SSP2	SSP3	SSP4	SSP5
Economic and Lifestyle	Economic growth	<u>Growth rates are high in low-and middle-income countries, and moderate in high-income countries.</u>	Medium, heterogeneous	<u>Slow (low)</u>	Low-income countries have low growth rates. Others are medium	<u>High</u>
	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	<u>Markets are unified and production is carried out in each region.</u>	Some degree of freedom in globalization	<u>Reverse from globalization. Active regional security policies</u>	Elite employees have global connections	<u>Globalization advances and markets move toward unification.</u>
	Consumption trend	Physical consumption decreases in high-income countries. Expand meat-free meals	Consumption centers on physical consumption, moderate meat consumption	<u>Mainly physical consumption</u>	Consumption levels are high among elites, but low among others.	<u>Material consumption, tourism and mobility consumption</u> Meat-centric life
Policies and Related Organizations	International cooperation	<u>Have the effect</u>	Relatively weak	<u>Weak</u>	Globally unified markets outside of vulnerable people	Targets for development are achieved, but targets for the environment are not achieved.
	Environmental policy	<u>Improved management at regional and global volume levels. Strengthening pollution regulation</u>	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	<u>The state and international organizations have influence</u>	Have a moderate influence	<u>Weak influence of international organizations</u>	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"

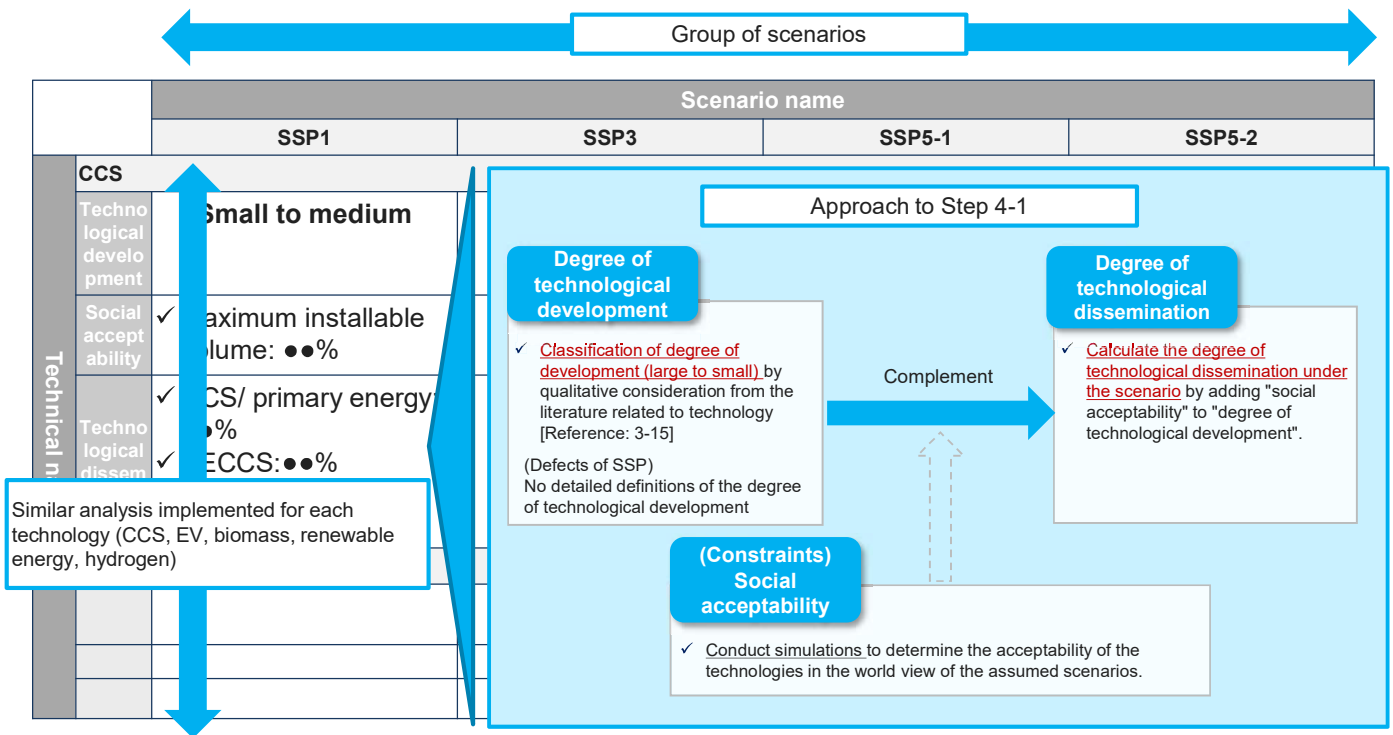


### Steps to evaluate business impact

	Step 4-1	Step 4-2	Step 4-3
Overview of Evaluation	<p><u>Evaluation of 5 technologies (Qualitative &amp; Quantitative)</u></p> <ul style="list-style-type: none"> <li>Classify of the technological development and acceptance by scenarios.</li> </ul>	<p><u>Business impact evaluation (Qualitative)</u></p> <ul style="list-style-type: none"> <li>Evaluate sector impact based on scenario worldview and technology evaluation</li> </ul>	<p><u>Business impact evaluation (Quantitative)</u></p> <ul style="list-style-type: none"> <li>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."</li> </ul>
Analytical methods	<ul style="list-style-type: none"> <li>Extract technology-related descriptions from multiple literature on climate change and classify "technological progress" into 3 stages</li> <li>We conduct simulations for each SSP scenario and calculate "degree of technological dissemination" by taking into account the results.</li> </ul>	<ul style="list-style-type: none"> <li>Qualitatively evaluate the external impact of 3 sectors×4 scenarios using 5Force analyses</li> </ul>	<ul style="list-style-type: none"> <li>Select recommended technologies for investment by sector and scenario, and construct our investment portfolio</li> <li>Scored "degree of impact of technology" (up to 6 points) from the viewpoint of necessity of government support and coverage of technology</li> <li>Evaluation of Japan's technological strengths on a 3-stage scale based on comparison with other countries' policies and budget requests in Japan</li> </ul>



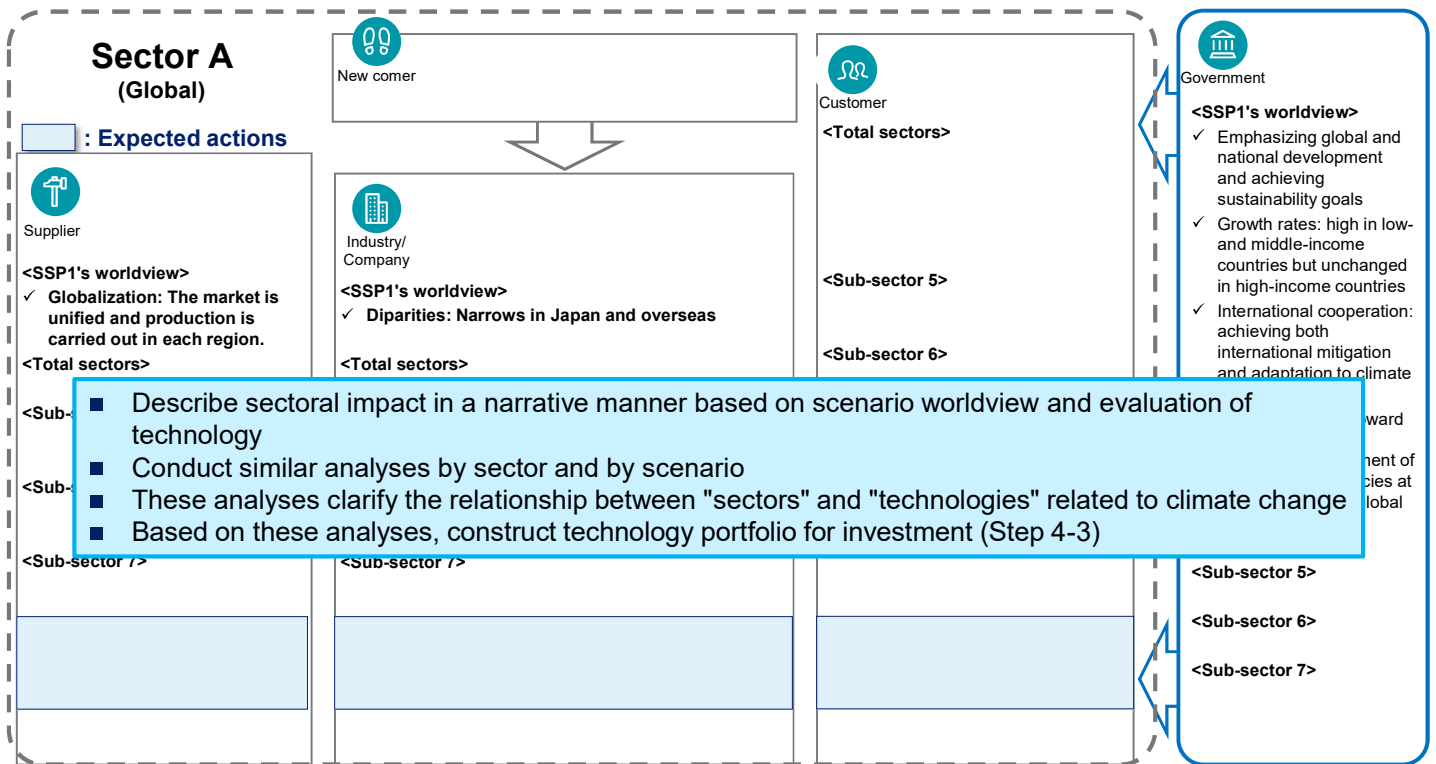
### Step 4-1 Diagram



### (Reference) "Degree of technological development" by scenarios

		Scenario name			
		SSP1	SSP3	SSP5-1	SSP5-2
Technical name	CCS	* ~ * *	* ~ * *	* * *	* * *
	Biogas				
Technical name	CC(U)S	<b>Approach to Classification of "Development"</b> <b>Degree of technological development</b>			
		<b>High (***)</b> • <b>CCS</b> : Realization of great cost cut. Technologies related to BECCS become commercialized and spread	<b>Medium (**)</b> • <b>CCS</b> : Technological development advances, as well as cost cut	<b>Low (*)</b> • <b>CCS</b> : Technology would not advance. EOR project would be promoted	
	Hydrogen	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.			
	Renewable energy	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

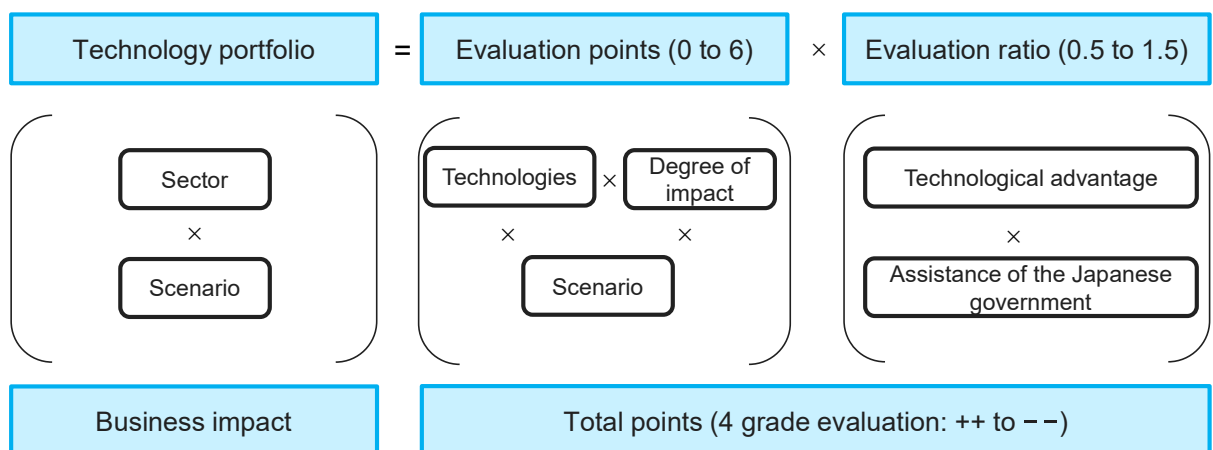


### Approach to evaluate business impact

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

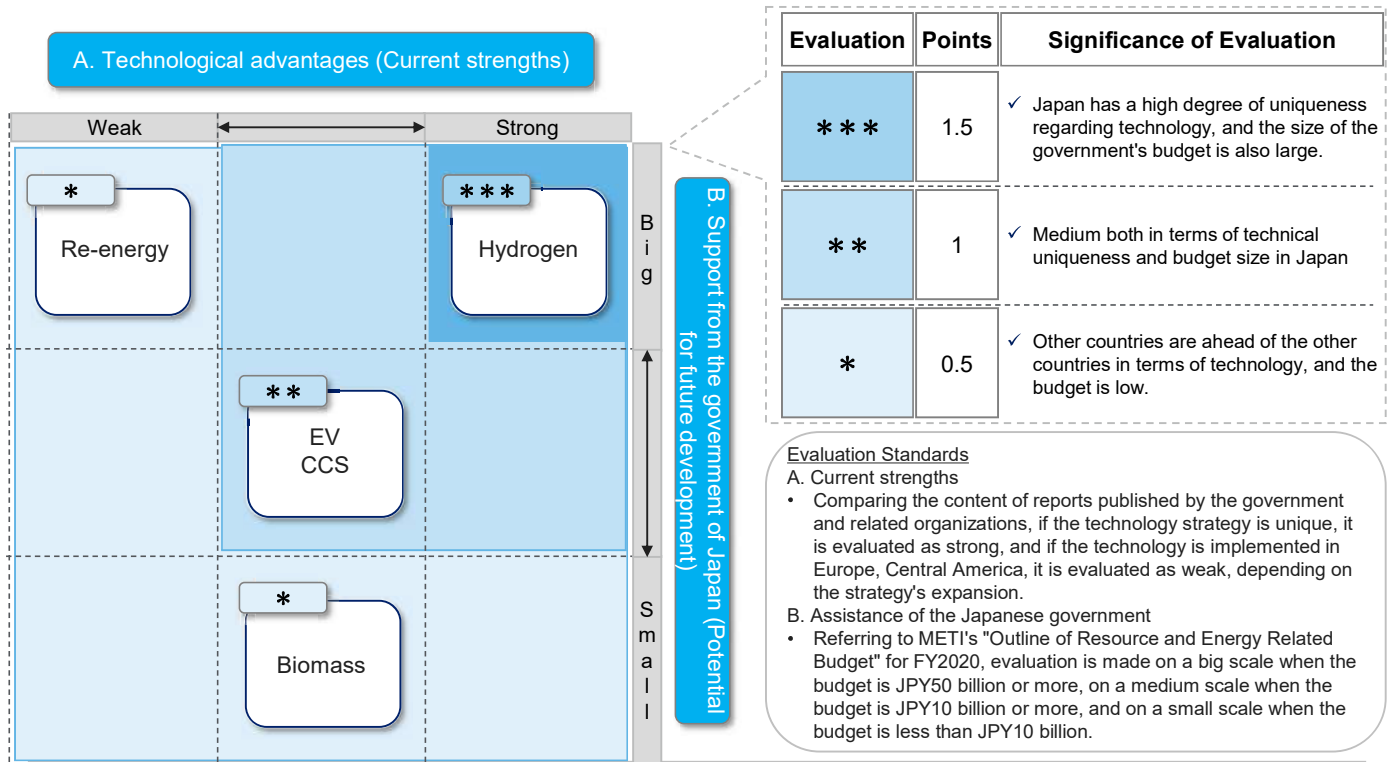
- Based on 5Force analyses, select recommended technologies for investment by sector and scenario, and construct our investment portfolio in each sector
- Scored as "degree of technological impact" (up to 6 points) by adding consistency with global data to "degree of technological dissemination" selected 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])

Evaluation Summary



## (Reference) Approach to evaluate Japan's technology strengths

- Setting technologies in which Japanese companies have relative advantages



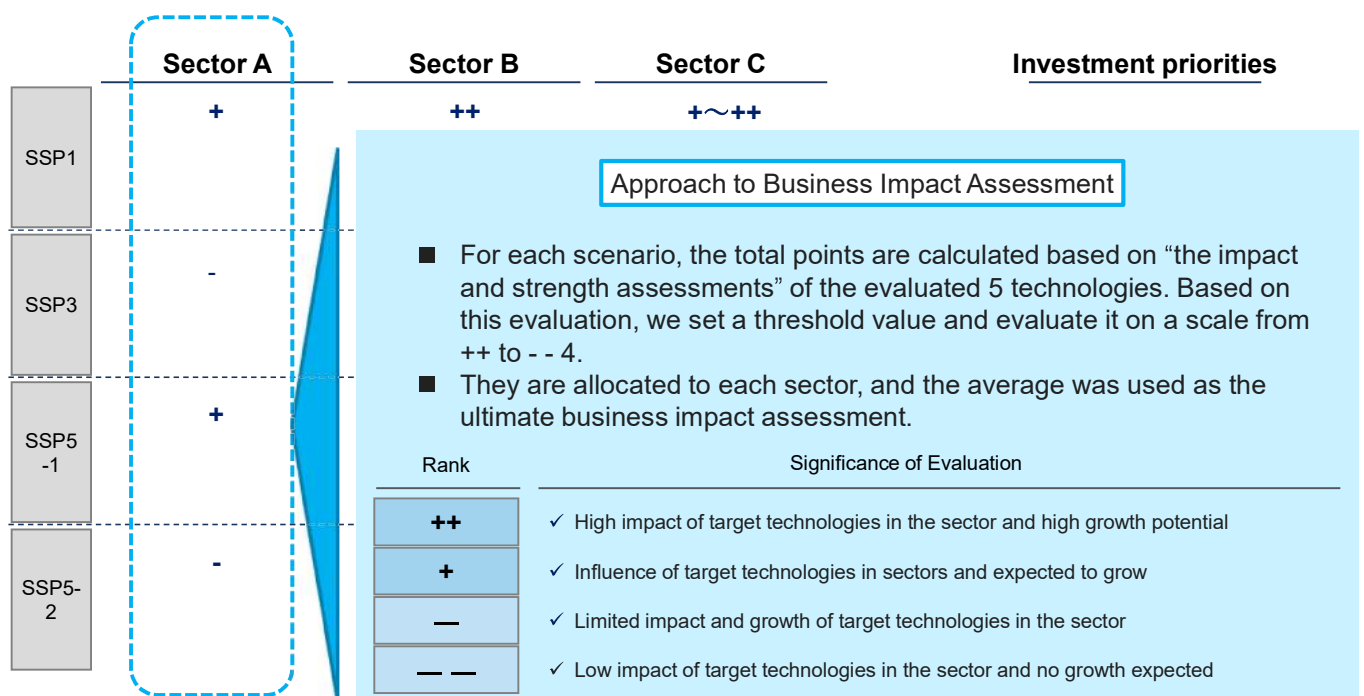
Note: Created based on information as of February 2019

3-18



## Step 4-3 Diagram: Business impact evaluation

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



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## 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

## Energy

✓ Practice Example①: ITOCHU Corporation

✓ Practice Example②: Chiyoda Corporation

# ITOCHU Corporation



- Textile Company
  - Apparel Division
  - Brand Marketing Division 1
  - Brand Marketing Division 2
- Machinery Company
  - Plant Project, Marine & Aerospace Division
  - Automobile, Construction, Realty & Logistics, Machinery & Industrial Machinery Division
- Metals & Minerals Company
  - Metal & Mineral Resources Division
- Energy & Chemicals Company
  - Energy Division
  - Chemicals Division
- Food Company
  - Provisions Division
  - Fresh Food Division
  - Food Products Marketing & Distribution Division
- General Products & Realty Company
  - Forest Products & General Merchandise Division
  - Construction & Logistics Division
- ICT & Financial Business Company
  - ICT Division
  - Financial & Insurance Business Division

Department in charge of scenario analysis



● As of 2018

3-22

STEP **2** 3 4 5

## STEP 2 “Assess materiality of climate-related risks”

### Climate-change risks and opportunities for the power generation segment

Risk item	Business impact (examples of considerations)	
Carbon pricing/emission rights trading	<ul style="list-style-type: none"> <li>• Introduction of carbon pricing and emission rights trading will <b>increase the cost of thermal power generation.</b> (It is highly likely that the cost will not be able to be passed on in the sales price.)</li> <li>• <b>Competitive advantages for renewable energy will increase.</b></li> </ul>	Large
Carbon dioxide emission targets/policies of countries	<ul style="list-style-type: none"> <li>• Strict regulations will <b>require the company to consider selling assets or making additional capital investment.</b></li> </ul>	Large
Change in energy mix	<ul style="list-style-type: none"> <li>• Electricity from particular resources will <b>become unsaleable, opportunity loss</b> will occur, or <b>sales will decrease.</b></li> <li>• The Company will <b>have to consider selling assets, or making capital investment in alternative energy resources.</b></li> </ul>	Large
Spread of recycling and energy-saving technologies (CCS, storage batteries, resource-saving design, etc.)	<ul style="list-style-type: none"> <li>• If carbon capture and storage (CCS) is made mandatory for thermal power generation, <b>extra costs will be incurred.</b></li> <li>• A drastic shift to renewable energy will <b>require huge investment in storage batteries and grid systems.</b></li> <li>• If a new, low-cost and high-efficiency renewable or energy-saving technology emerges, the <b>demand for thermal power generation will decrease.</b></li> </ul>	Large
Renewable energy prices (FIT price)	<ul style="list-style-type: none"> <li>• <b>Sales prices of new renewable energy projects will decline.</b></li> <li>• <b>Competitive advantages for renewable energy will increase.</b></li> </ul>	Large
Changes in the reputations among investors	<ul style="list-style-type: none"> <li>• Divestment will accelerate, and continuation of the thermal power generation business will <b>increase fund-raising costs.</b></li> </ul>	Large

**Introduction of carbon pricing will lead to a rise in power generation costs and changes in energy mix, which will have great financial impacts.**

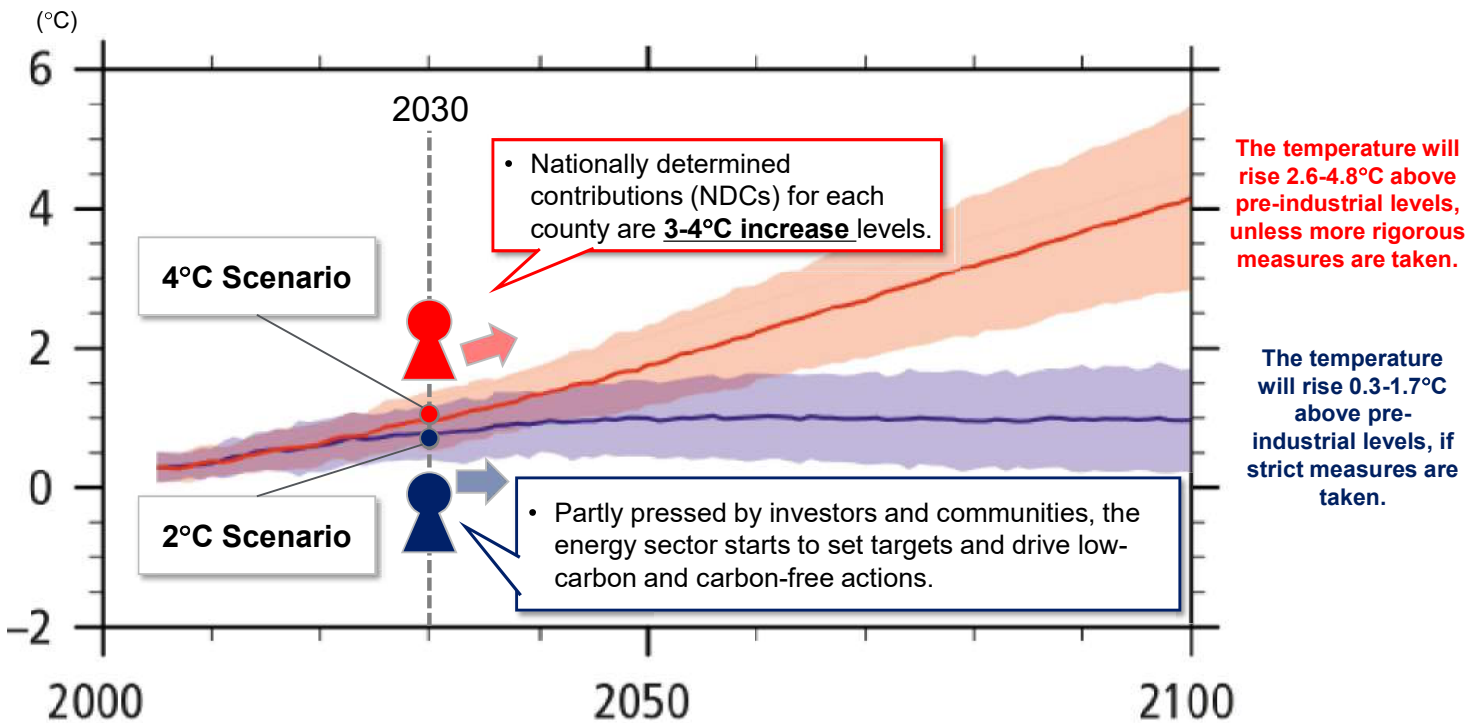
3-23



### STEP 3 "Identify and define range of scenarios"

Consider society in 2040 with two scenarios of climate change that are highly uncertain.

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



Sources: Figure SPM.6 in the Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5); International Energy Agency (IEA), "ETP 2017"; UNEP, "the Emission Gap Report 2015"; and website of the Ministry of Foreign Affairs

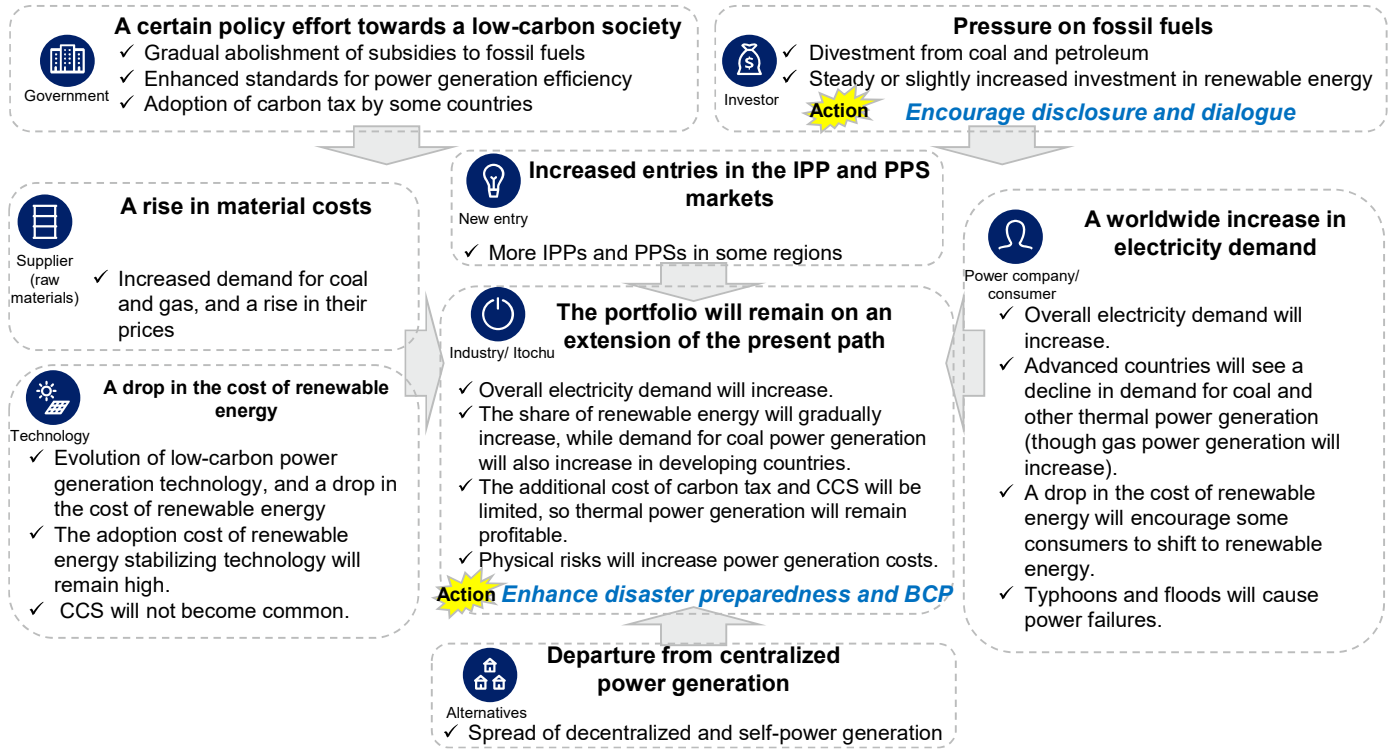
### STEP 3 "Identify and define range of scenarios"

IEA's and Other Assumptions based on Scientific Grounds

		Present (2014)	2040		Sources
			World 40 years ahead in the 4°C scenario	World 40 years ahead in the 2°C scenario	
Carbon pricing/ emission rights trading	Carbon pricing/ emission rights trading	N/A	N/A	<b>\$140/t (US)</b>	• IEA WEO2016 (450 scenario)
Carbon emissions targets/ policies*	Fossil fuel prices	Coal: <b>\$78/t</b> Gas: <b>\$4.4/Mbtu (US)</b>	Coal: <b>\$108/t</b> Gas: <b>\$7.5/Mbtu (US)</b>	Coal: <b>\$77/t</b> Gas: <b>\$5.9/Mbtu (US)</b>	• IEA ETP 2016 (4DS, 2DS)
	Renewable energy prices (FIT price) (US)**	N/A	PV utility scale: <b>7.2-8.8</b> yen/kWh Onshore wind power: <b>6.2-7.7</b> yen/kWh	PV utility scale: <b>6.6-7.1</b> yen/kWh Onshore wind power: <b>6.2-7.7</b> yen/kWh	• IEA WEO2016 (NPS, 450 scenario)
Changes in energy mix	Energy output by source (US)	Coal thermal: <b>1,713</b> TWh (40%) Gas thermal: <b>1,161</b> TWh (27%) Renewable: <b>570</b> TWh (13%)	Coal thermal: <b>1,016</b> TWh (21%) Gas thermal: <b>1,480</b> TWh (30%) Renewable: <b>1,488</b> TWh (30%)	Coal thermal: <b>153</b> TWh (3%) Gas thermal: <b>959</b> TWh (20%) Renewable: <b>2,560</b> TWh (54%)	• IEA WEO2016 (NPS, 450 scenario)
Spread of renewable and energy-saving technologies	Penetration rate of CCS	N/A	N/A	Coal thermal with CCS: <b>64%</b> Gas thermal with CCS: <b>18%</b>	• IEA ETP 2016 (2DS)

### STEP 3 “Identify and define range of scenarios”

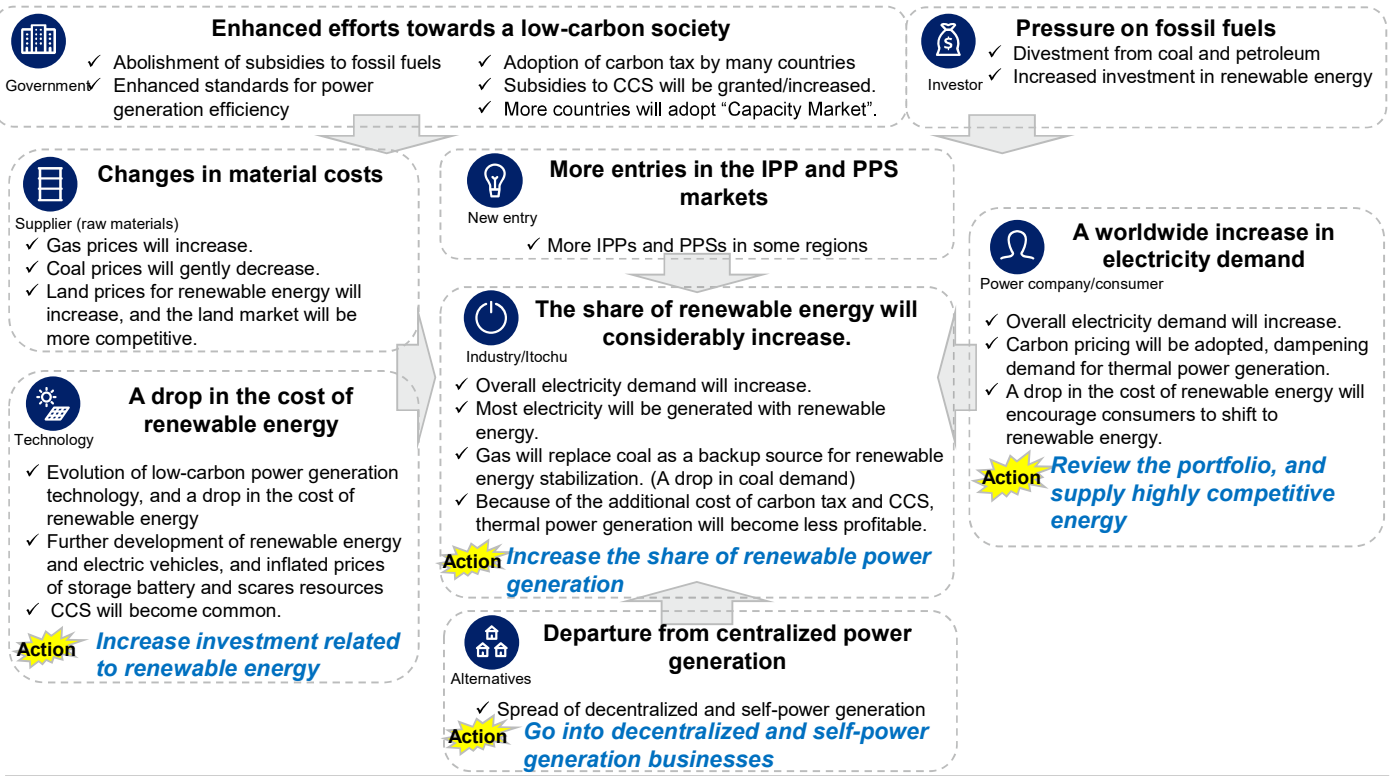
In the 4°C scenario, the world will see an increased share of renewable energy, while the Company will continue following the present path towards further expansion



**While keeping the portfolio on an extension of the present path, enhance the business continuity plan (BCP) to respond to physical risks**  
**Encourage active disclosure and dialogue to secure reputation**

### STEP 3 “Identify and define range of scenarios”

In the 2°C scenario, the world will reduce the use of thermal power generation, and substantially increase the share of renewable energy



**While constructing a business portfolio focusing on renewable energy in line with the world trend of departure from carbon, pursue new electricity business opportunities**

## STEP 4 “Evaluate business impacts”

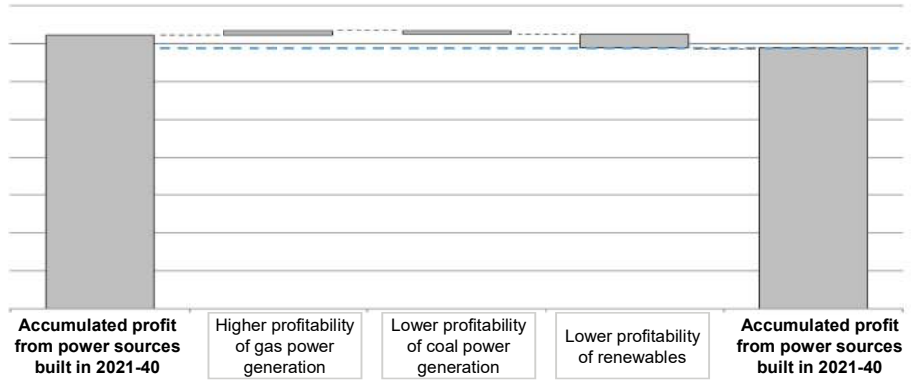
Under both the 2°C and 4°C scenarios, the Company will maintain at least the current level of income

### 4°C Scenario

(Image)

There are possibilities that:

- Gas power generation will be more profitable.
- Coal power generation will be less profitable.
- Renewables will also be less profitable.
- Accumulated income will drop.

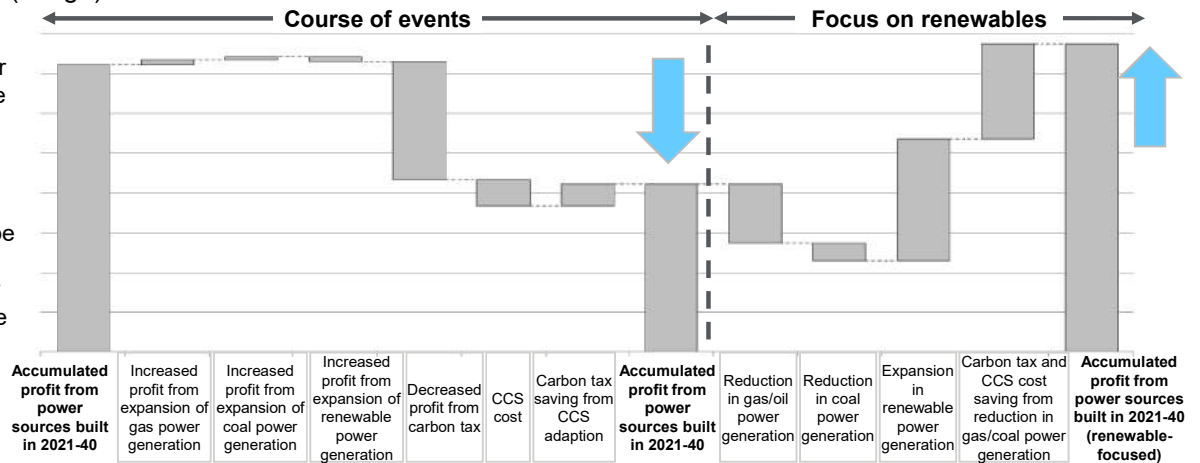


### 2°C Scenario

(100% carbon tax)

(Image)

- Power generation other than renewables will be subject to carbon tax, which will result in a substantial drop in profitability.
- But the Company will be able to maintain or increase profitability by building new renewable plants.



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## Energy

✓ Practice Example①: ITOCHU Corporation

✓ Practice Example②: Chiyoda Corporation

# Define range of scenarios

Analytical Assumptions	Target
Target	2040
Scenarios	4°C → Without any countermeasures (ex: no carbon tax, etc.) 2°C → 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.

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

Step **2** 3 4 5 Scenario **4°C** **2°C**

### 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	<ul style="list-style-type: none"> <li>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.</li> </ul>	Large
	Carbon emission targets/policies of each country (including subsidies)	Revenue	<ul style="list-style-type: none"> <li><u>Regulatory tightening affects orders for fossil-fuel-derived plants, affecting PL</u></li> </ul>	
	In the energy mix Change	Revenue	<ul style="list-style-type: none"> <li><u>Large impact on PL due to changes in fossil fuel-derived power generation rate, which affects plant orders</u></li> </ul>	
	Energy Demand	Revenue	<ul style="list-style-type: none"> <li><u>Significant impact on PL due to decrease in demand for gasoline and decrease in orders for petroleum refineries</u></li> <li><u>Smaller plant size and diversification of customers and regions reduced business opportunities.</u></li> </ul>	
	Spread of low-carbon technologies	Revenue	<ul style="list-style-type: none"> <li><u>Influence on PL due to the spread of electric vehicles, reduced demand for gasoline, etc., affecting the volume of orders received for petroleum plants.</u></li> </ul>	
	Developing next-generation technologies	Revenue Spending	<ul style="list-style-type: none"> <li><u>Popularization of decarbonizing materials (bio-plastics, etc.) reduces the market size of petroleum products and has a large impact on orders for petroleum refineries</u></li> </ul>	
Other	Changes in customer reputation, changes in investor reputation, rising mean temperatures, rising sea levels, and extreme weather conditions	Revenue Spending	<ul style="list-style-type: none"> <li>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.</li> <li>Construction delays caused by extreme weather conditions have an impact on PL due to increased construction costs, etc.</li> </ul>	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.

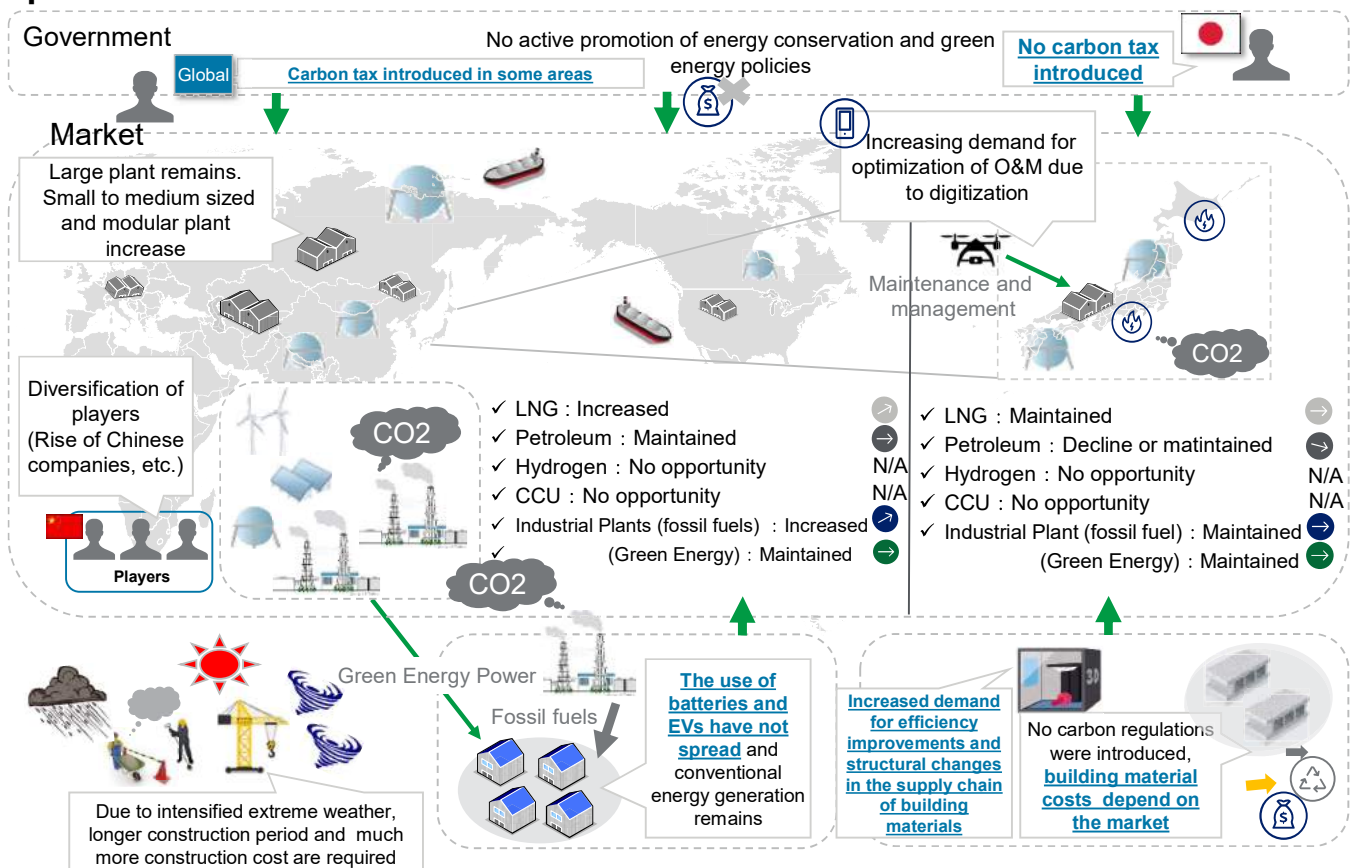
[Step 3: Identify and define a range of scenarios]

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

		At present	2040			Source
			4°C(STEPS)	2°C(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, FCEV) (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)	2.7 EJ/ years	Steel sector: 4.0 EJ/ years Cement Division: 2.0 EJ/ 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

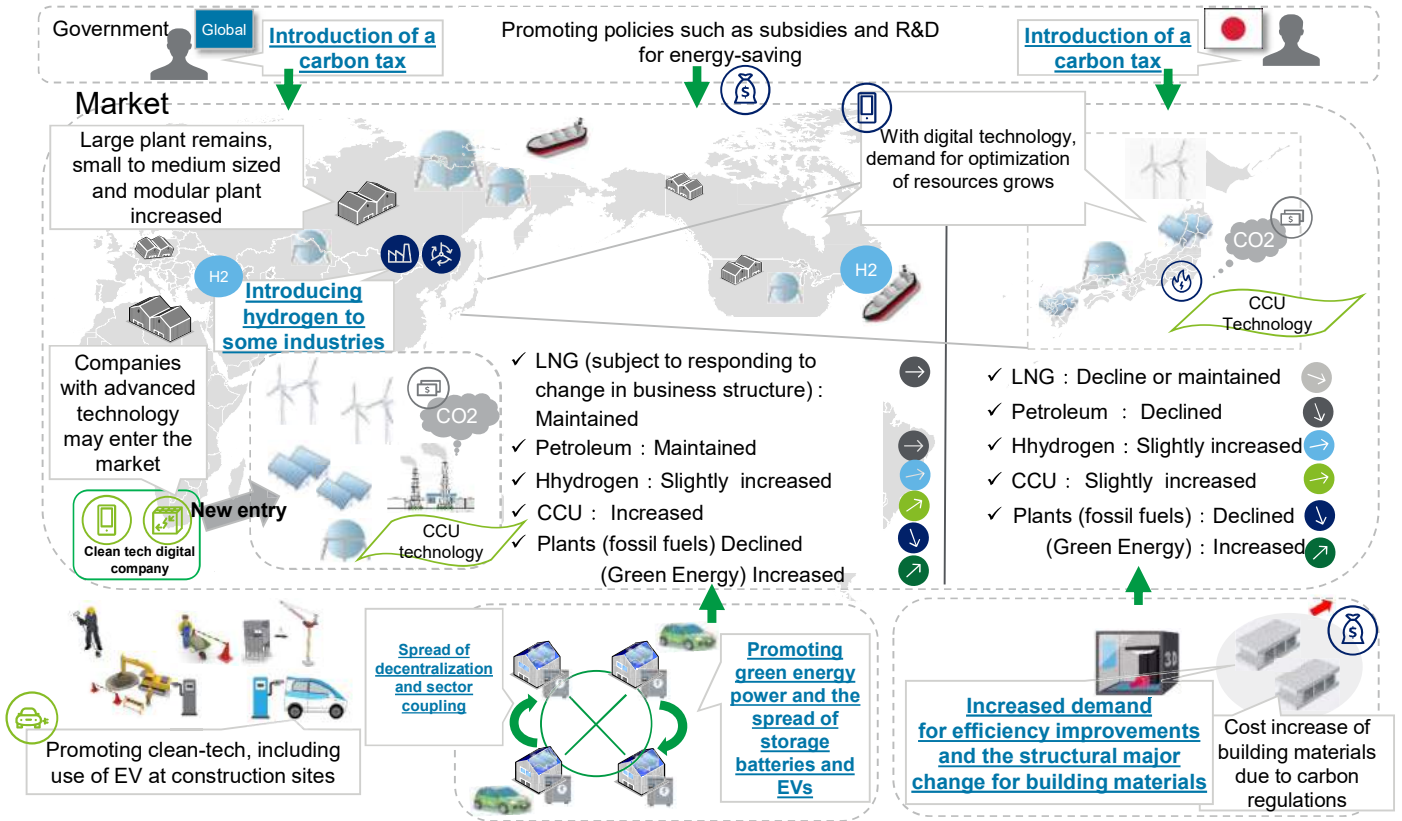
[Step 3: Identify and define range of scenarios]

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]

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



3-34

[Step 4: Evaluate business impacts]









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

3-35

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

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

3-36

## Transportation

- ✓ **Practice Example①: Mitsui O.S.K. Lines, Ltd.**
- ✓ **Practice Example②: Japan Airlines Co., Ltd.**
- ✓ **Practice Example③: Mitsubishi Motors Corporation**

3-37

# Climate-related Impact on Mitsui O.S.K. Lines

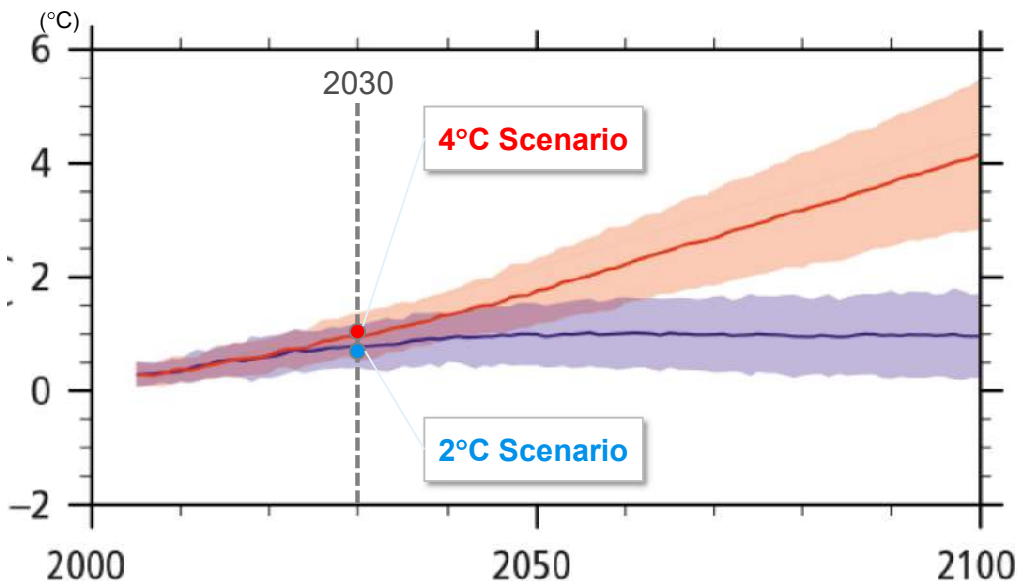
	Risk item	Business impact	
Transition risk	Increase/decrease in Key products and prices	<ul style="list-style-type: none"> <li>Changes in energy mix will impact the <b>demand for key cargo transport (crude oil, petroleum products, petrochemicals, coal, LNG)</b>, leading to fluctuations in profit of ocean shipping business</li> <li>Transition to a low-carbon society will <b>decrease the demand for coal and petroleum</b>, which <b>will reduce</b> the cargo volume and <b>profit in the ocean shipping business</b>.</li> <li>However, the <b>spread of CCS and CCU</b> can revive the <b>demand for coal transport</b>, enabling the shipping business to maintain profit.</li> <li><b>Spread of EVs and other next-generation vehicles</b> will <b>substantially change the ways of completed vehicle transport and supply chains</b>. This will <b>reduce the vehicle transport volume</b> and lower profit in the ocean shipping business.</li> <li><b>Spread of renewable energy will increase the demand for hydrogen transport</b>, which can help maintain profit in the ocean shipping business.</li> <li><b>Increased demand for onshore wind power generation will increase profit from development of onshore facilities (costs of transport and installation)</b>, which will increase profit in the ocean shipping business.</li> <li>Climate change will adversely impact cereal crop harvests, which will lower the <b>demand for bulk cargo transport and reduce</b> profit in the ocean shipping business.</li> </ul>	Large
	Promotion of next-generation vessels	<ul style="list-style-type: none"> <li><b>Shippers will expect environmental considerations in transport</b>, calling on the ocean shipping business <b>to shift to next-generation vessels</b>. This will <b>increase R&amp;D costs, capital investments</b>, and overall expenditures.</li> <li><b>Adaption of next-generation vessels will save fuel costs and payments of carbon tax</b>, reducing overall expenditures.</li> </ul>	
	National regulations on SOx/NOx	<ul style="list-style-type: none"> <li>The 2020 IMO <b>fuel sulphur regulations will require the ocean shipping business to purchase appropriate fuel</b>. This will <b>increase operating costs</b> and overall expenditures.</li> <li><b>Installation of SOx scrubber systems will increase capital costs</b> and overall expenditures. Promotion of alternative fuels, though not directly related to climate change or global warming, can indirectly contribute to CO2 emissions reduction.</li> </ul>	
	Energy-saving policy (EEDI/Energy efficiency laws)	<ul style="list-style-type: none"> <li>The <b>EEDI for new ships will tighten the regulations</b> (Phase 2 from 2020 and Phase 3 from 2025), which will inflate ship prices, <b>and increase maintenance costs</b> and overall expenditures.</li> </ul>	
	Energy-saving subsidies	<ul style="list-style-type: none"> <li><b>Access to energy-saving subsidies will save capital investment</b>, and reduce overall expenditures.</li> <li><b>FIT and other policies to promote renewable energy will reduce the demand for crude oil, coal and LNG transport</b>, the transport volume, and income in the ocean shipping business.</li> <li><b>An increase in the demand for biomass fuel transport</b> will increase the transport volume and income in the ocean shipping business.</li> </ul>	
	Trend in energy demand	<ul style="list-style-type: none"> <li><b>Stricter regulations on the use of cleaner fuels or those with less environmental impact will increase the costs of technology development, capital, fuel and vessels (including crew training costs)</b>, and overall expenditures.</li> </ul>	
Others	Carbon pricing	<ul style="list-style-type: none"> <li>If <b>market-based measures (MBMs)</b> for GHG from ships are <b>made obligatory</b> by IMO, <b>fuel will be charged</b>, and ship operators <b>will have to purchase emission rights</b> for emissions exceeding their allocated volumes. This will increase overall expenditures.</li> </ul>	Medium to large
	Change in reputation among customers (shippers) and investors; melting of permafrost and glaciers; extremely abnormal weather; etc.	<ul style="list-style-type: none"> <li>General preference to transport means with environmental considerations will increase the demand for vessels.</li> <li>Development of the North Sea Route will reduce traveling time, and the capital and travel costs. This will lead to more new contracts and increase freight revenue.</li> <li>Abnormal whether and typhoons require ship operators to change navigation routes to longer routes. This can damage reputation from shippers.</li> </ul>	Small to medium

**Adoption of carbon pricing and emission rights trading will increase vessel fuel costs and overall expenditures. In addition, investment in development of next-generation vessels will have considerable financial impacts.**



## Consider society in 2030 with two scenarios

[Global average surface temperature (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: Figure SPM.6 in the Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5)





# Assumptions in the Scenarios

		Present	2030		Sources
			World in the 4°C scenario	World in the 2°C scenario	
Increase/ decrease in Key products and prices	Total traffic volume	66,000 G tonne-km/year (2015)	113,588 G tonne-km/year	101,178 G tonne-km/year	• 2ii (ACT, LCT scenarios)
	Coal traffic volume	7,300 G tonne-km/year (2015)	7,665 G tonne-km/year	5,256 G tonne-km/year	• IEA WEO2017/2ii (ACT, LCT scenarios)
	Petroleum traffic volume	19,000 G tonne-km/year (2015)	25,039 G tonne-km/year	15,987 G tonne-km/year	• IEA WEO2017/2ii (ACT, LCT scenarios)
	Automobile traffic volume	36.2 million vehicles/year (2017)	53.02 million vehicles/year	43.27 million vehicles/year	• The Global Calculator V23 (IEA 2DS/4DS scenarios)
	Steel demand	1,670Mt (2014)	1,855Mt	1,855Mt	• IEA ETP 2017 (RTS, 2°C scenario)
	LNG demand	3,635bcm (2014)	4,269bcm	4,545bcm	• IEA ETP 2017 (RTS, 2°C scenario)
	Demand for offshore wind power generation	350GW (2014)	1,255GW	1,840GW	• Agency for Natural Resources and Energy, Renewable Energy Institute, Japan Maritime Center, etc.
Spread of next-generation vessels	Spread of next-generation fuels	FAME: 1,040USD/Mt, 38MJ/kg MDO: 482USD/Mt, 43MJ/kg (2016)	n.a.	n.a.	• IEA Bioenergy report "Biofuels for the marine shipping sector"
	EEDI regulations	Phase 1 = 10%	Phase 3 = 30% (in and after 2025)	Phase 3 = 30% (in and after 2025)	• IMO
Regulations	CO2 emissions of global marine transport	810 million tonnes (Emissions from ships worldwide, 2010)	924 million tonnes (Emissions from ships worldwide)	823 million tonnes (Emissions from ships worldwide)	• 2ii (UMAS Scenarios 8, 10)
Carbon pricing	Carbon tax	* Average bidding price: Approx. \$8/t at the EU-ETS	Europe: \$37/t China: \$23/t	Japan, North America, Europe: \$100/t China: \$75/t	• IEA WEO 2016 (450, NPS scenario) • "Implementation and Considerations of Emissions Trading in Selected Countries", a Ministry of Environment report, 2016
	Fuel price	Petroleum: \$97/bbl	Petroleum: \$113/bbl	Petroleum: \$97/bbl	• IEA ETP 2016/2ii

3-40



# CO2 Emissions from the Global Maritime Transport Sector

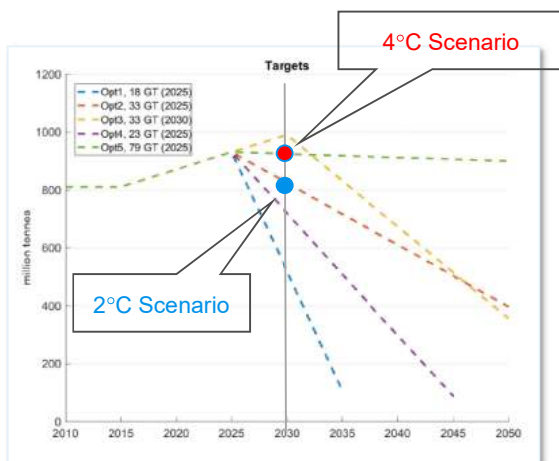


Figure 16: CO<sub>2</sub> targets quantified

Table 14: Absolute CO<sub>2</sub> emissions targets for international shipping under five different target derivations (million tonnes)

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Opt.1 - Responsibility principle, 1.5 degrees, 18 Gt (2025)	810	810	870	930	518	106			
Opt.2 - Responsibility principle, 2 degrees, 33 Gt (2025)	810	810	870	930	823	716	610	503	396
Opt.3 - Responsibility principle, 2 degrees, 33 Gt (2030)	810	810	870	930	990	821	673	514	356
Opt.4 - Egalitarian principle, developed country based, 23 Gt (2025)	810	810	870	930	719	508	297	86	
Opt.5 - Egalitarian principle, developing country based 79 Gt (2025)	810	810	870	930	924	917	911	905	898

### Opt 2 = Scenario 8:

- The scenario sets CO<sub>2</sub> emissions targets at 33Gt during the period 2010 to 2100 on the assumption that MBM starts in 2025 and 20% of the total revenue derived from a carbon pricing can be used to purchase CO<sub>2</sub> offsets. It is used as an ACT scenario (2°C) in the 2ii report.

### Opt 5 = Scenario 10:

- The scenario sets CO<sub>2</sub> emissions targets at 79Gt during the period 2010 to 2100 on the assumption that MBM starts in 2025 and 80% of the total revenue derived from a carbon pricing can be used to purchase CO<sub>2</sub> offsets. It is used as an LCT scenario (4°C) in the 2ii report.

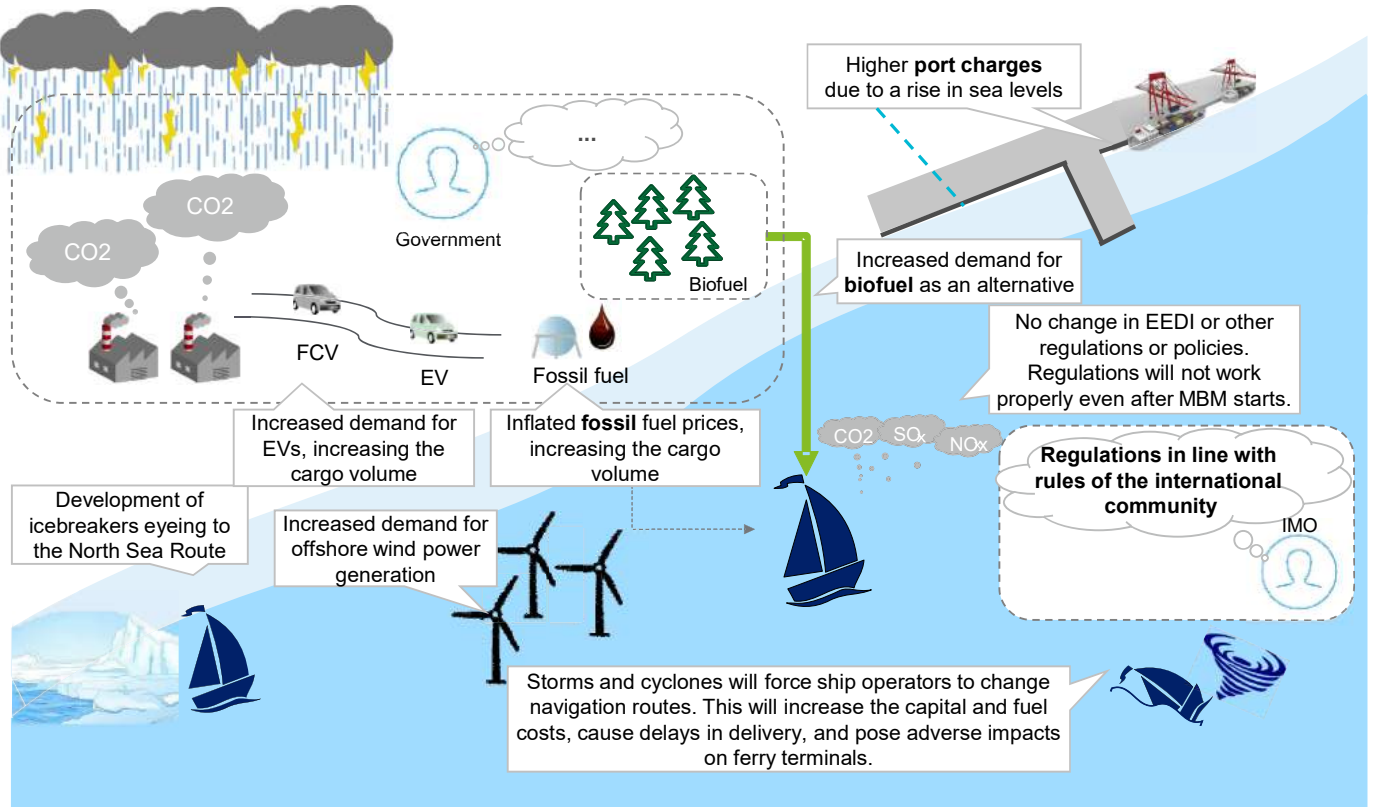
Source: UMAS, "CO<sub>2</sub> Emissions from International Shipping - Possible reduction targets and their associated pathways", 2016. P.45

3-41



# World in the 4°C Scenario: More Natural Disasters and Inflated Fuel Costs

STEP 2 3 4 5 Scenario 4°C 2°C

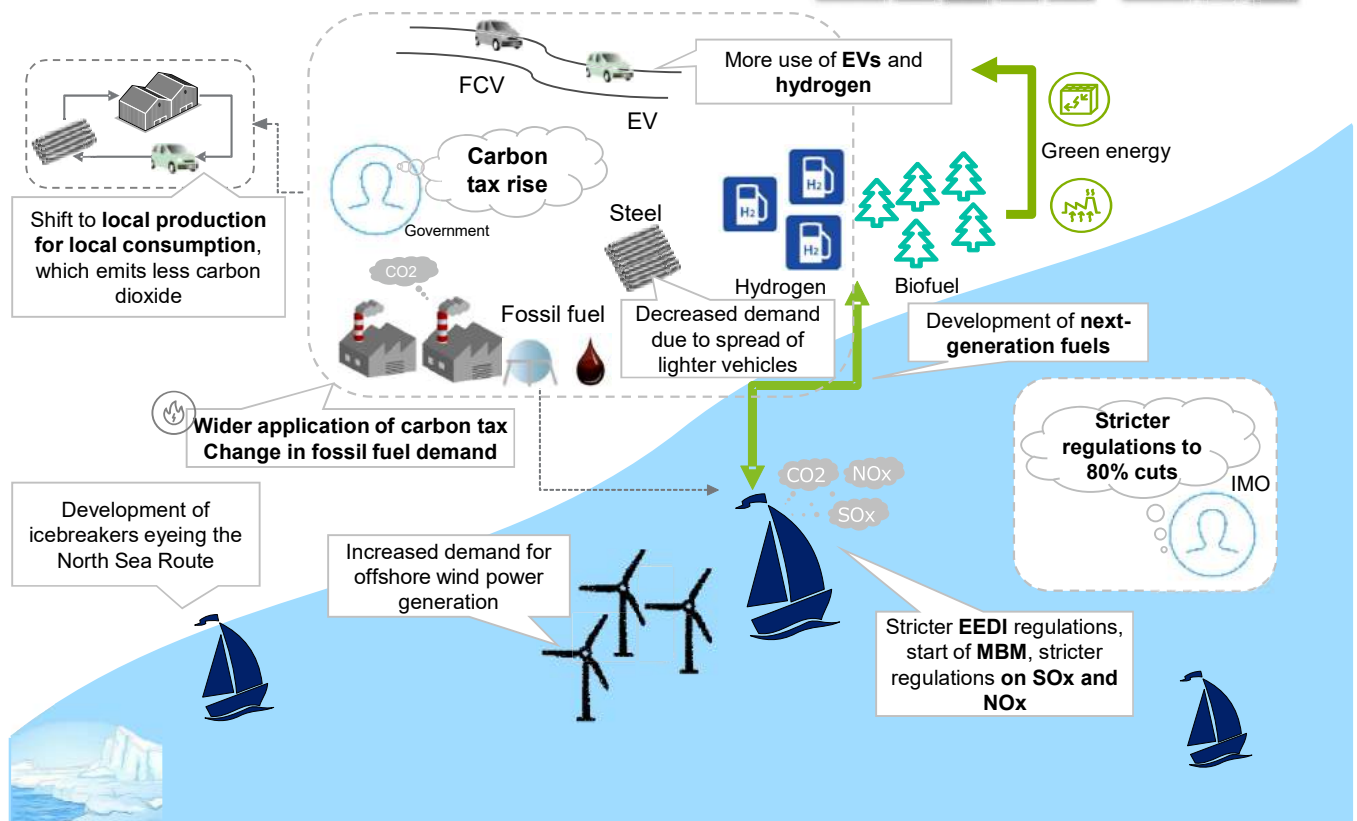


3-42



# World in the 2°C Scenario: Cleaner Society, Shift to Renewables, and Dampened Demand for Fossil Fuel

STEP 2 3 4 5 Scenario 4°C 2°C

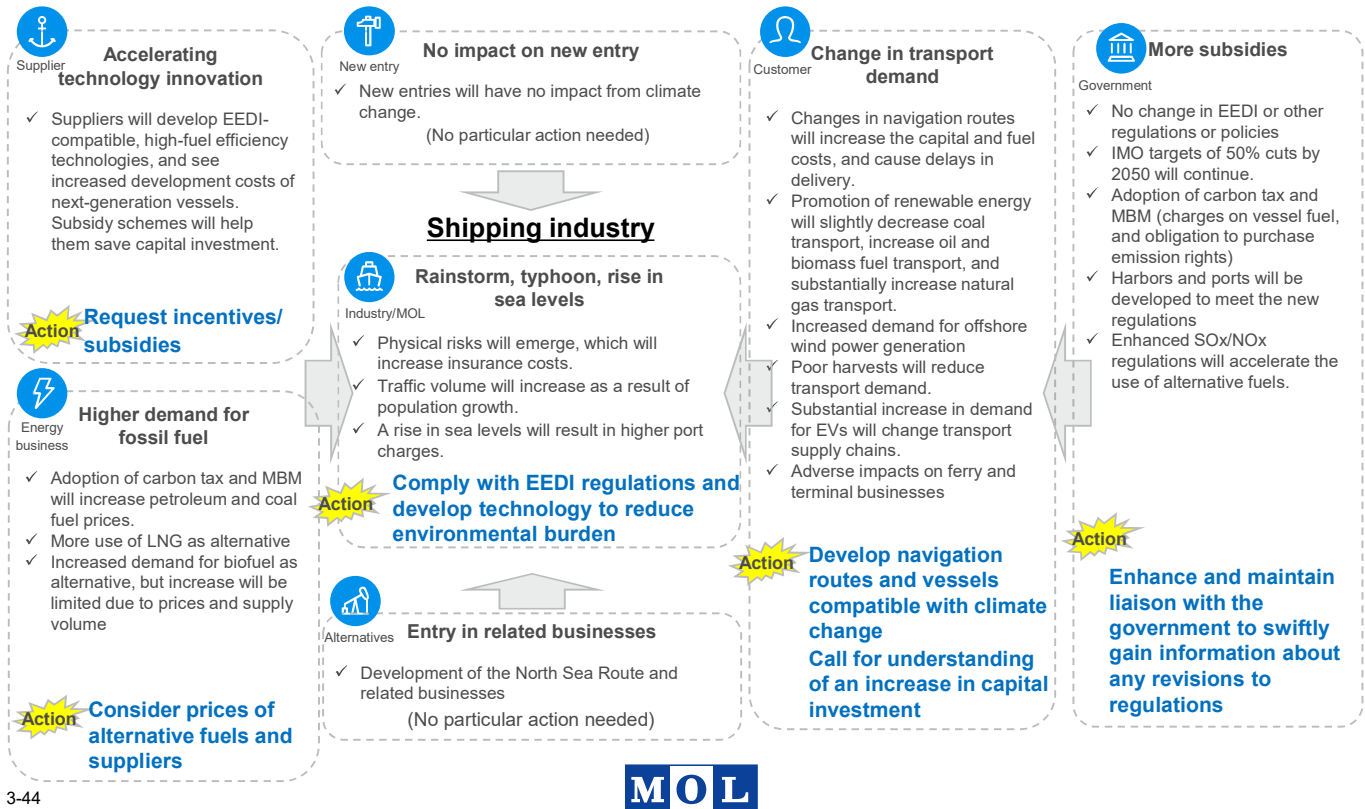


3-43



# World in the 4°C scenario, the Company will continue following the present path towards further expansion.

## World in the 2030s in the 4°C scenario



3-44

# World in the 2°C scenario: More Action Needed towards a Low-Carbon Society

## World in the 2030s in the 2°C scenario



3-45

## World in the 4°C scenario, population growth and other factors will increase traffic volume. The Company will use high-efficiency and LNG vessels to deal with inflated fuel costs.

STEP 2 3 **4** 5 Scenario **4°C** 2°C

Risk item		Financial impact indicator	Summary of impact	Background of the impact	Magnitude of impact (¥100 million)		
Transition risks	Increase/decrease in key cargoes	Coal traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	The continued upward trend of coal demand, and population growth and vital economy will boost coal demand further.		
		Petroleum traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	The continued upward trend of petroleum demand, and population growth and vital economy will boost coal demand further.		
		Automobile traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	Consumers will not have enough incentives to purchase next-generation vehicles because of unsolved infrastructure problems, poor availability of related products, and high prices. So, the vehicle market will remain focused on vehicles with an internal combustion engine (ICE).		
		Steel traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	Currently, steel is used the most for construction and automobiles. It is hardly possible to consider any alternative to steel for construction, so impacts of transition risks will be minimal. (Increase in climate disasters will result in an increase in demand for stronger and more durable materials.)		
		LNG traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	The continued upward trend of LNG demand, and population growth and vital economy will boost LNG demand further.		
		Traffic volume related to offshore wind power generation	Sales (cost of ocean shipping business)	Increase in related projects will increase cost (freight revenue) of ocean shipping business.	Further spread of renewable energy and particularly an increase in demand for offshore wind power generation using Japan's outstanding technology will increase revenues from facility construction (transport and installation costs).		
	Energy-saving policy/regulations / carbon pricing	Inflated fuel prices	Transport of other products	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	The continued upward trend of demand, and population growth and vital economy will boost demand further.	
			MBM/emission rights trading	Expenditures (cost of ocean shipping business)	Emission trading will increase expenditures.	Emission trading will be adopted to achieve the CO2 reduction target by 2050, but the trading volume will be limited. New technologies will be put in place to achieve the goal.	
	Trend in energy demand	Inflated fuel prices	Expenditures (cost of ocean shipping business)	Adoption of carbon pricing will inflate fuel prices, which will increase cost (fuel costs) of ocean shipping business.	Carbon pricing will slightly increase. This will be passed on to fuel prices in advanced countries, causing financial impacts.		
			Expenditures (cost of ocean shipping business)	Rise in fuel prices due to supply-demand balance will increase costs (fuel costs) of ocean shipping business.	Considerable rise in fossil fuel costs will have great financial impacts.		
	Energy-saving policy/regulations / carbon pricing	EEDI and other regulations	Expenditures (cost of ocean shipping business)	Adoption of high-efficiency vessels will reduce cost (fuel costs) of ocean shipping business.	Low-carbon transport modes will be required. Fuel efficiency of vessels will be improved, reducing operation costs.		
			Expenditures (cost of ocean shipping business)	Regulations will increase new shipbuilding costs.	To develop low-carbon transport modes, shipbuilders will seek high-efficiency vessels and install high-efficiency facilities in existing vessels. This will increase shipbuilding and repair costs.		
Spread of next-generation vessels	Adoption of LNG-fueled vessels	Expenditures (cost of ocean shipping business)	Adoption of LNG-fueled vessels will impact cost (fuel costs) of ocean shipping business.	Adoption of LNG-fueled vessels will reduce vessel fuel costs and costs equivalent to carbon pricing.			
		Expenditures (cost of ocean shipping business)	Adoption of LNG-fueled vessels will increase new shipbuilding costs.	Adoption of LNG-fueled vessels will require additional investment as the difference from conventional vessels, having great financial impacts.			
Spread of next-generation fuels (biofuels, etc.)	Spread of next-generation fuels (biofuels, etc.)	Expenditures (cost of ocean shipping business)	Spread of biofuels will increase cost (fuel costs) of ocean shipping business.	Biofuels will become common and more easily available. Businesses will consider adopting such fuels toward a low-carbon society.			

3-46



## World in the 2°C scenario, fossil fuel traffic volume will decrease. The Company will face greater burden of emission trading and carbon tax.

STEP 2 3 **4** 5 Scenario **4°C** **2°C**

Risk item		Financial impact indicator	Summary of impact	Background of the impact	Magnitude of impact (¥100 million)		
Transition risks	Increase/decrease in key cargoes	Coal traffic volume	Sales (profit of ocean shipping business)	Decrease in traffic volume will reduce profit (freight revenue) of ocean shipping business.	Shift from fossil fuels to renewable energy will reduce the coal traffic demand.		
		Petroleum traffic volume	Sales (profit of ocean shipping business)	Decrease in traffic volume will reduce profit (freight revenue) of ocean shipping business.	Shift from fossil fuels to renewable energy will reduce the petroleum traffic demand.		
		Automobile traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	Demand for EVs will considerably increase, affecting transport supply chain. A low-carbon society will draw higher attention, reducing the growth of traffic volume of ICE. But population growth will offset the reduction, and overall traffic volume will increase.		
		Steel traffic volume	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	Currently, steel is used the most for construction and automobiles. It is hardly possible to consider any alternative to steel for construction, but steel can be replaced by lighter materials such as aluminum, plastics, and CFRP for car bodies.		
		LNG traffic volume	Sales (profit of ocean shipping business)	Fluctuations in traffic volume will increase profit (freight revenue) of ocean shipping business.	Increased LNG demand in a low-carbon society will increase LNG traffic volume.		
		Traffic volume related to offshore wind power generation	Sales (cost of ocean shipping business)	Increase in related projects will increase cost (freight revenue) of ocean shipping business.	Further spread of renewable energy and particularly an increase in demand for offshore wind power generation using Japan's outstanding technology will increase revenues from facility construction (transport and installation costs).		
	Energy-saving policy/regulations / carbon pricing	Inflated fuel prices	Transport of other products	Sales (profit of ocean shipping business)	Increase in traffic volume will increase profit (freight revenue) of ocean shipping business.	The continued upward trend of demand, and population growth and vital economy will boost demand further.	
			MBM/emission rights trading	Expenditures (cost of ocean shipping business)	Emission trading will increase expenditures.	Emission trading will be adopted to achieve the CO2 reduction target by 2050, but the tradable volume will be large. The Company will have to purchase emission rights if it fails to meet the targets. This will increase expenditures.	
	Trend in energy demand	Inflated fuel prices	Expenditures (cost of ocean shipping business)	Adoption of carbon pricing will inflate fuel prices, which will increase cost (fuel costs) of ocean shipping business.	Carbon pricing will increase. This will be passed on to fuel prices in advanced countries, causing financial impacts.		
			Expenditures (cost of ocean shipping business)	Rise in fuel prices due to supply-demand balance will increase cost (fuel costs) of ocean shipping business.	Slight rise in fossil fuel costs will increase fuel costs.		
	Energy-saving policy/regulations / carbon pricing	EEDI and other regulations	Expenditures (cost of ocean shipping business)	Adoption of high-efficiency vessels will reduce cost (fuel costs) of ocean shipping business.	Low-carbon transport modes will be required. Fuel efficiency of vessels will be improved, reducing operation costs.		
			Expenditures (cost of ocean shipping business)	Regulations will increase new shipbuilding costs.	To develop low-carbon transport modes, shipbuilders will seek high-efficiency vessels and install high-efficiency facilities in existing vessels. This will increase shipbuilding and repair costs.		
Spread of next-generation vessels	Adoption of LNG-fueled vessels	Expenditures (cost of ocean shipping business)	Adoption of LNG-fueled vessels will impact cost (fuel costs) of ocean shipping business.	Adoption of LNG-fueled vessels will reduce vessel fuel costs by the amount equivalent to carbon pricing.			
		Expenditures (cost of ocean shipping business)	Adoption of LNG-fueled vessels will increase new shipbuilding costs.	Adoption of LNG-fueled vessels will require additional investment as difference from conventional vessels, having great financial impacts.			
Spread of next-generation fuels (biofuels, etc.)	Spread of next-generation fuels (biofuels, etc.)	Expenditures (cost of ocean shipping business)	Spread of biofuels will increase cost (fuel costs) of ocean shipping business.	Biofuels will become common and more easily available. Businesses will consider adopting such fuels toward a low-carbon society.			

3-47



# Transportation

- ✓ Practice Example①: Mitsui O.S.K. Lines, Ltd.
- ✓ Practice Example②: Japan Airlines Co., Ltd.
- ✓ Practice Example③: Mitsubishi Motors Corporation

3-48

## Scenario Analysis in Practice - STEP 2 Assess materiality of climate-related risks (extract)



- ✓ List and categorize risk items into three groups in terms of assumed impacts on the business

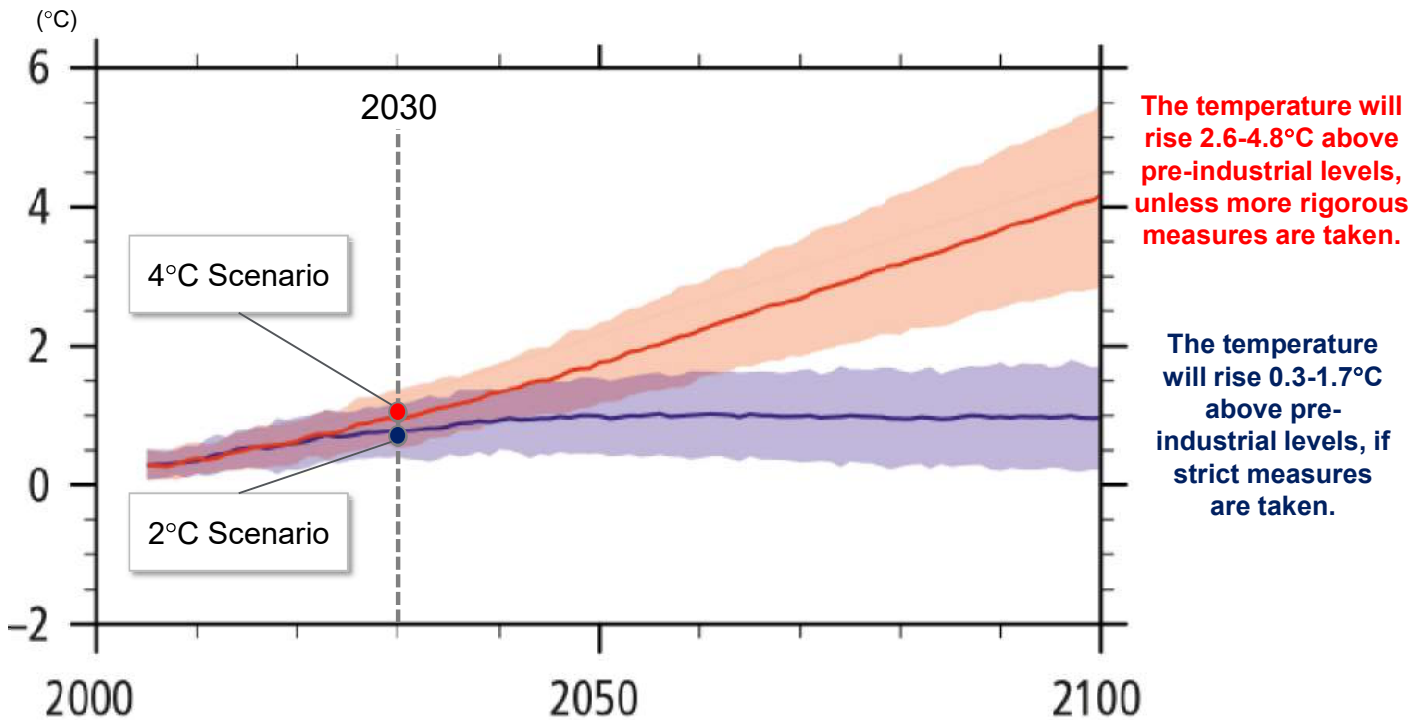
Category	Risk item	Assessment
Policy and Legal	Targets and regulations on carbon emissions and fuel efficiency in the airline industry	Large
	Targets and regulations on carbon emissions and fuel efficiency in relevant countries	Medium
	Carbon pricing	Medium
Technology Shifts	Spread of alternative fuels	Large
	Improvement in fuel efficiency	Medium
	Development of next-generation airplanes	Small
Market Shifts	Inflated fuel prices	Large
Physical Risks	Increased severity of extreme weather events	Large
	Changes in rainfall and weather patterns	Large
	Rise in average temperature	Medium to Large

3-49

# Scenario Analysis in Practice – STEP 3 Identify and define range of scenario

✓ Consider a society with high climate uncertainty in 2030 with two existing scientific scenarios

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

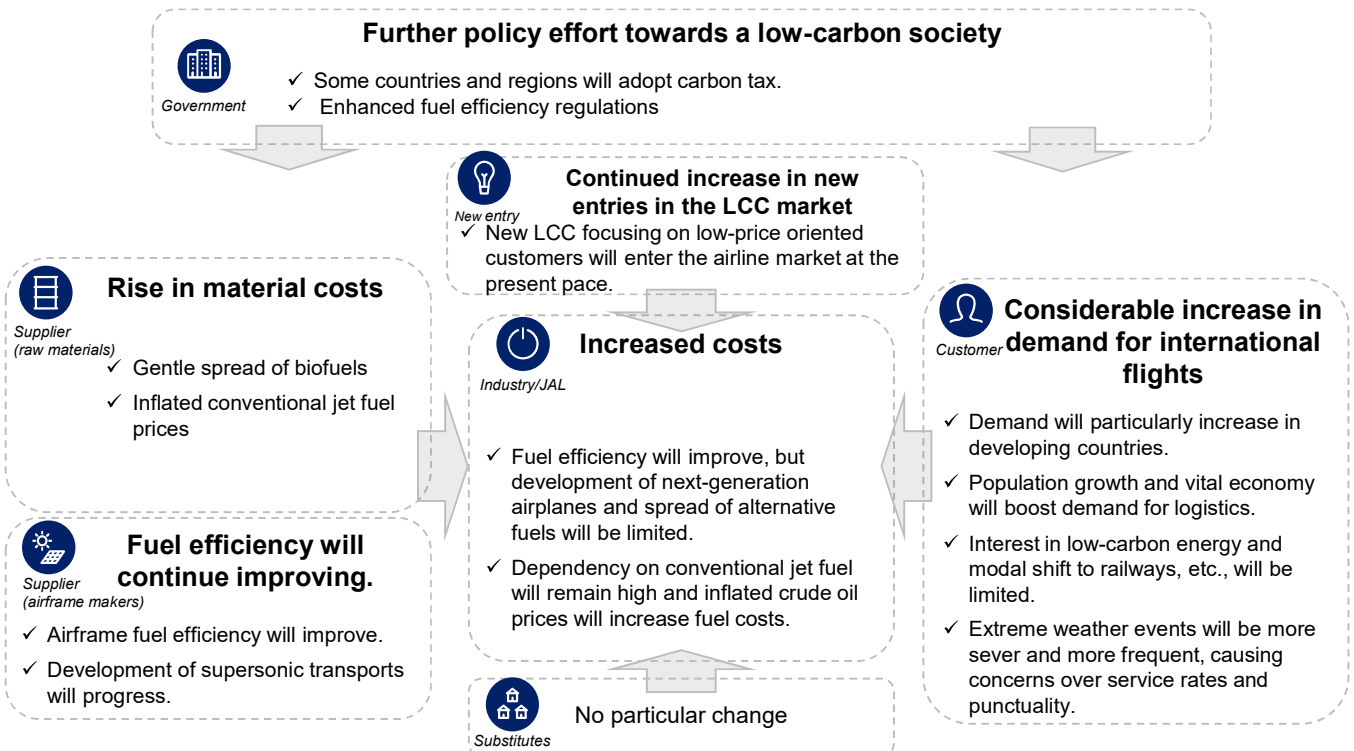


3-50 Sources: Figure SPM.6 in the Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5); International Energy Agency (IEA), "ETP 2017"; UNEP, "the Emission Gap Report 2015"; and website of the Ministry of Foreign Affairs

# Scenario Analysis in Practice - STEP 3 Identify and define range of scenario (extract)

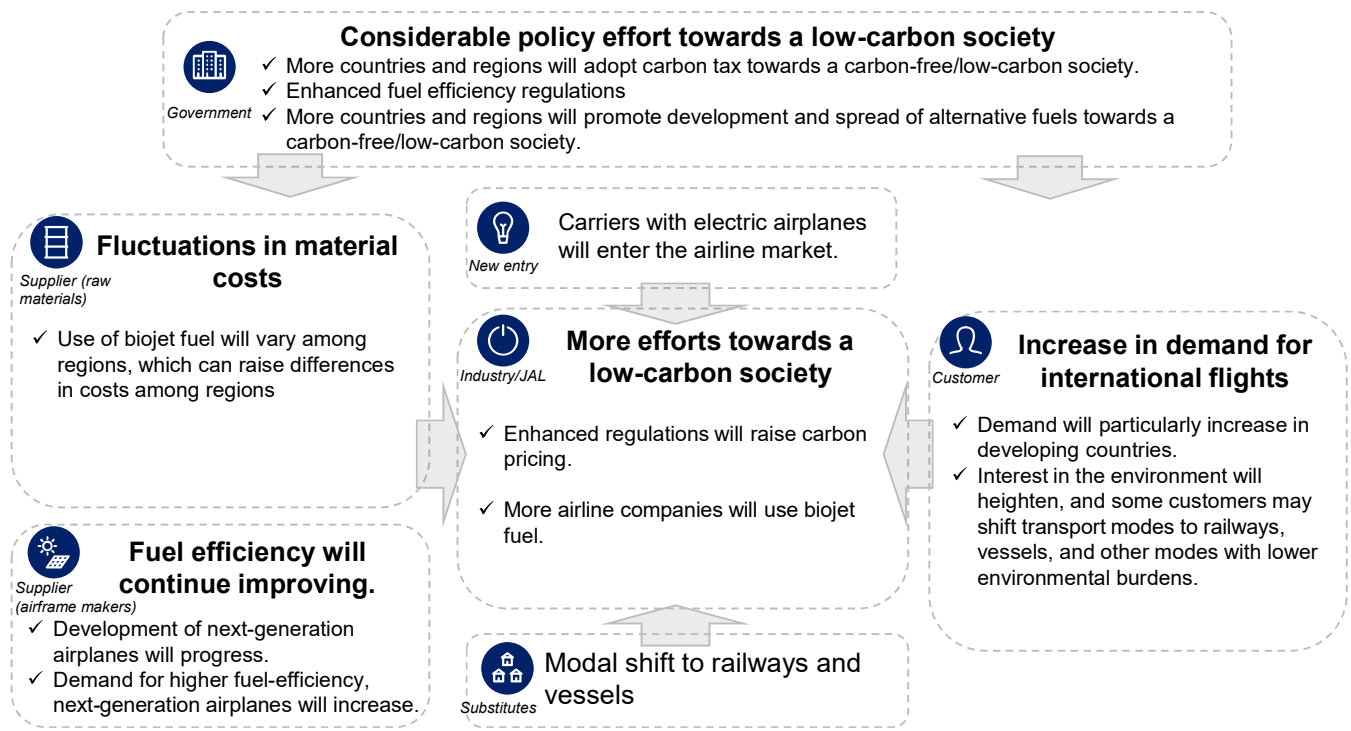
✓ The world in the 4°C scenario will be an extension of the present.

4°C Scenario



# Scenario Analysis in Practice – STEP 3 Identify and define range of scenario

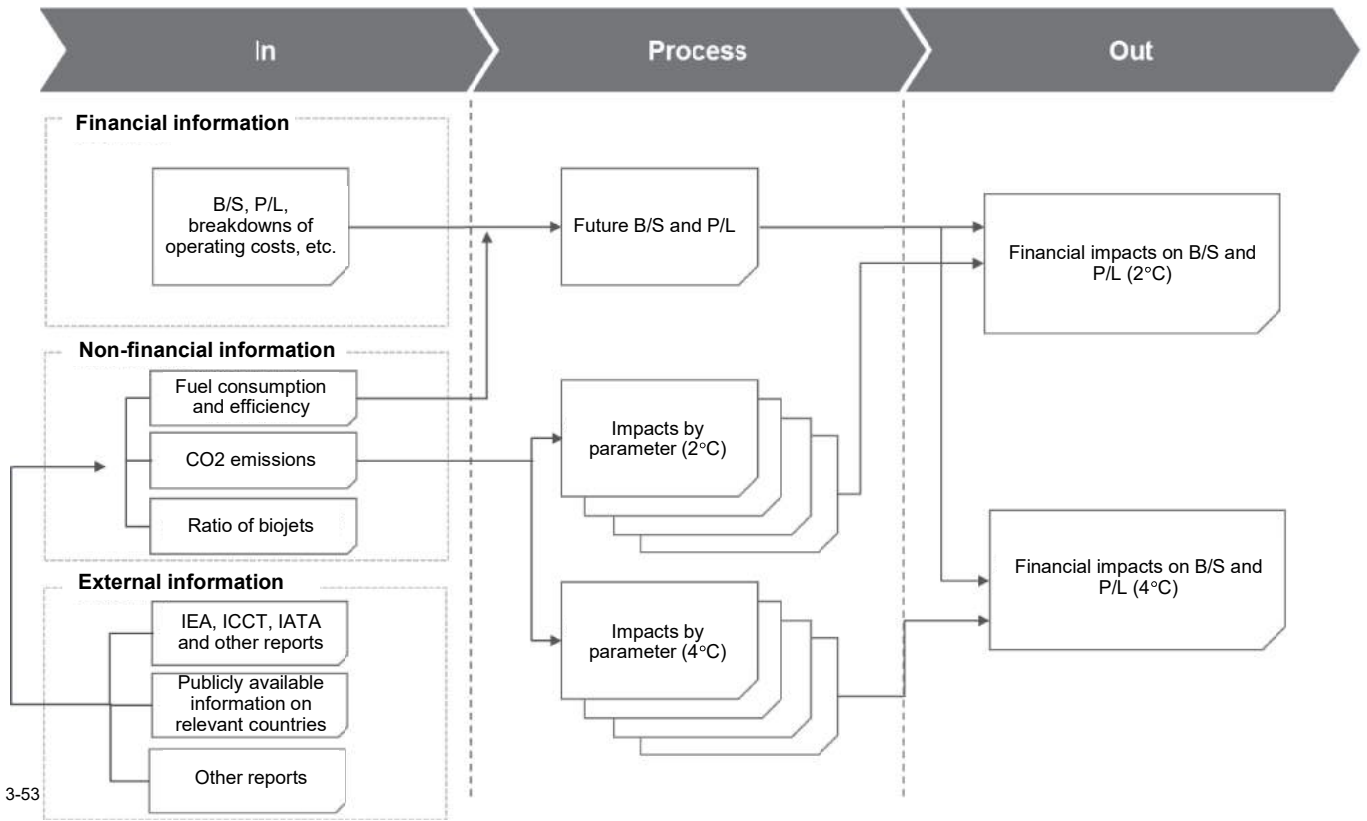
✓ In the 2°C Scenario, alternative fuels will become more available, and modal shifts will take place. Therefore, the Company may have to revise its supply chain and business model. 2°C Scenario



3-52

# Scenario Analysis in Practice: STEP 4 Evaluate business impacts

✓ Analyze parameters based on financial and non-financial information, and estimate financial impacts.



3-53

# Transportation

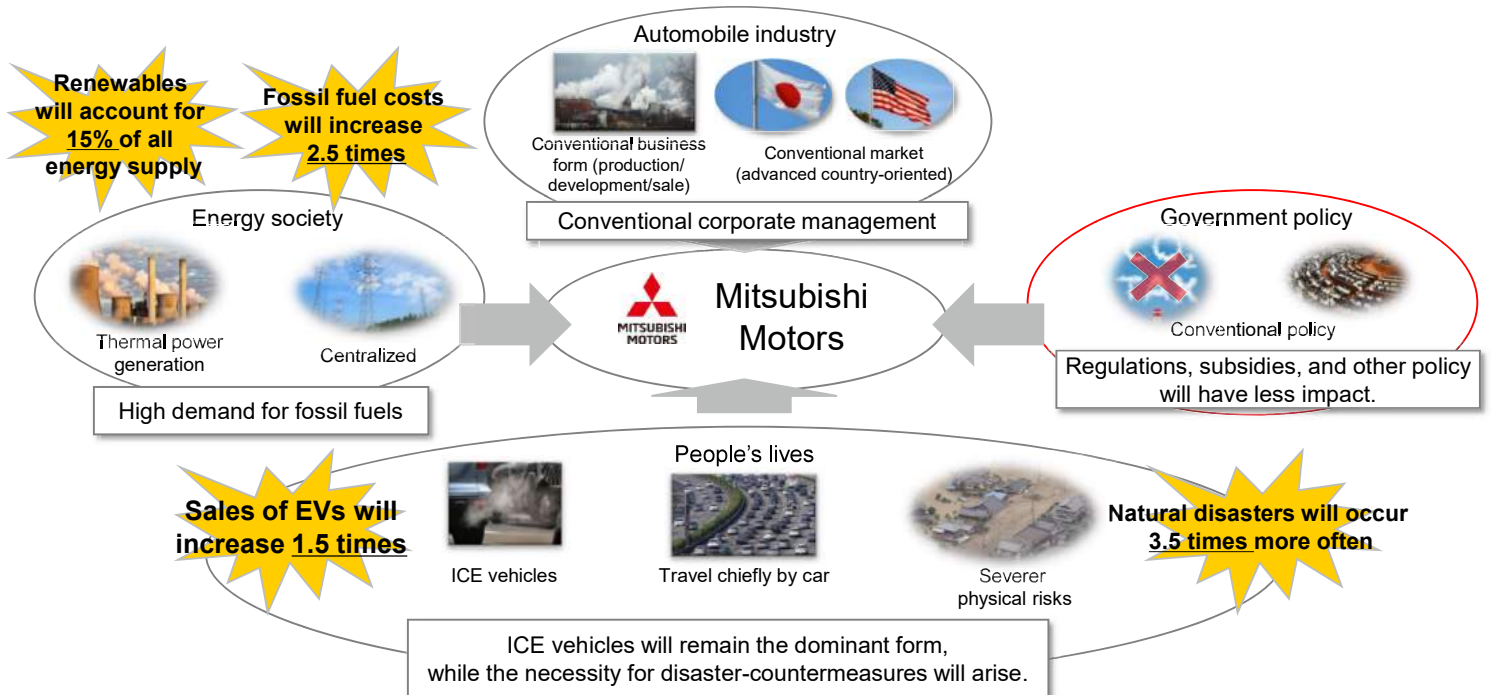
- ✓ Practice Example①: Mitsui O.S.K. Lines, Ltd.
- ✓ Practice Example②: Japan Airlines Co., Ltd.
- ✓ Practice Example③: Mitsubishi Motors Corporation

3-54

STEP 2 3 4 5 Scenario 4°C 2°C 

## 1-3a STEP3: Identify and define range of scenario (4°C)

In 2030 in the 4°C Scenario, the world will see 1.5-2 fold increases in the number of natural disasters and resulting damage. The scenario assumes that the use of electric vehicles will not be widespread.



3-55



# 1-4a STEP4 : Evaluate business impacts (4°C)

Changes in social environment Events that can take place in the future	Future prediction Choice and combinations of information, story-making	Impacts on business Interpretation of actual impacts	Business impacts Impacts on annual profit
<ul style="list-style-type: none"> <li>Changes in customer behaviors</li> <li>Enhanced carbon tax and ZEV regulations</li> <li>Progress of next-generation vehicle technology</li> <li>Drop in battery prices</li> </ul>	<b>Further spread of EVs</b> <ul style="list-style-type: none"> <li>Changes in consumer behaviors, government policy, and technology progress will increase car sales to 3 million cars per year. (Global market)</li> </ul>	<b>Expanded share of EVs</b> <ul style="list-style-type: none"> <li>The share of EV sales will grow at a certain rate.</li> <li>Demand will increase chiefly for PHEV. The average battery capacity will slightly increase.</li> <li>Battery costs will remain the same because of increased demand for scarce resources and increased battery production.</li> <li>Capital investment and R&amp;D will slightly increase to meet the increased share of EVs.</li> </ul> <b>Government subsidies</b> <ul style="list-style-type: none"> <li>Subsidies at the present level will be secured (for capital investment in renewables)</li> </ul>	
<ul style="list-style-type: none"> <li>Inflated energy prices</li> <li>Accelerating renewable energy and energy-saving development</li> </ul>	<b>Inflated energy prices</b> <ul style="list-style-type: none"> <li>Increased demand for fossil fuels will raise fuel prices from 2,200 yen to 4,950 yen/barrel.</li> <li>The share of renewables will increase from 7% to 15% in Japan. Demand for ancillary services will increase, leading to higher electricity rates.</li> <li>Grid power procurement costs will increase from 14,300 yen to 15,620 yen/Mwh.</li> </ul>	<b>Increased energy procurement costs</b> <ul style="list-style-type: none"> <li>Increased demand for fossil fuels will increase energy prices.</li> </ul> <b>Further efforts for energy-saving and renewable energy development</b> <ul style="list-style-type: none"> <li>Energy consumption will be reduced to the mandatory annual rate set in the Energy-Saving Act.</li> </ul>	
<ul style="list-style-type: none"> <li>More frequent and severe natural disasters</li> </ul>	<b>Natural disasters will cause greater damage to the economy.</b> <ul style="list-style-type: none"> <li>Temperature rises will lead to more frequent and severer natural disasters. In particular, Japan will experience more torrential rains, 0.2 to 0.7 more times per year.</li> <li>Increased natural disasters will increase car accidents and flood damage cars. This will increase payments for insurance companies.</li> </ul>	<b>Increased damage to production facilities and supply chains</b> <ul style="list-style-type: none"> <li>The Company will have overall physical damage to supply chain, suspension of operations, and worsening of working environment.</li> </ul> <b>Enhanced efforts to protect supply chain</b> <ul style="list-style-type: none"> <li>The Company will enhance countermeasures against natural disasters to minimize damage to supply chains to at least present levels.</li> </ul> <b>Development of new technology to avoid physical risks</b> <ul style="list-style-type: none"> <li>Development of flood-ready vehicles</li> <li>Enhancement of V2X function</li> </ul> <b>Sale of new-tech vehicles to avoid physical risks</b> <ul style="list-style-type: none"> <li>The Company will seek to expand the market share with new value added.</li> </ul>	

3-56

## (Reference) Examples of Actual Physical Risks (Business Impacts)

### Mitsubishi Motors CEO Says West Japan Torrential Rains Reduce Production of More than 10,000 Cars

Mitsubishi Motors Co. published consolidated financial results on November 6th. Net profit increased 7% year-on-year to 51.8 billion yen due to strong sales of sports utility vehicles (SUVs) and minivans in emerging economies including Indonesia, Thailand and China. A series of natural disasters including the West Japan Torrential Rains, and typhoons Nos. 21 and 24 caused the company to **reduce production worth 4 billion yen**. The Company, however, achieved profit growth.

At a press conference for the first half of fiscal 2018, held on November 6th, the Chief Executive Officer said: "The West Japan Torrential Rains caused tremendous damage to Okayama prefecture, where our Mizushima Plant is located, and the production declines totaled more than 10,000 vehicles." "Thanks to the efforts of our suppliers and many business partners, however, we managed to minimize the impact on production and shipping", he added. (Nikkei Shimbun, November 6, 2018)

(100 million yen)	Impact of West Japan Torrential Rains	Impacts of Typhoons Nos. 21 and 24
Operating profit	-14	-10
Non-operating and extraordinary losses	-12	-4
<b>Total</b>	<b>-26</b>	<b>-14</b>

\* Impacts in the 1st half of FY2018

(Mitsubishi Motors Reports First-Half Financial Results for FY2018, November 6, 2018)

### Mazda warns of 28 billion yen loss from Japan floods Production disrupted for months in areas hit by rain

Mazda Motor expects a **roughly 28 billion yen (\$248 million) hit to operating profit due to production cuts** at the main factory (Hiroshima pref.) and the Hofu plants (Yamaguchi pref.) from the torrential rains that flooded western Japan in July, the company said.

They operated at reduced capacity in August and September, as paralyzed transportation networks hampered workers' commutes. ... For the year ending March, many factors squeezed earnings, such as the higher costs of materials such as steel and precious metals, as well as spending to bolster the automaker's sales network in the U.S. and comply with tougher environmental regulations. This leaves the company **with little room to absorb the losses from the rains from the reduced production of 28 billion yen**.



(Nikkei Shimbun, September 21, 2018)

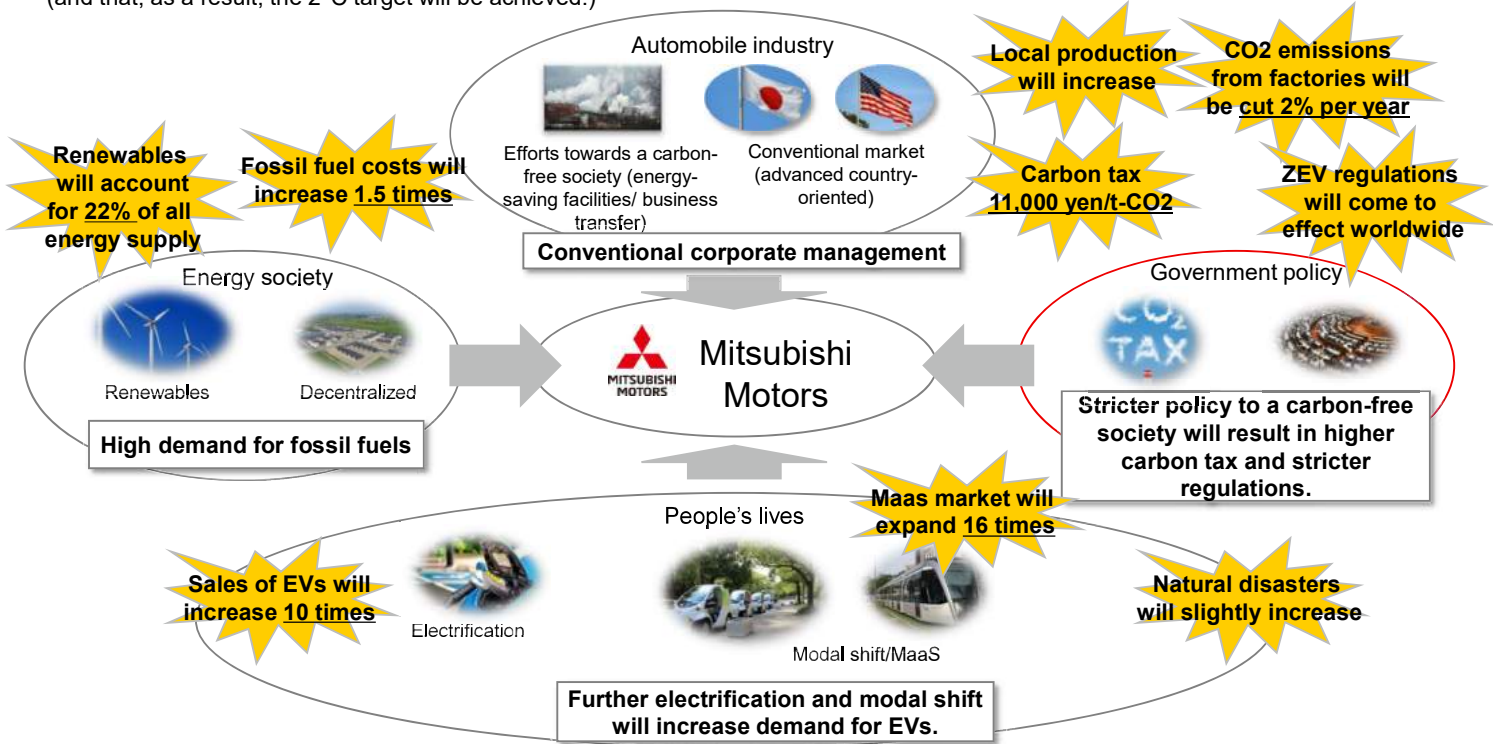
### Vehicle Insurance Claims Exceed 20,000 - Nearly 70% in Heavy Rain-hit Okayama and Hiroshima, a GIAJ report reveals

The General Insurance Association of Japan (GIAJ headed by Keiji Nishizawa) compiled the number of car accident claims related to the torrential rains in west Japan. A total of 48,303 insurance claims including vehicles (including commercial vehicles), fire, and new types (including accident insurance) insurance claims were brought to member insurance companies by July 17. **Car insurance claims totaled 23,644**. Member companies set up emergency headquarters at their head offices or local branches in the afflicted prefectures, and started to inspect and collect flood-damaged cars under insurance coverage...

(Daily Automobile (Nikkan Jidosha Shimbun), July 23, 2018)

### 1-3b STEP3: Identify and define range of scenarios (2°C)

In 2030 in the 2°C Scenario, the number of natural disasters and damage will remain almost present levels. The scenario assumes that the use of renewables, energy-saving technology, and electric vehicles will steadily progress, (and that, as a result, the 2°C target will be achieved.)



3-58

### 1-4b STEP4: Evaluate business impacts (2°C)

Changes in social environment Events that can take place in future	Future prediction Choice and combinations of information, story-making	Impacts on business Interpretation of actual impacts	Business impacts Impacts on annual profit
<ul style="list-style-type: none"> <li>Changes in customer behaviors</li> <li>Enhanced carbon tax and ZEV regulations</li> <li>Progress of next-generation vehicle technology</li> <li>Drop in battery prices</li> </ul>	<p><b>Further and quicker spread of EVs</b></p> <ul style="list-style-type: none"> <li>Changes in consumer behaviors, government policy, and technology progress will increase car sales to a maximum 17.6 million cars per year. (global market)</li> </ul>	<p><b>Expanded share of EVs</b></p> <ul style="list-style-type: none"> <li>The share of EV sales will sharply grow. Sales of new cars will decrease under the 4°C scenario.</li> <li>Demand will increase chiefly for EV. The average battery capacity will double.</li> <li>Adoption of alternative resources and sharp increase in battery production will more than halve battery costs.</li> <li>Capital investment and R&amp;D will increase to meet the increased share of EVs.</li> </ul> <p><b>Government subsidies</b></p> <ul style="list-style-type: none"> <li>Subsidies will be secured for investment in battery development and renewables. Credit incomes will also be secured.</li> </ul>	
<ul style="list-style-type: none"> <li>Inflated energy prices</li> <li>Accelerating renewable energy and energy-saving development</li> </ul>	<p><b>Inflated energy prices</b></p> <ul style="list-style-type: none"> <li>Increased demand for fossil fuels will raise fuel prices from 2,200 yen to 3,630 yen/barrel.</li> <li>The share of renewables will increase from 7% to 22% in Japan. Demand for ancillary services will increase, leading to higher electricity rates.</li> <li>Grid power procurement costs will increase from 14,300 to 16,610 yen/Mwh.</li> </ul>	<p><b>Increased energy procurement costs</b></p> <ul style="list-style-type: none"> <li>For CO2 emissions reduction, inexpensive thermal power generation and oil prices will cost more.</li> <li>Electricity will cost more because of carbon pricing on thermal power generation.</li> </ul> <p><b>Further efforts for energy-saving and renewable energy development</b></p> <ul style="list-style-type: none"> <li>The Company will seek low-cost electricity through third-party PVs and grid power companies.</li> </ul>	
<ul style="list-style-type: none"> <li>Inflated energy prices</li> <li>Accelerating renewable energy and energy-saving development</li> <li>Spread of EVs</li> </ul>	<p><b>Development of a renewable energy decentralized society</b></p> <ul style="list-style-type: none"> <li>Increased use of renewables and inflated fossil fuel prices will make the electricity system less stable. This will lead to a decentralized society. More use of V2X and reuse of batteries.</li> </ul>	<p><b>Entry in energy management business</b></p> <ul style="list-style-type: none"> <li>Launch of new businesses including sales of reusable batteries</li> <li>The Company will build a battery supply chain management scheme to minimize costs of used batteries.</li> </ul>	
<ul style="list-style-type: none"> <li>Changes in customer behaviors</li> </ul>	<p><b>Accelerating progress of Maas and urban traffic</b></p> <ul style="list-style-type: none"> <li>Heightened inclination to the environment and shift in preference from ownership to sharing will facilitate development of MaaS and urban traffic.</li> </ul>	<p><b>Decrease in new car sales</b></p> <ul style="list-style-type: none"> <li>Development of Maas and urban traffic will reduce new car sales in the global market.</li> </ul> <p><b>Entry in new businesses</b></p> <ul style="list-style-type: none"> <li>Entry in Maas and CASE businesses will help the Company secure profit.</li> </ul>	
<ul style="list-style-type: none"> <li>More frequent and severe natural disasters</li> </ul>	<p><b>Natural disasters will cause greater damage to the economy.</b></p> <ul style="list-style-type: none"> <li>Temperature rises will lead to more frequent and severer natural disasters. In particular, Japan will experience more torrential rains, 0.2 to 0.5 times more per year.</li> <li>Increased natural disasters will increase car accidents and flood damage cars. This will increase payments for insurance companies.</li> </ul>	<p><b>Increased damage to supply chains</b></p> <ul style="list-style-type: none"> <li>More torrential rains will cause physical damage to supply chains, suspension of operations, and worsening of working environments.</li> </ul> <p><b>Enhanced efforts to protect supply chains</b></p> <ul style="list-style-type: none"> <li>The Company will enhance countermeasures against natural disasters to minimize damage.</li> </ul> <p><b>Creation of new value added</b></p> <ul style="list-style-type: none"> <li>The Company will deal more with V2H functions to increase the market share.</li> </ul>	

3-59

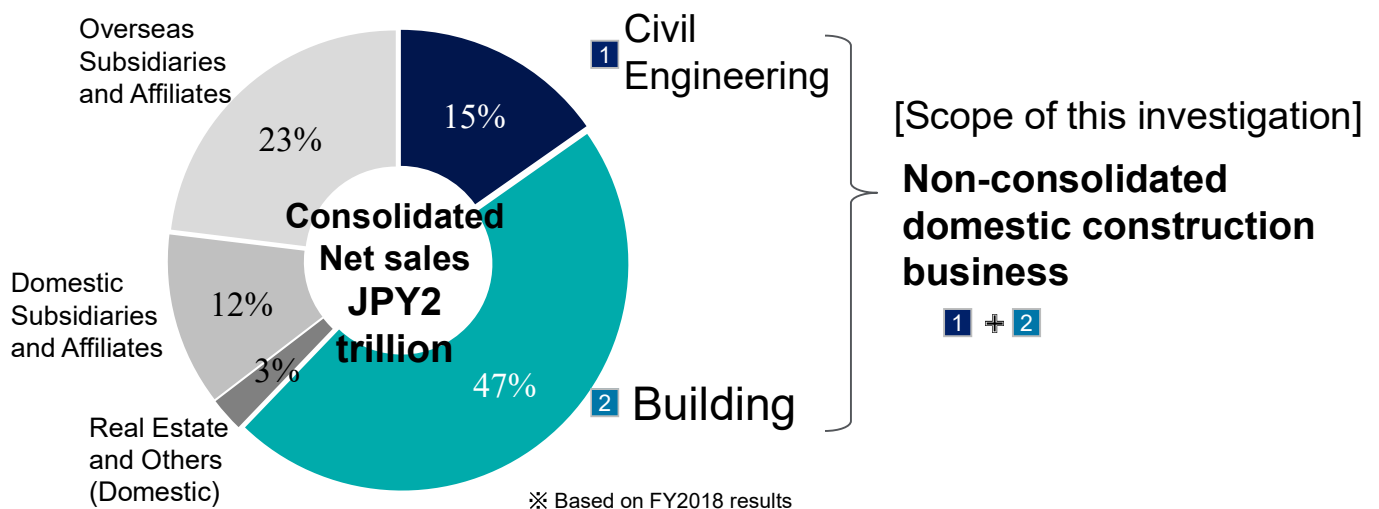
# Building/ Forest Product

- ✓ Practice Example①: Kajima Corporation
- ✓ Practice Example②: Sumitomo Forestry Co., Ltd.
- ✓ Practice Example③: Tokyu Fudosan Holdings Corporation

3-60

## [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.



3-61

**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.**

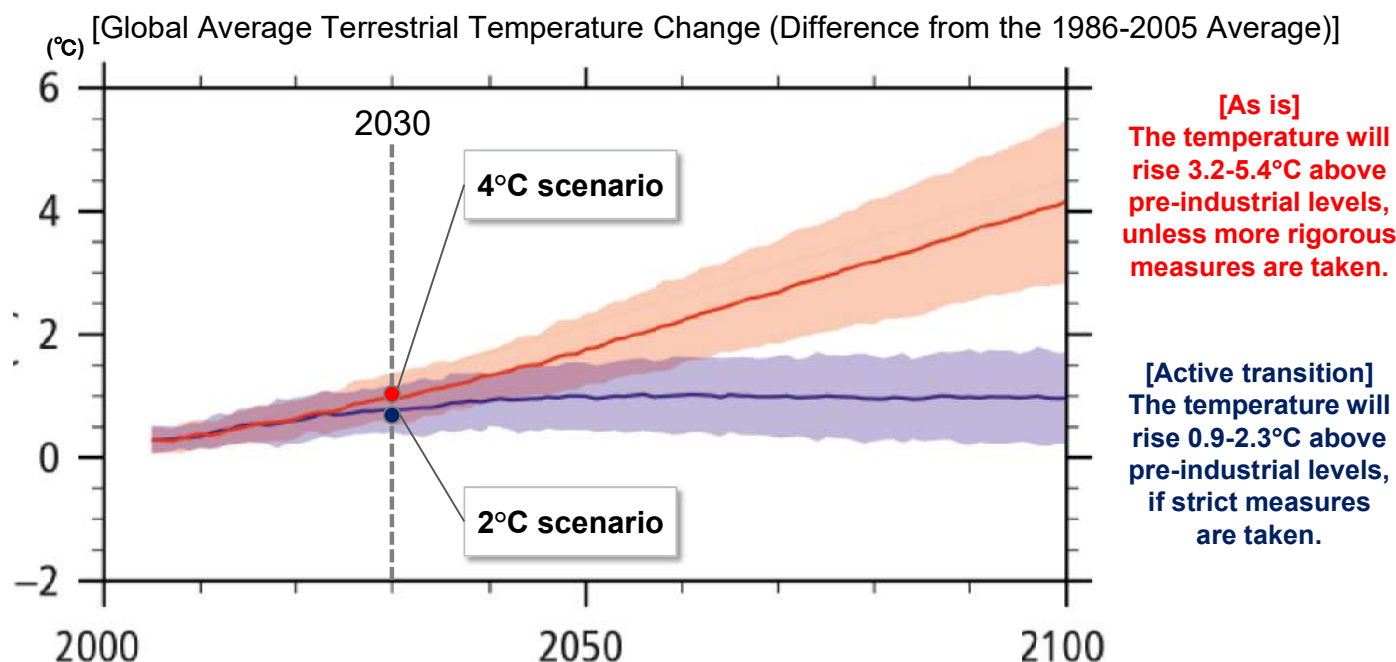
		Classification	Consideration of Risks and Opportunities	Assessment
Transition risk	Policy	Carbon price	Price competitiveness including carbon price and development of low-carbon materials and construction technologies are necessary. A delay in the development of low-carbon is subject to patent royalties 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

3-62

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

**Analyzed impacts on company by drawing the 2°C and 4°C 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.**



Source: AR5 SYR Diagram SPM.6

3-63

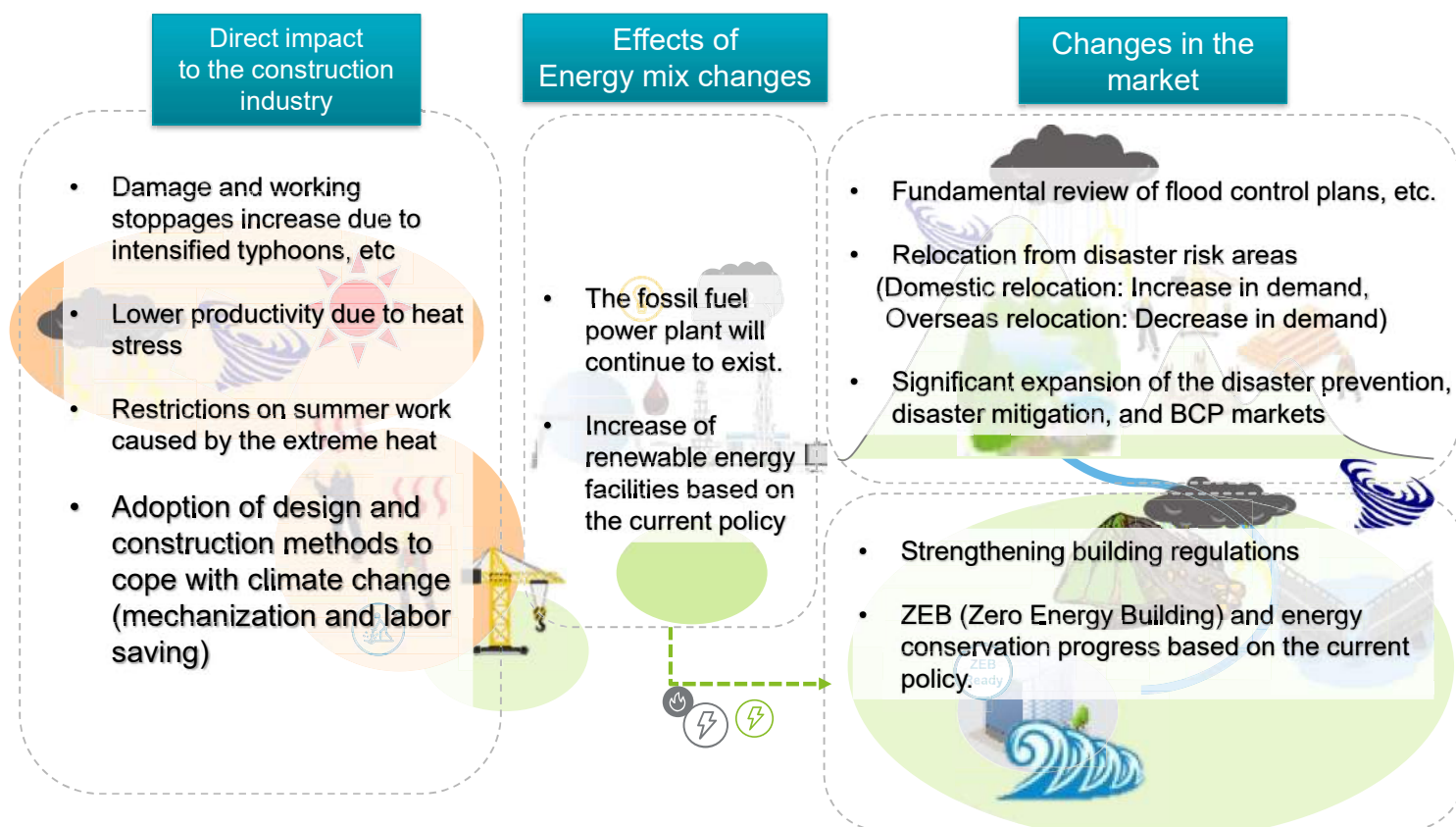
**3 [Step3: Identify and Define range of scenarios]**  
**Assumptions based on scientific evidence (such as IEA)**

Item	Parameter	At present	2030		Source
			4°C	2°C	
Carbon price	Carbon tax	※ Average successful bid in the European EU-ETS: Approx. \$8 per tonne	-	<b>88 USD/t</b>	• 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%	<b>0.99%</b>	<b>0.99%</b>	• ILO 「Working on a warmer planet」
	Temperature increase	0°C as a benchmark	Average 2.1°C (2030-2050)	Average 1.9°C (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	<b>3.0 days/year</b>	<b>2.5 days/year</b>	• 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	<b>\$7.3 billion/year</b>	—	• WRI "The Aqueduct Global Flood analyze"

3-64

**3 [Step3: Identify and Define range of scenarios]** ➤ Increased demand due to increased physical risk 4°C 2°C  
 ➤ Possibility of labor restriction during summer due to the harsh heat

**Assumption of Future Society (4°C scenario)**



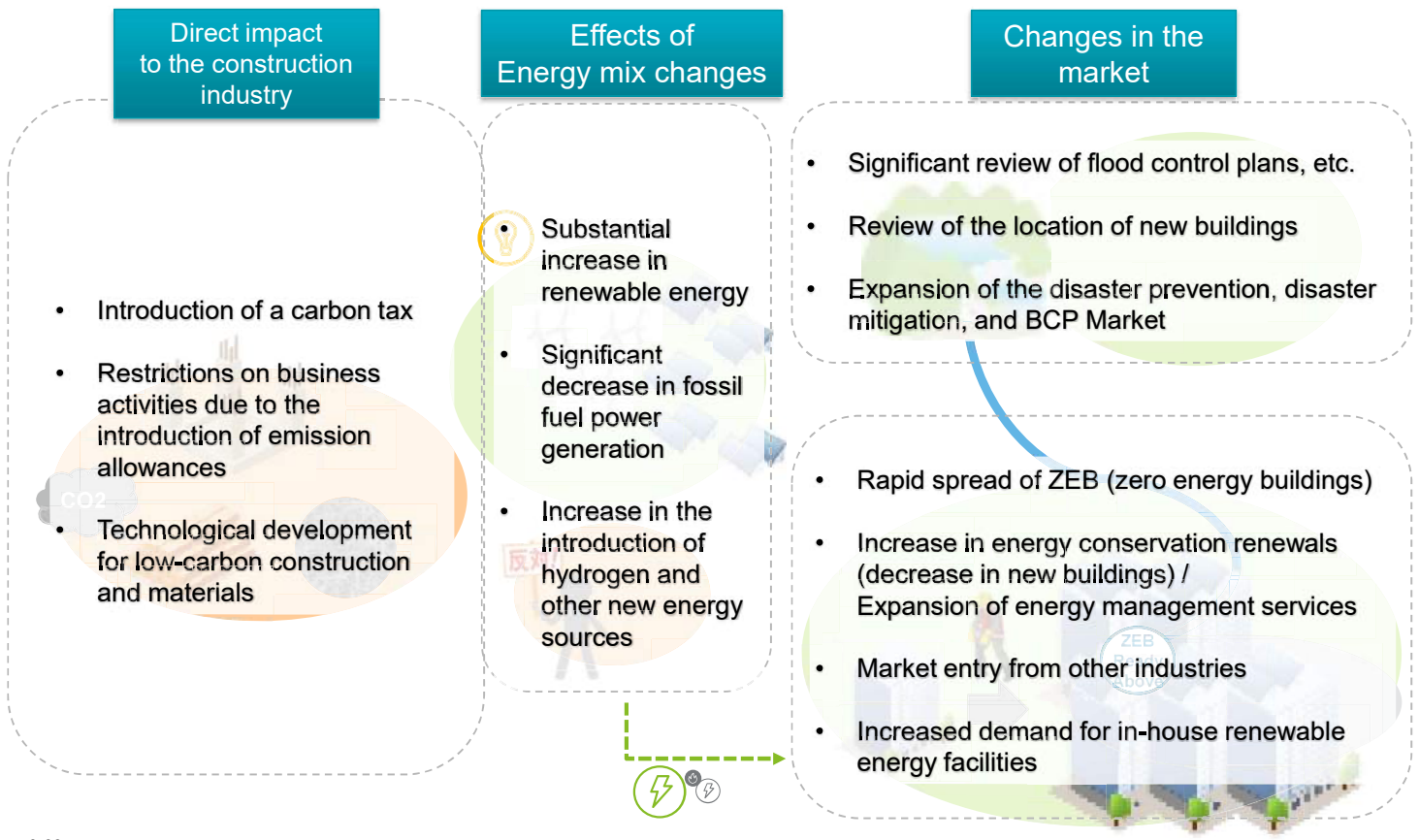
3-65

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°C 2°C

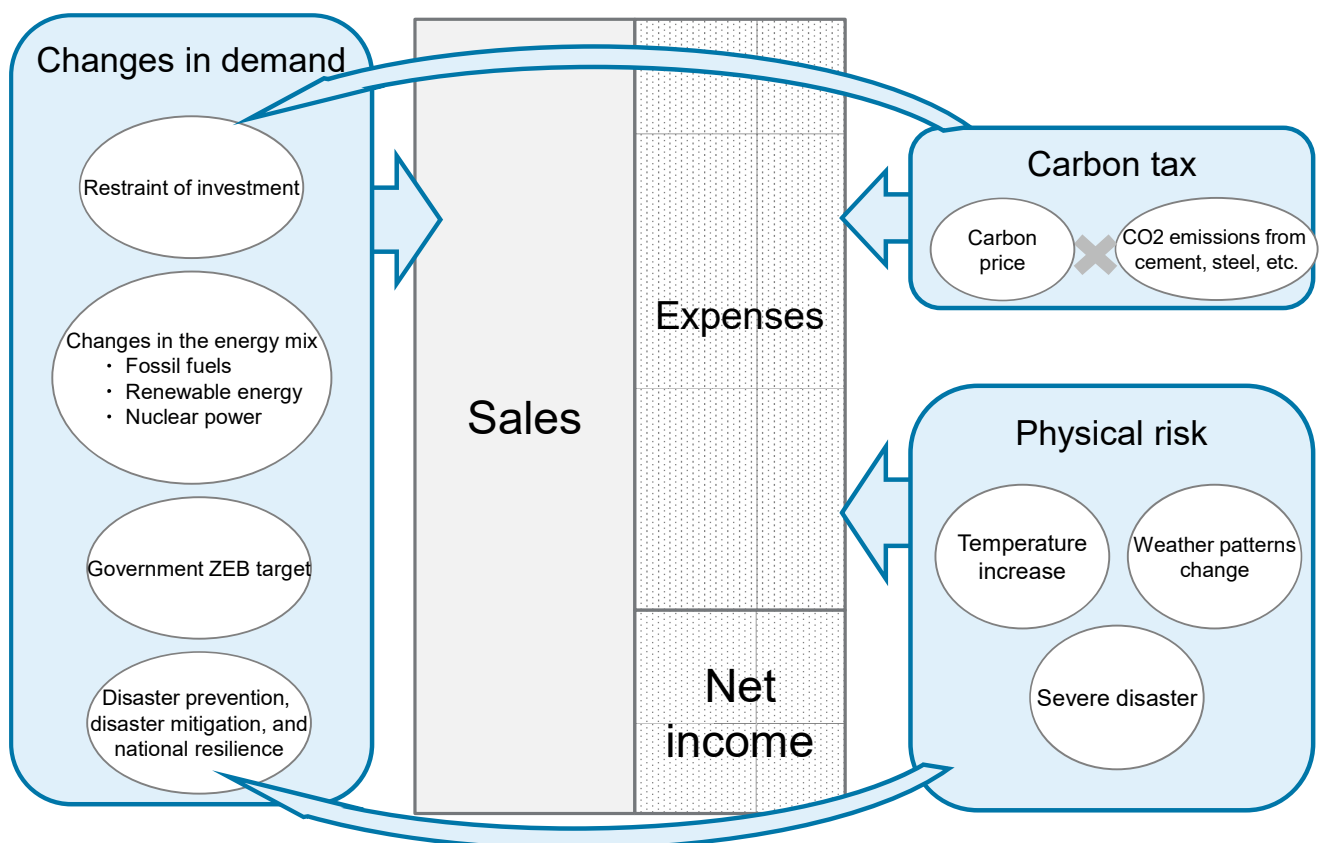
Assumption of Future Society (2°C scenario)



3-66

4 [Step4: Evaluate business impacts]

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



3-67

**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 <sub>2</sub> 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	+ -	

3-68

**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<sub>2</sub> emission allowances

- ① Promote activities to reduce CO<sub>2</sub> 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

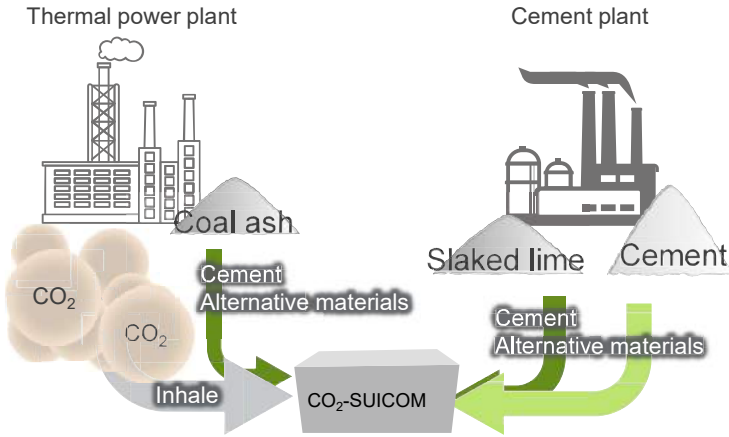
- ① Promotion of technical development related to disaster prevention, disaster mitigation, and BCP
- ② Development and utilization of hazard maps incorporating unique knowledge
- ③ Construction that contributes to the strengthening of national resilience including buildings and structures

3-69

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

**CO<sub>2</sub>-SUICOM**

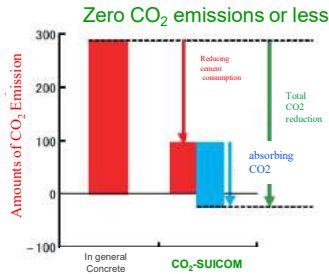
By "sinking" CO<sub>2</sub> in a way that trees "breathe",  
Concrete to reduce the amount of CO<sub>2</sub> to virtually zero or less



In "CO<sub>2</sub> - SUICOM",

Reducing cement consumption by using coal ash, special admixtures and other materials instead of cement, and absorbing CO<sub>2</sub> into the concrete during manufacturing, we are able to reduce CO<sub>2</sub> emissions to virtually zero or less.

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



**Eco-crete R<sup>3</sup>**

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

Raw concrete used at examination  
Remaining unused concrete after being unloaded

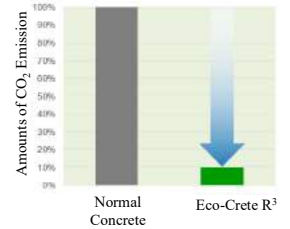


Change returned concrete into concrete again!

In "Eco-Crete R<sup>3</sup>",

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<sub>2</sub> emissions.

Reduce CO<sub>2</sub> emissions by up to 90%



**Building/ Forest Product**

- ✓ Practice Example①: Kajima Corporation
- ✓ Practice Example②: Sumitomo Forestry Co., Ltd.
- ✓ Practice Example③: Tokyu Fudosan Holdings Corporation



## Forest protection policy, and increase in forest fires and pests will have impacts

	Risk item	Business impact on timber and building material business	Assessment
Transition risk	Carbon emissions targets/policies	<ul style="list-style-type: none"> <li>• <b>Governments' forest carbon absorption policy will increase timber procurement costs.</b></li> </ul>	Large
	Forest protection policy	<ul style="list-style-type: none"> <li>• Governments' adoption of logging tax and charges will increase <u>timber procurement costs</u>.</li> </ul>	
	Renewable energy subsidies	<ul style="list-style-type: none"> <li>• Promotion of <u>wood biomass power generation will increase sales</u>. If the government stops subsidies, sales will decrease.</li> </ul>	
	Changes in energy mix	<ul style="list-style-type: none"> <li>• <u>If relevant countries incorporate biomass in their sustainability standards, sales will increase.</u></li> <li>• <u>But increased demand will increase fuel costs (timber chips) in the biomass power generation business.</u></li> </ul>	
Physical risk	Sluggish economic activities due to stricter climate change regulations	<ul style="list-style-type: none"> <li>• <u>If construction itself is suppressed, supply and demand of timber and building materials will become sluggish, and sales will decrease.</u></li> </ul>	Large
	Rise in average temperatures	<ul style="list-style-type: none"> <li>• <b>Forest fires and pests will increase timber procurement costs.</b></li> <li>• <u>Higher temperature and increased precipitation will facilitate timber growth, possibly improving productivity and reducing timber procurement costs.</u></li> </ul>	
	Changes in precipitation and weather patterns	<ul style="list-style-type: none"> <li>• <u>Changes in forestation and timber procurement areas will increase timber procurement costs.</u></li> </ul>	
Others	Increased severity of extreme weather events	<ul style="list-style-type: none"> <li>• <b>Suspension of factory operations will reduce sales. Decreased forest resources will increase timber procurement costs.</b></li> </ul>	Small to Medium
	Fluctuations in key product prices, progress of next-generation technology, changes in reputation among investors, dissemination of renewable and energy-saving technologies	<ul style="list-style-type: none"> <li>• Adoption of AI and IoT will reduce transport and factory operation costs.</li> <li>• Increased trade of energy-saving products and high-efficiency insulating materials will increase sales of timber and building materials for renewable-oriented markets.</li> </ul>	

**Efforts to comply with governments' forest protection policy and logging regulations, as well as changes in forest resources caused by physical risks, will have great financial impacts.**

3-72

## Changes in sales caused by housing policy and delay in construction due to extreme weather events will have impacts

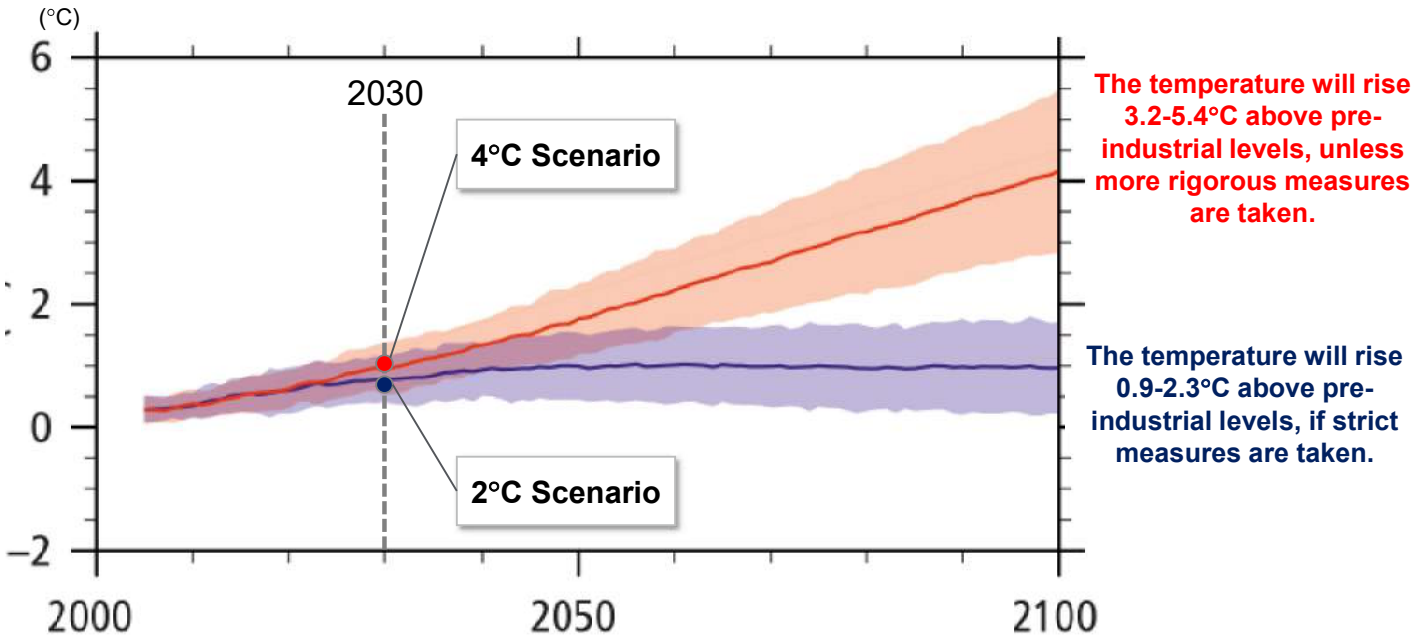
	Risk item	Business impact on housing and construction	Assessment
Transitional risk	National carbon emissions targets/policies	<ul style="list-style-type: none"> <li>• <u>Governments' forest carbon absorption policy will increase timber procurement costs.</u></li> </ul>	Large
	Forest protection policy	<ul style="list-style-type: none"> <li>• Governments' adoption of timber tax and charges will increase <u>timber procurement costs</u>.</li> </ul>	
	Building policy	<ul style="list-style-type: none"> <li>• Efforts to meet government's policy will <b>increase investment and reconstruction costs.</b></li> <li>• If the government <u>continues subsidies</u>, <u>monetary incentives will arise</u>. Some policies can <u>impact market competition and sales</u>.</li> </ul>	
	Changes in reputation customers	<ul style="list-style-type: none"> <li>• If customers pay more attention to climate change, they will opt for forest <u>certified timber</u>, which will <u>increase procurement costs</u>.</li> </ul>	
Physical risk	Increased severity of extreme weather events	<ul style="list-style-type: none"> <li>• <b>Severe natural disasters will cause delays in construction. This, together with recovery of facilities, will increase construction costs.</b></li> <li>• <b>More extremely hot days will lower outdoor work efficiency, and cause delay in construction and require more careful health management of workers. All this will increase costs.</b></li> </ul>	Large
Others	Subsidy policies or RE, changes in energy mix, changes in reputation investor, fossil fuel subsidies, average temperature rise, etc.	<ul style="list-style-type: none"> <li>• Subsidies for PV power systems will increase monetary incentives.</li> <li>• Accelerating divestment will be more unfavorable to companies not practicing environment business.</li> <li>• Changes in subsidies will change demand for renewable and other forms of energy, having impacts on operation costs.</li> </ul>	Small to Medium

**Changes in government policies on forest protection and buildings, as well as severer extreme weather events, will increase costs and have great financial impacts.**

3-73

Consider society in 2030 with two scenarios of climate change that are highly uncertain. Assess climate change risks and opportunities in the 2°C and 4°C scenarios

[Global average surface temperature (difference from the 1986-2005 average)]



Source: Figure SPM.6 in the Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5)

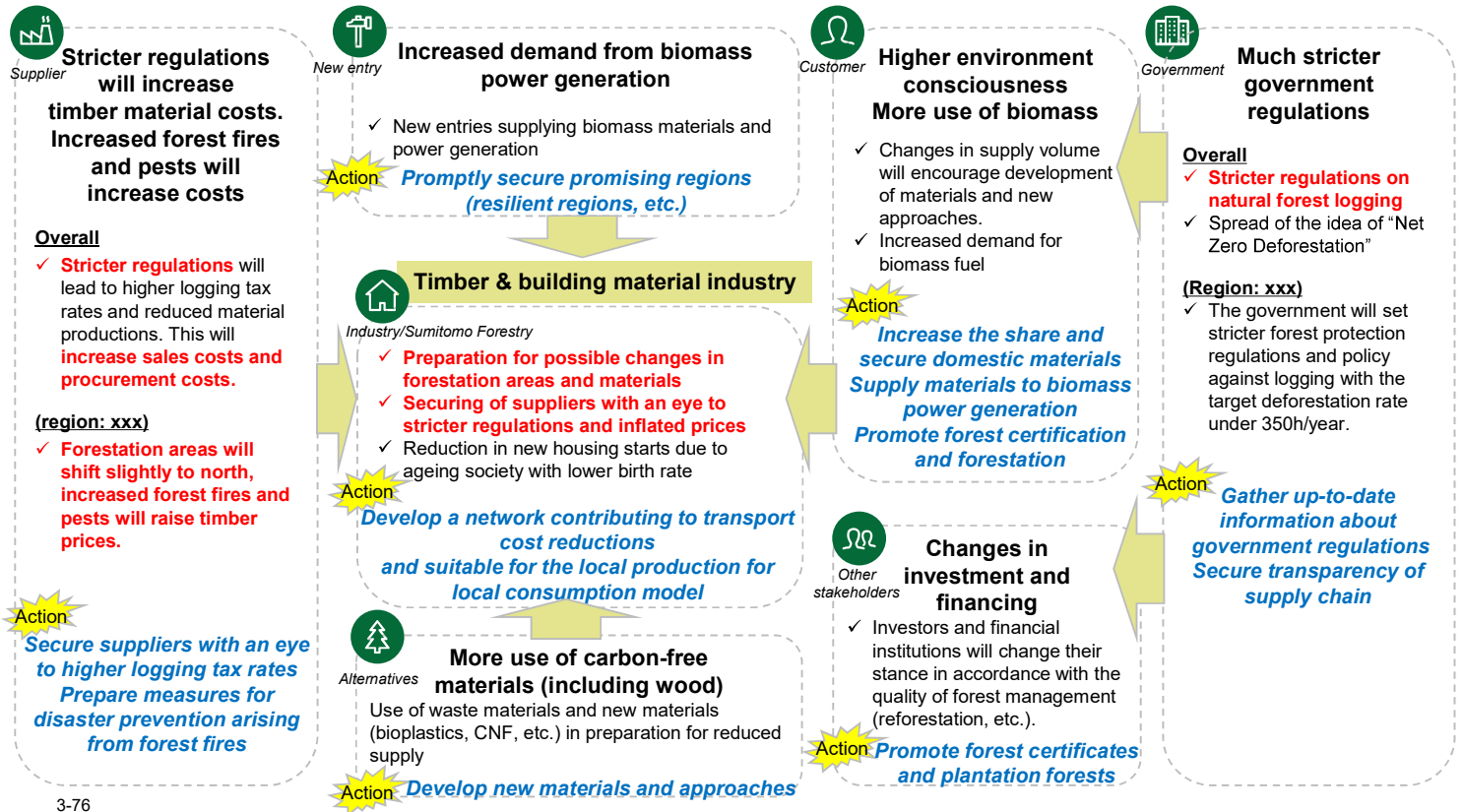
In the 4°C scenario, increased forest fires and pests by global warming change supply chains

World in the 2030s in the 4°C scenario (example)



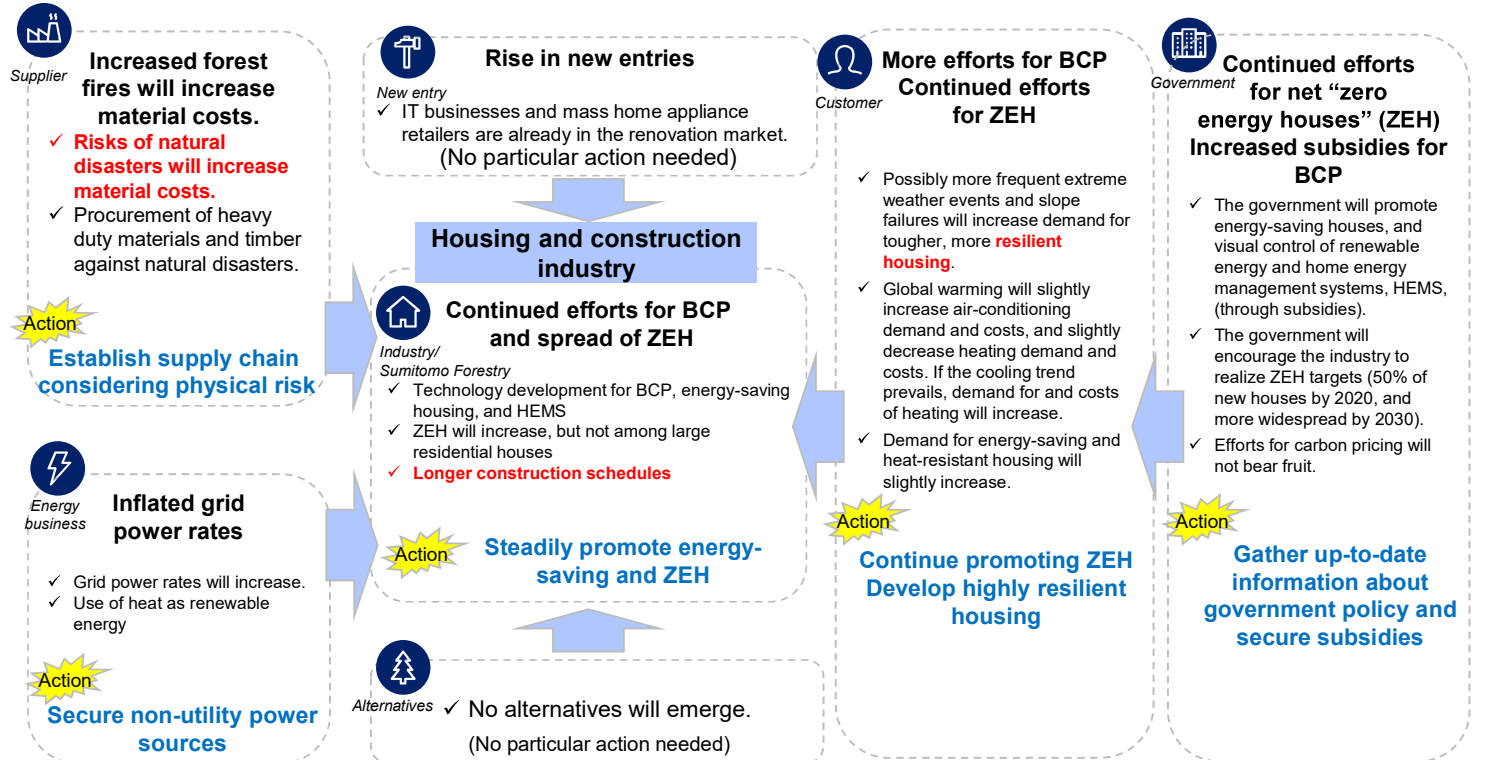
In the 2°C scenario, stricter forest regulations and increased forest fires will have impacts

World in the 2030s in the 2°C scenario (example)



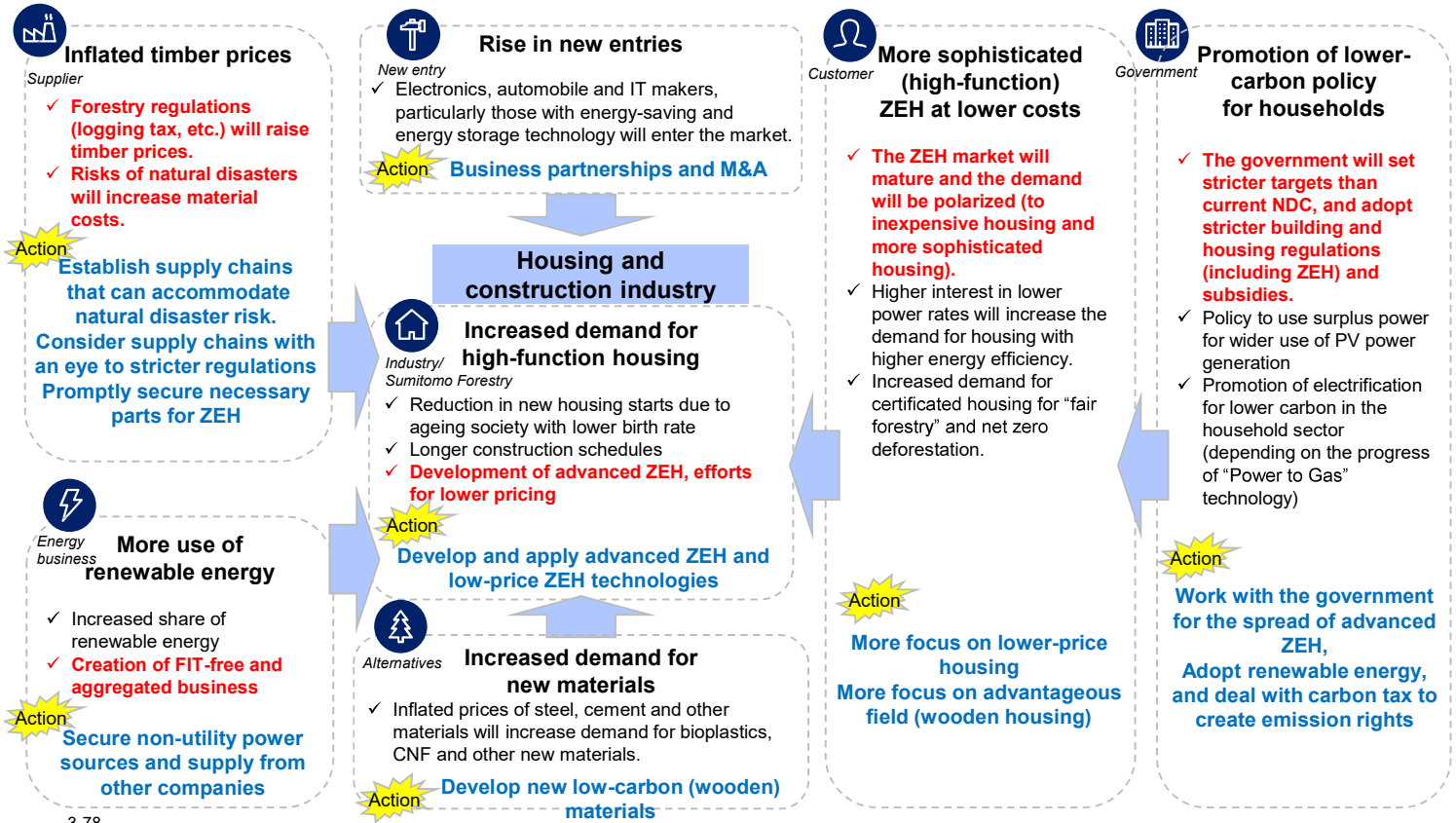
In the 4°C scenario, the world will be on an extension of the present path (The landscape of the housing and construction industry will remain unchanged. The focus will be on BCP.)

World in the 2030s in the 4°C scenario (example)

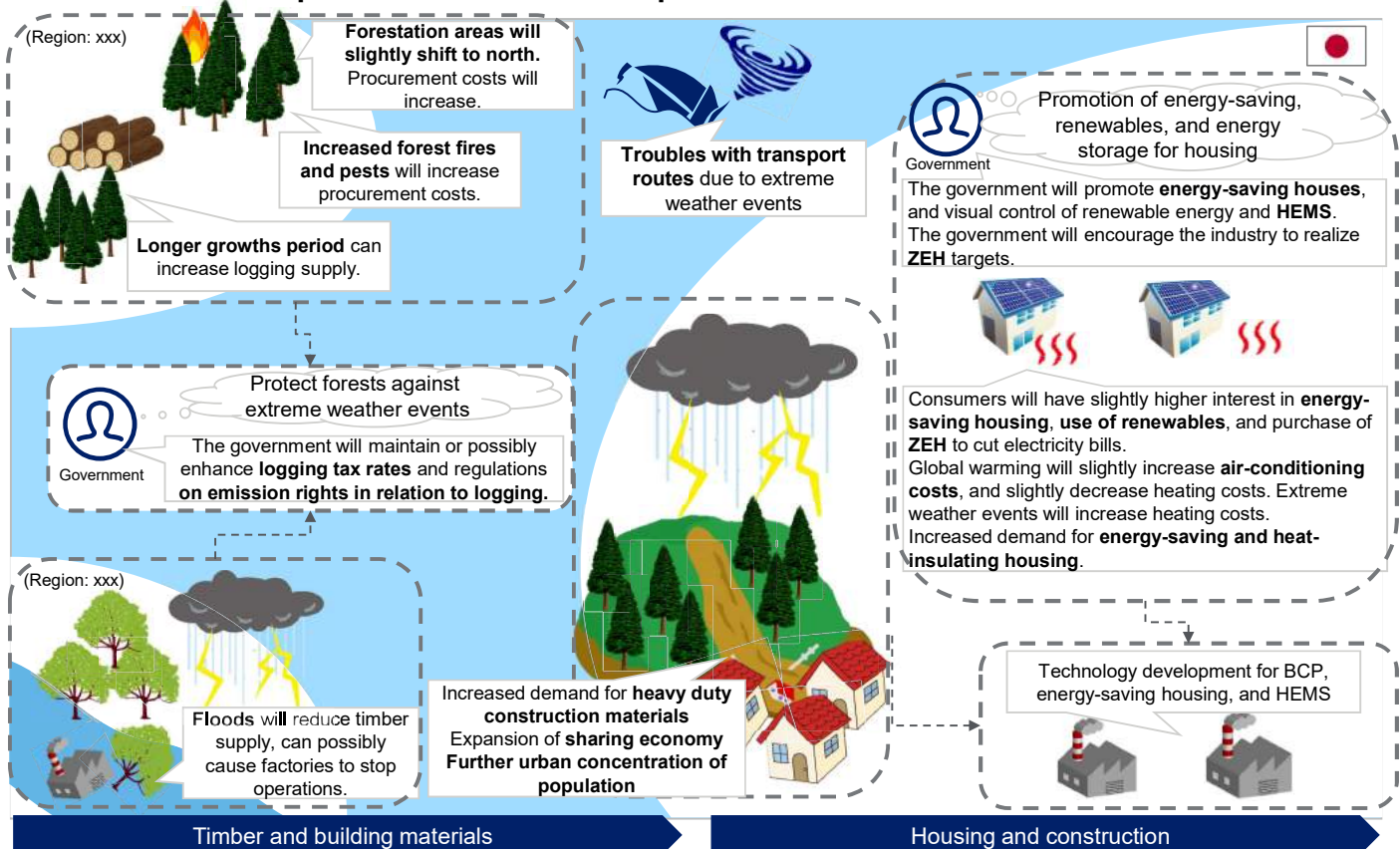


In the 2°C scenario, the Company will have to find business solutions to increased demand for lower-carbon housing

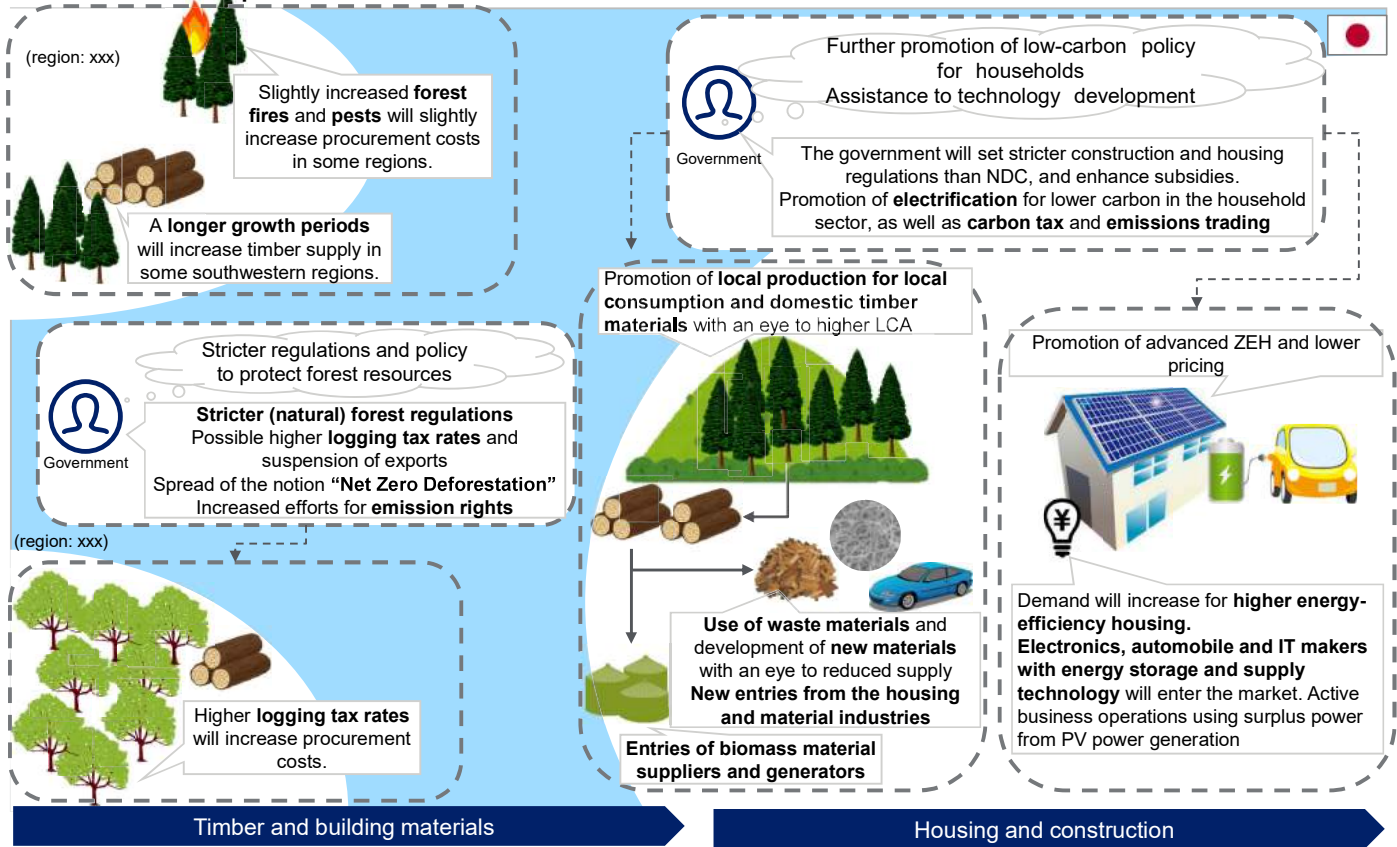
World in the 2030s in the 2°C scenario (example)



Government initiatives will increase energy-saving housing (ZEH), while there will be risk that more forest fires and pests make it difficult to procure timber and construction materials



Government initiatives will lead to the ZEH market maturity. They will also facilitate development of advanced ZEH and lower pricing, and new entries from other industries will increase. There will also be risk that stricter forest regulations and increased fires make it difficult to procure timber and construction materials.



Define the world in selected scenarios based on IEA and other scientific grounds

		Present	2030		Sources
			4°C	2°C	
National carbon emissions targets/policies	Government targets	Indonesia deforestation 325ha (the 2030 target)	450ha (assumed)	300ha (assumed)	Indonesia NDC
		Regulations on logging in natural forests	None	<b>Country targets (20-100%)</b>	(Assumptions)
Forest protection policy	Forest protection policy (likely to be logging tax)	(Malaysia: \$12/m3)	(n.a.: unpredictable)	(n.a.: unpredictable)	(to be considered)
Building policy	ZEH targets	New housing starts	xxx unit (present level)	xxx unit (opportunity loss of xx%)	(Assumptions)
		Share of ZEH	ZEH: xxx%	<b>Advanced ZEH: xxx%</b>	(Assumptions)
Subsidies for renewable energies, etc.	Subsidy amount Share of biomass power generation	Energy mix in Japan 1.7%	3.7%	4.6%	Agency for Natural Resources and Energy, "Challenges to the 2030 Energy Mix - Overall Picture"
Changes in energy mix					
Rise in average temperatures	Changes in vegetation and increase in fires	Forest fire area 0.951%/year (Canada)	<b>1.594%/year</b>	<b>1.690%/year</b>	Natural Resources Canada Forest Change indicators "Fire regime" (RCP2.6, RCP8.5)
	Increase in forest pests	(n.a.: data unavailable)	(n.a.: unpredictable)	(n.a.: unpredictable)	(to be considered)
Changes in precipitation and weather patterns	Flooding risk	\$405m/year (Indonesia)	<b>\$875m/year</b>	\$405m/year	WRI "The Aqueduct Global Flood analyzer"
Severer extreme weather event	Frequency of torrential rains	Event probability: 0.3 times/year (Japan)	<b>0.6 times/year</b> (around 2100)	(n.a.: data unavailable)	Ministry of the Environment, "Synthesis Report on Observations, Projections and Impact Assessments of Climate Change, 2018"

1 [Key indicator: Annual area burned]

A rise in temperatures will increase the number of large fires, having great impacts both in the 2°C and 4°C scenarios.

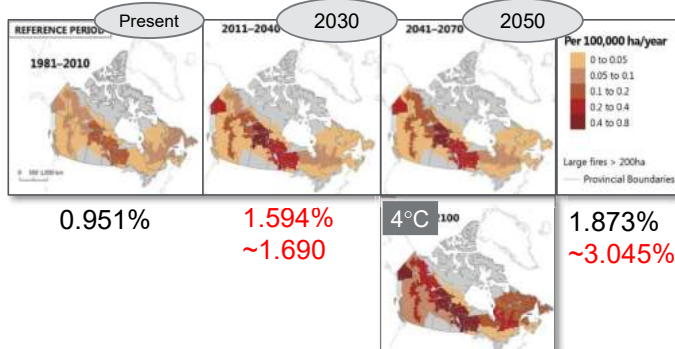
Scientific forecasts



— Annual area burned by large fires in Canada

	Annual area burned (qualitative)
Present	Forest fires in the central part of the continent
2030	Large scale forest fires central region
2050	Forest fires also in the northwest

Annual area burned by large fires (Area burned/year)



Source: Natural Resources Canada, "Forest Change Indicators, Fire Regime RCP 2.6 scenario" 3-82

Recognition of forestry companies

— CDP response on climate change risks —

Companies cited	Comments (extracts)
STORAENSO UPM	Higher risks of forest fires: Not yet occurred in northwestern Russia, where the company procures materials, but possible future risks (UPM)
Brambles	Impacts of unforeseeable cyclones, fires, earthquakes and other natural disasters (Brambles)

Forest fire risk recognition among worldwide companies

- STORAENSO: A forest products company providing products in over 30 countries worldwide. A leading company in the global market
- UPM: A forest industry company having production plants in 13 countries, strong in business fields combining bioenergy and forestry industries
- Brambles: A supply-chain logistics company doing business in over 60 countries worldwide

World leading forest companies recognize that climate change is causing more forest fires.

Source: CDP response

STEP4 "Evaluate business impacts"

In the 4°C scenario, the Company must eliminate financial impacts of forest fires

4°C scenario

- Forest protection and building (ZEH) regulations will remain at the present level.
- Annual area burned by large scale fires will be 1.594%. (Area burned/year)
- Increased torrential rains will prolong construction schedules and increase costs.
- The penetration rate of biomass power generation is assumed to be 3.7% in Japan.

	Business impact	Evaluation (100 million yen)
2030 with no action	Higher timber prices due to forest protection regulations	XX
	Opportunity loss due to failure to develop higher-level ZEH	XX
	Higher timber prices due to forest fires	XX
	Higher costs due to heavy rains	XX
	Subtotal	▲ XX
2030 with actions taken	Securing timber suppliers with an eye to forest protection	XX
	Opportunities through development of ZEH and higher-level ZEH	XX
	Increase in demand for biomass power generation	XX
	Efforts to prevent forest fires	XX
	Total	+XX

## In the 2°C scenario, the Company must eliminate financial impacts of stricter regulations (forest and ZEH) and forest fires

### 2°C scenario

- Timber costs will sharply increase on the assumption that the governments of countries enhance forest protection policies and restrict exports of timber from natural forests. (The percentage of restricted imports was calculated based on the share of natural forest in each country. The inflated timber costs will not be passed onto timber prices.)
- Opportunity loss due to failure to develop higher-level ZEH
- Annual area burned by large scale fires will be 1.690%. (Area burned/year)
- The penetration rate of biomass power generation is assumed to be 4.6% in Japan.
- It is also assumed that the Company will complete a change of timber suppliers as a forest fire prevention measure.

	Business impact	Evaluation (100 million yen)
2030 with no action	Higher timber prices due to forest protection regulations	XX
	Opportunity loss due to failure to develop higher-level ZEH	XX
	Higher ZEH costs	XX
	Higher timber prices due to forest fires	XX
	Higher costs due to heavy rains	XX
	Subtotal	▲ XX
2030 with actions taken	Securing timber suppliers with an eye to forest protection	XX
	Opportunities through development of ZEH and higher-level ZEH	XX
	Increase in demand for biomass power generation	XX
	Efforts to prevent forest fires	XX
	Total	+XX

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## Building/ Forest Product

- ✓ Practice Example①: Kajima Corporation
- ✓ Practice Example②: Sumitomo Forestry Co., Ltd.
- ✓ Practice Example③: Tokyu Fudosan Holdings Corporation

3-85

**Target business segments and years of the climate-related risk assessment**  
**Consider urban development and resort (resort hotels, golf courses, and ski areas) business segments**

**Target business segments and years**

Business segment	Target year	Grounds
Urban development	2030	This is one of the Company's leading segments. The purpose is to consider action to be taken in the mid-term timeframe from the scenario analysis perspective.
Resort business (resort hotels, golf courses, and ski areas)	2050	The purpose is to consider physical risk impacts and possible countermeasures to be taken. These impacts will differ in magnitude in the long run.

3-86

**Assess materiality of climate-related risks**

STEP 2 3 4 5 Scenario 4°C 2°C

**Various factors related to climate change will impact the Company' business**

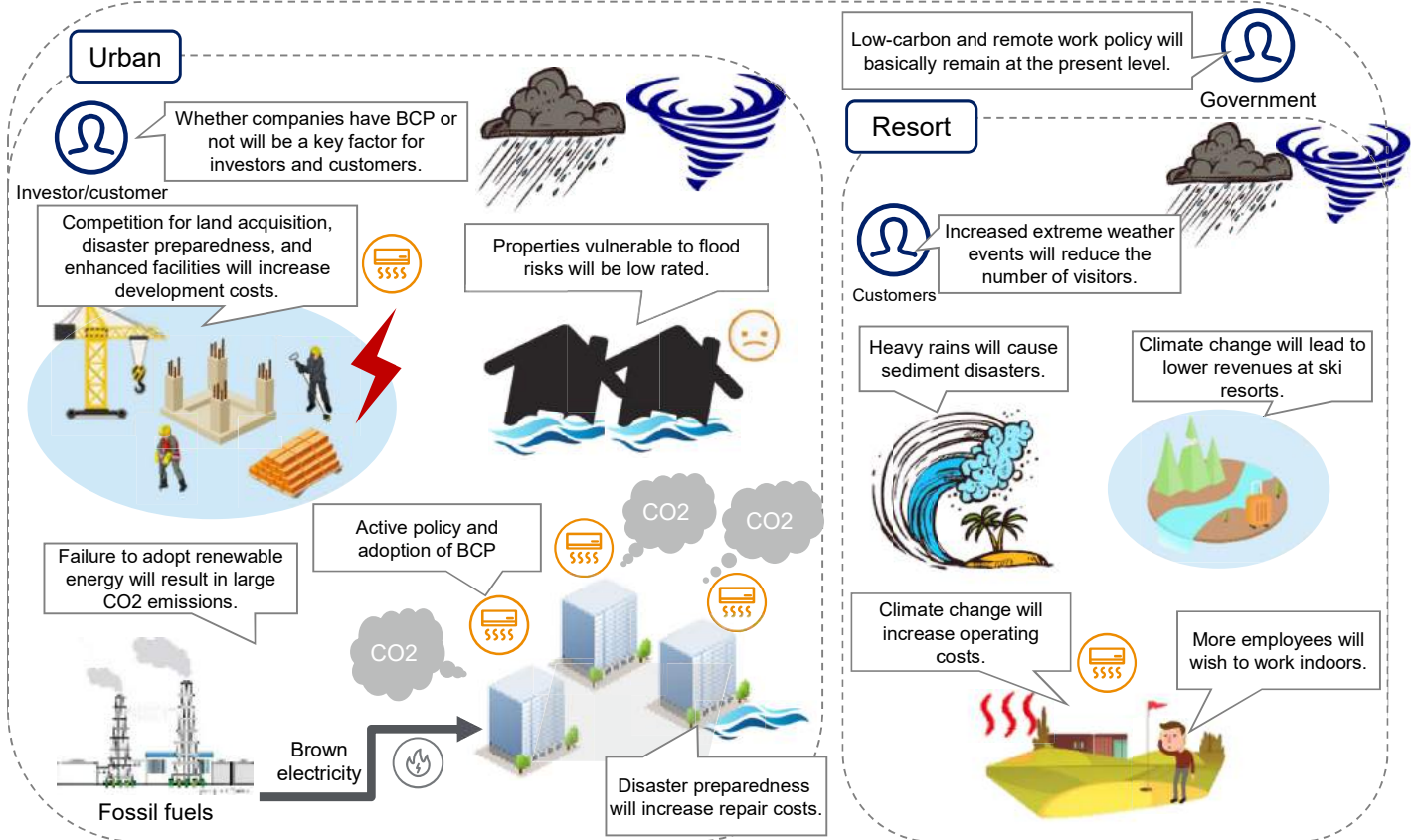
	Politics	Economy	Society	Technology
<b>Transition Risks (Stricter regulations, etc.)</b>	<ul style="list-style-type: none"> <li><b>Carbon pricing</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Adoption of carbon tax will incur costs for CO2 emissions.</li> <li><b>Carbon emissions targets/policies</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Expanded coverage of energy-saving laws, enhanced targets of cap and trade programs, and mandatory installation of energy-saving functions will increase technology and facility installation costs.</li> <li><b>ZEB regulations</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Application of ZEB regulations to buildings will increase construction and repair costs.</li> </ul>	<ul style="list-style-type: none"> <li>Energy prices Increased use of renewable energy and inflated fossil fuel prices will lead to less stable grid systems and increase energy prices.</li> <li>Trends in energy demand Fluctuating demand for energy as a whole will impact energy procurement costs.</li> <li>Changes in energy mix Changes in the share of renewable energy will change emission reductions companies need to make.</li> </ul>	<ul style="list-style-type: none"> <li><b>Changes in consumer behaviors</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Increased needs for (i) disaster-resilient and (ii) "green" buildings</li> <li><b>Changes in reputation among consumers and investors</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Any delay to meet the needs for (i) disaster-resilient and (ii) "green" buildings can result in consumer boycott and withdrawal of investors.</li> </ul>	<ul style="list-style-type: none"> <li><b>Progress of ZEB technology</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Rise in advanced materials and technologies will reduce ZEB construction and repair costs.</li> <li><b>Spread of energy-saving and renewable technology</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> Progress towards a low-carbon society will facilitate development of energy-saving and renewable technology, and reduce adoption costs.</li> </ul>
<b>Physical Risks (climate change, etc.)</b>	<ul style="list-style-type: none"> <li><b>Higher average temperatures and sea levels</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> A rise in average temperatures will cause more heatstroke. It will also lead to more use of air-conditioning, which will increase operation costs.</li> <li><b>Severer extreme weather events (wind and flood damage)</b> <span style="background-color: #0056b3; color: white; border-radius: 50%; padding: 2px;">Great impact</span> More frequent typhoons and torrential rains will cause more wind and flood damage to buildings, increase repair costs, and reduce customers.</li> </ul>			

3-87



**(Reference) Image of a future society in the 4°C scenario**

**Extreme weather events will be more frequent and shifts to a low-carbon society and renewable energy will not progress.**



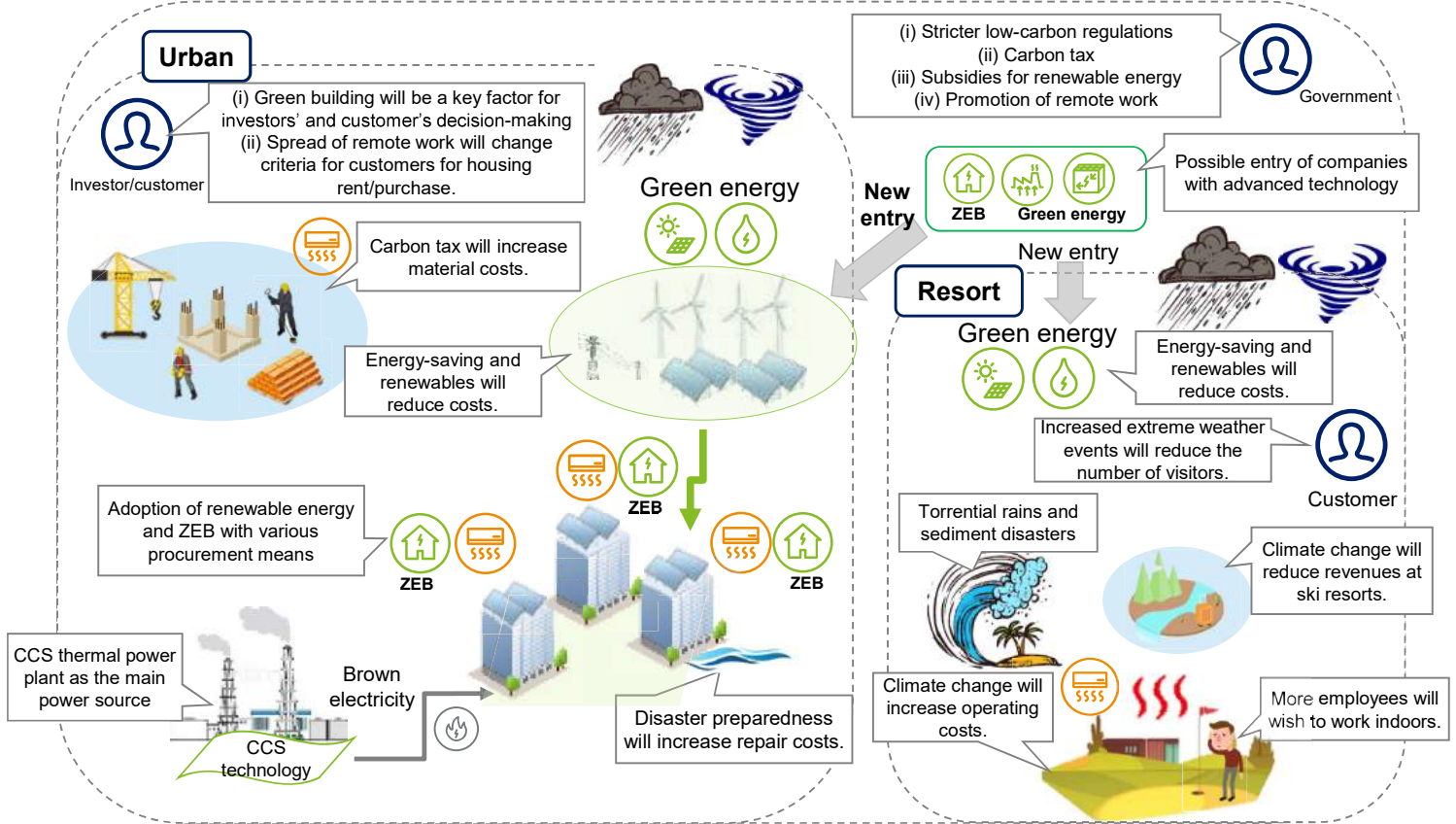
**Business impacts in the 4°C scenario**

**Interpret that changes in the environment in the future will have impacts on business to some extent**

	<u>Changes in social environment</u> Events likely to occur in future	<u>Adverse business impacts</u> Interpretation of actual business impacts	<u>Positive business impacts</u> Interpretation of actual business impacts
<b>Development business</b>  2030	Enhanced environment regulations including ZEB and energy-saving laws	Adoption of energy-saving, renewable and ZEB for legal compliance	Steady efforts for compliance
	Increased extreme weather events	Increased damage to buildings	Enhanced resilience of buildings and more active customer promotion
	BCP-oriented customer preference and transfer of properties	Loss of customers due to insufficient BCP	
	Higher vacancy rate due to increased remote work	Loss of customers due to increased remote work	Increase in satellite offices
<b>Resort business</b>  2050	Lower revenues at ski resorts due to climate change	Shorter business hours at ski resorts	Adoption of advanced snow machines
	Decrease in customers/visitors as they avoid the outdoors due to increased extreme weather events	Lower revenues due to customers' avoidance of outdoor activities and shift to alternative recreation	Creation of new business opportunities leveraging existing assets
	Torrential rains and sediment disasters Increased workload due to climate change	Increased loss due to sediment disasters	Efforts and promotion for heatstroke measures and BCP
		Increased labor costs for emergency actions	
Increased procurement and air-conditioning costs due to climate change	Increased air-conditioning and operating costs due to higher temperatures		
	Increased food material costs due to higher temperatures		

**(Reference) Image of a future society in the 2°C scenario**

**Extreme weather events will be less frequent than in the 4°C scenario, and adoption of ZEB and renewable energy will progress**



**Business impacts in the 2°C scenario**

**Interpret that Stricter laws and regulations in the future will have impacts on business to some extent**

	Changes in social environment Events likely to occur in future	Adverse business impacts Interpretation of actual business impacts	Positive business impacts Interpretation of actual business impacts
<b>Urban development business</b>	Adoption of carbon tax	Increased construction costs including ZEB adoption costs	Steady efforts for compliance
	Enhanced environment regulations including ZEB and energy-saving laws	Adoption of energy-saving, renewable and ZEB for legal compliance	Reduced costs thanks to ZEB technology development
	Stricter cap and trade programs	Increased costs of green electricity certificates	Reduced costs thanks to renewable technology development
	BCP-oriented customer preference and transfer of properties	Increased damage to buildings Loss of customers due to insufficient BCP	Improved competitiveness of resilient buildings
<b>2030</b>	Enhanced environment regulations including energy-saving laws	Increased costs of saving-energy adoption	Adoption of renewable and other non-utility electricity
<b>Resort business</b>	Lower revenues at ski resorts due to climate change	Shorter business hours at ski resorts	Adoption of advanced snow machines
	Decrease in customers/visitor as they avoid outdoors due to increased extreme weather events	Lower revenues due to customers' avoidance of outdoor activities and shift to alternative recreation	Creation of new business opportunities leveraging existing assets
	<b>2050</b>	Increased procurement and air-conditioning costs due to climate change	Increased air-conditioning and operating costs due to higher temperatures Increased food material costs due to higher temperatures

# Construction Material

## ✓ Practice Example①: LIXIL Group Corporation

3-92

### 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)

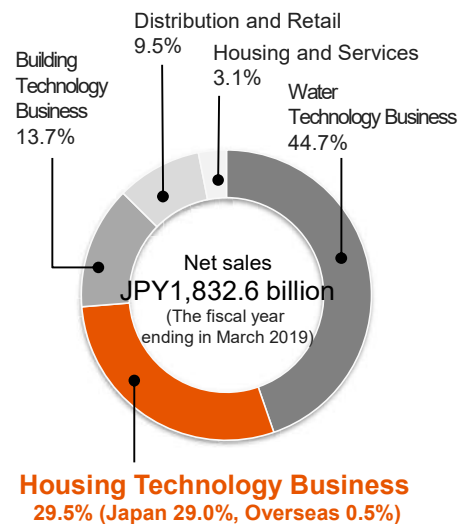
- Sales JPY1,832.6 billion
- Approx. 75 thousand employees
- Sites in 150 or more countries

#### [LIXIL's business domains]

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



#### [Target organization]



# 1. Target Business

## 1 - 2 Selection of target business divisions

➤ For 2 businesses, estimate financial impacts in 2030 using the 2°C/4°C scenario.

### [Target business]

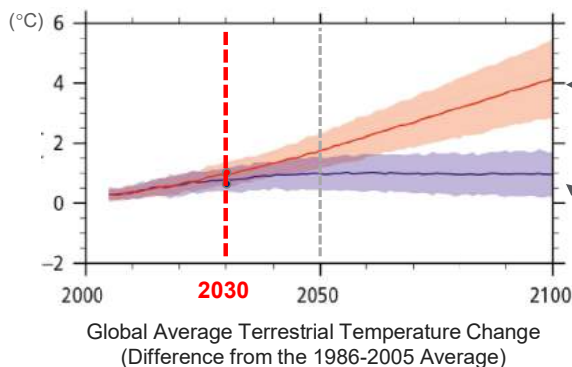
Target business	Reasons for selection
Sash door	Due to the impact of higher costs for raw materials due to tighter regulations and the spread of high-performance products such as energy-saving products
ZEH ※ Net Zero Energy House	Introduction of renewable energy for climate change countermeasures, <b>As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

### [Participating departments]

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

Cooperation: other related departments at headquarters

### [2 future scenarios]



<b>4°C Scenario</b>	<b>Scenarios with large physical impacts</b> <ul style="list-style-type: none"> <li>• There is no significant tightening of regulations.</li> <li>• Expansion of damage caused by extreme weather conditions such as typhoons and floods</li> <li>• Re-energy and ZEH penetration is limited, etc.</li> </ul>
<b>2°C Scenario</b>	<b>Scenarios in which the impact of policy shifts is significant</b> <ul style="list-style-type: none"> <li>• Introduction of a carbon tax, drastic tightening of recycling regulations, etc.</li> <li>• Rising raw material and energy prices</li> <li>• Increasing use of renewable energy and ZEH, etc.</li> </ul>

# 2. Assessment materiality of climate-related risks

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

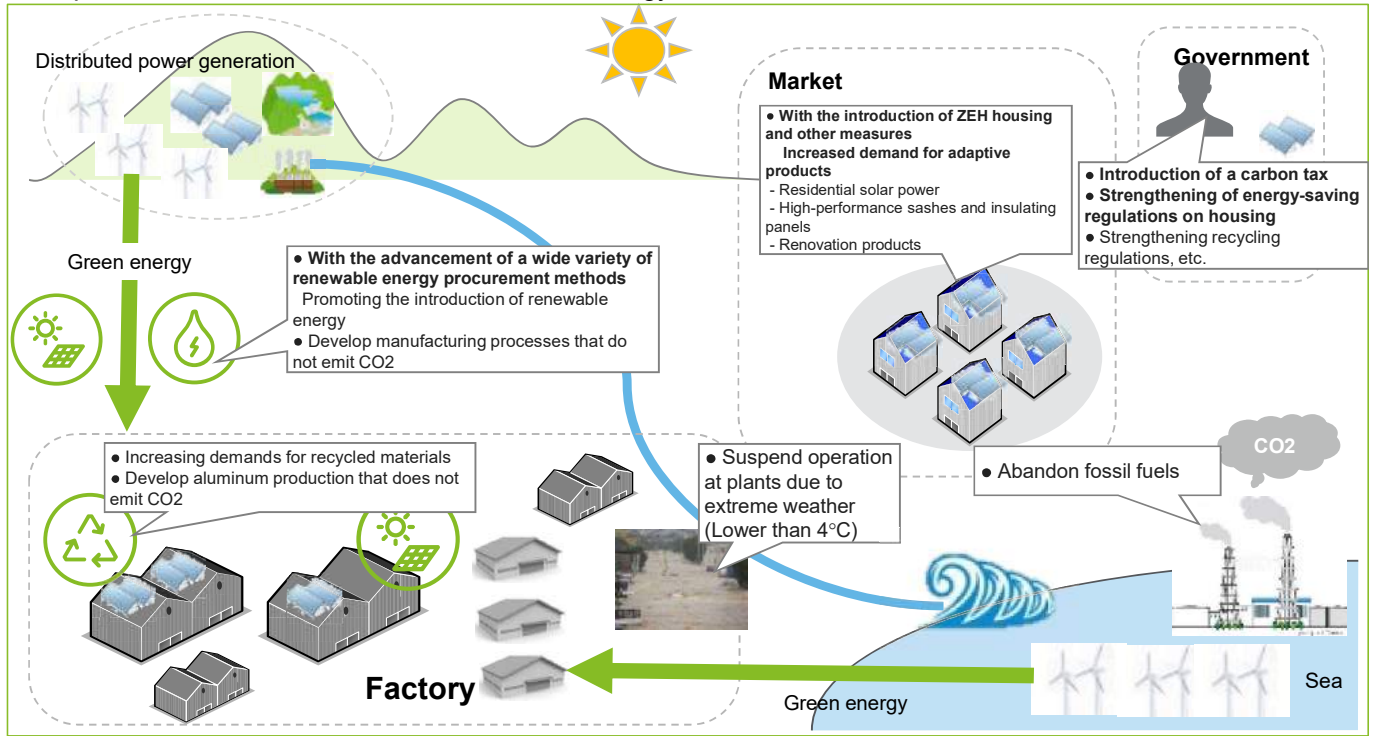
### Summary of risks and opportunities (only “Large” impact excerpted)

Assumed risks			Anticipated business impact		
Major classification	Medium	Small	Risk	Opportunity	Impact
Transition risk	Policies and regulations	<b>Carbon tax</b>	• Fuel taxes and soaring electricity prices	• To boost efficiency • Increase awareness of energy conservation among customers	<b>Large</b>
		<b>Tightening regulations</b>	• 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	
		<b>Renewable energy policy</b>	• 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	<b>Technology investment</b>	• Increased investment costs in the manufacturing process	• Promoting Innovation in manufacturing processes	
		<b>Changes in the market</b>	• Rising prices of raw materials	• Development of alternative materials	
Physical risk	Acute	<b>Extreme weather</b>	• 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

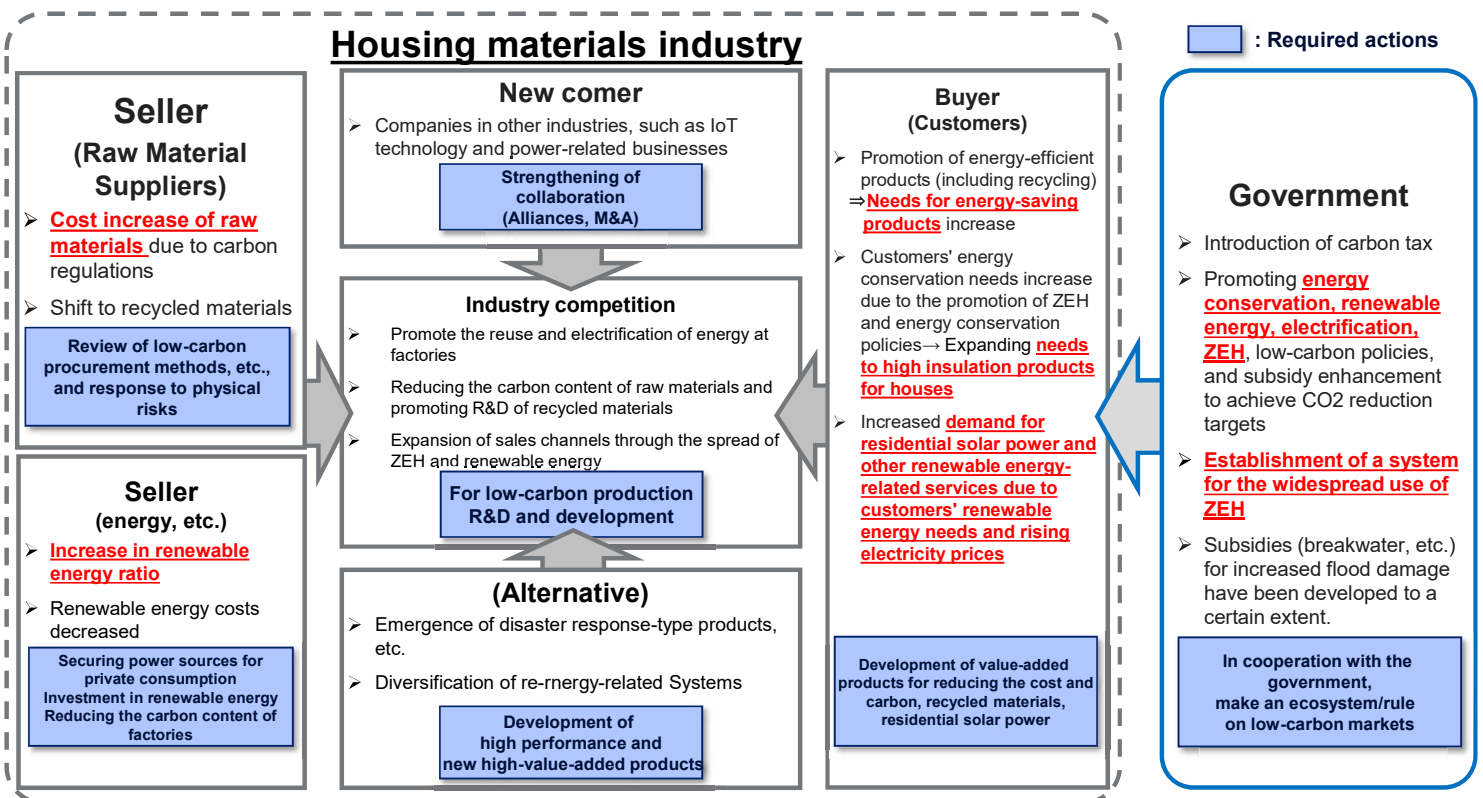
#### 3-1 Worldview of the 2°C scenario

➤ 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

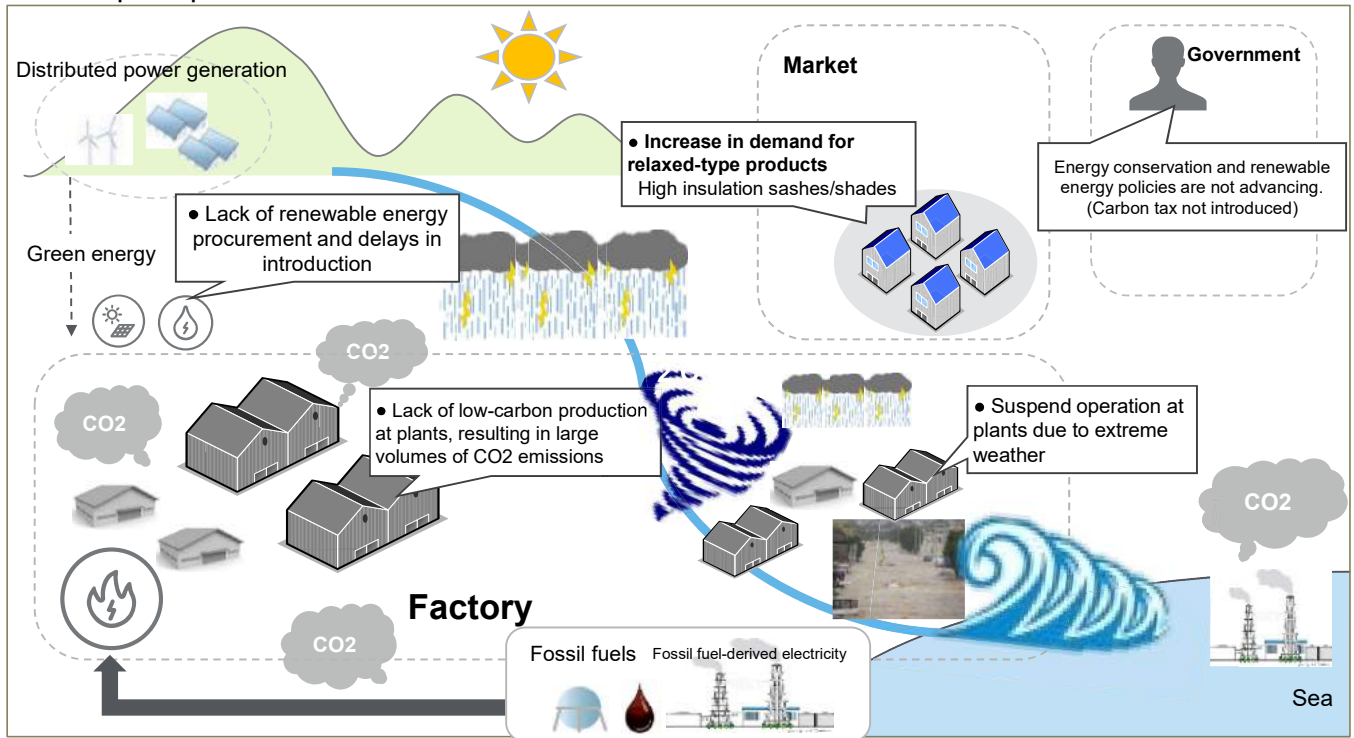
#### 3-2 5Force analysis of the 2°C scenario



### 3. Identify and define range of scenarios

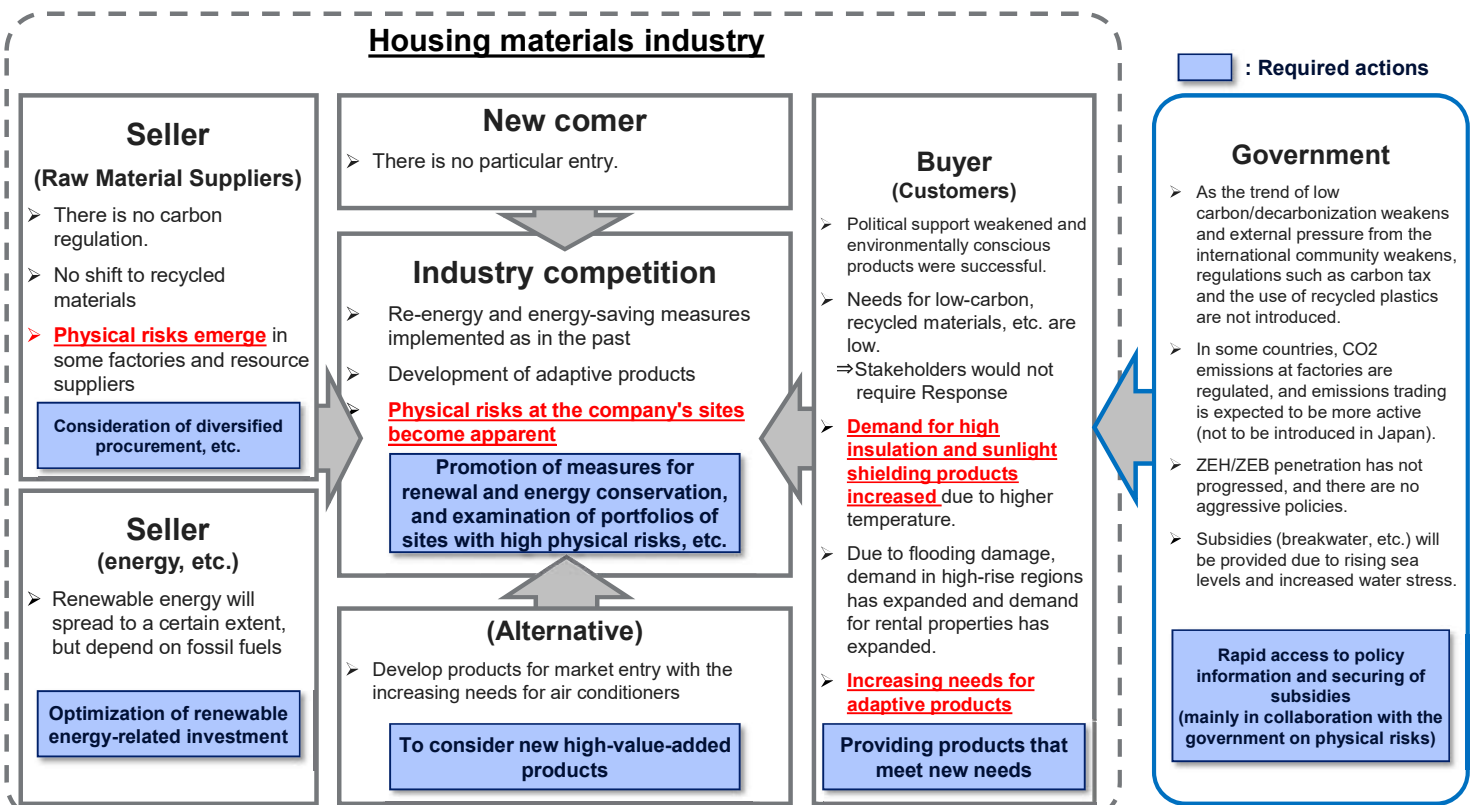
#### 3-3 Worldview of the 4°C scenario

- 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



### 3. Identify and define range of scenarios

#### 3 - 5 Assumptions for each scenario

		At present	2030		Source
			2°C world	4°C world	
Carbon price	Carbon tax	-	<b>\$100/t</b>	(Not installed at 4°C)	• IEA WEO 2019
Renewable energy policy	ZEH penetration rate	Newly built houses 54,352 units (2018)	Newly built homes <b>100%</b>	(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	-	<b>14%</b> (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	<b>1.7 times</b>	<b>3 times</b>	• 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

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

Estimated Risks and Opportunities	
<b>Risk</b>	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.
<b>Opportunity</b>	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

## 4. Evaluate business impacts

### 4 - 2 Business impact evaluation (summary of the 2°C Scenario)

#### 2°C Scenario

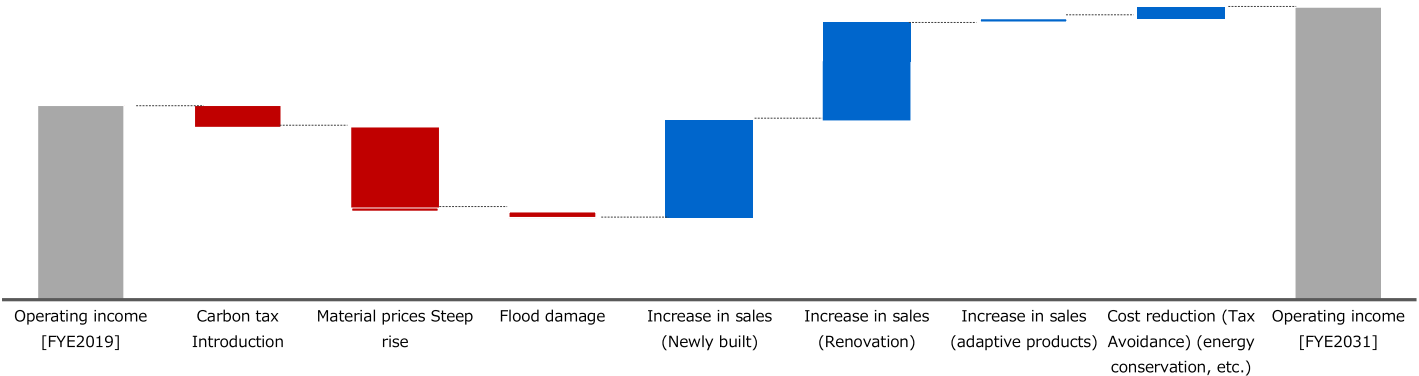
- In the 2°C scenario, there is a **large increase or decrease in profit** due to institutional development by the government, tightening of regulations, and changes in consumer preferences.
- Especially, **the renovation of the existing house which occupies the majority of the house is indispensable.**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



## 4. Scenario analysis results

### 4 - 3 Evaluation of Business Impact (Summary of the 4°C Scenario)

#### 4°C Scenario

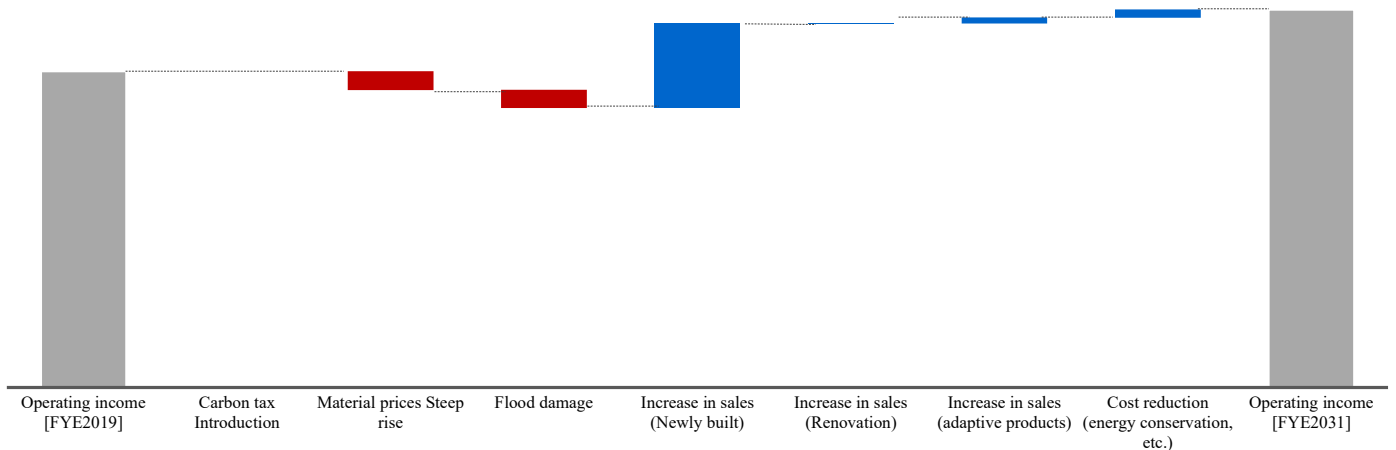
- As the 4°C scenario is an extension of the current scenario, the increase and decrease of profit is **relatively small.**

**Risk**

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

**Opportunity**

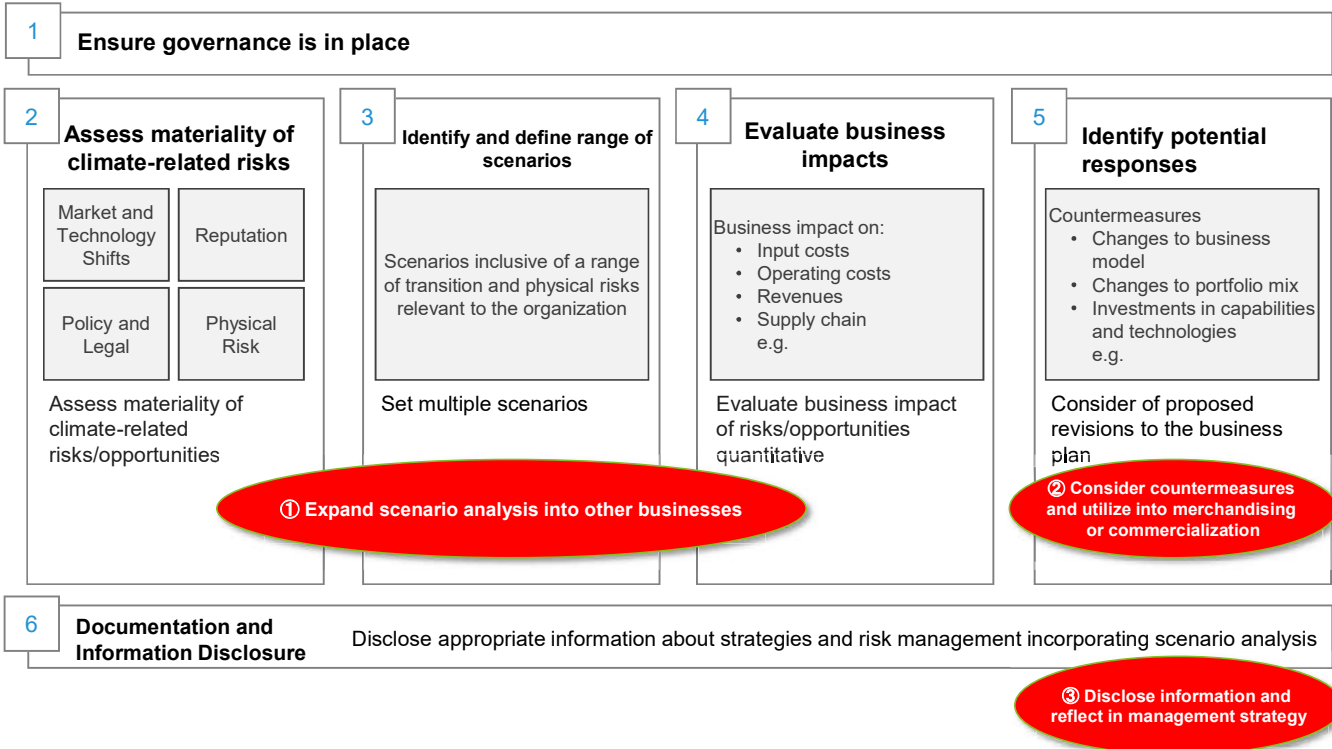
 Sales increase for high-performance building materials and solar panels due to the dissemination of new ZEH (current pace), in addition to expected increase in profits due to **the expansion of market for adaptive products.**





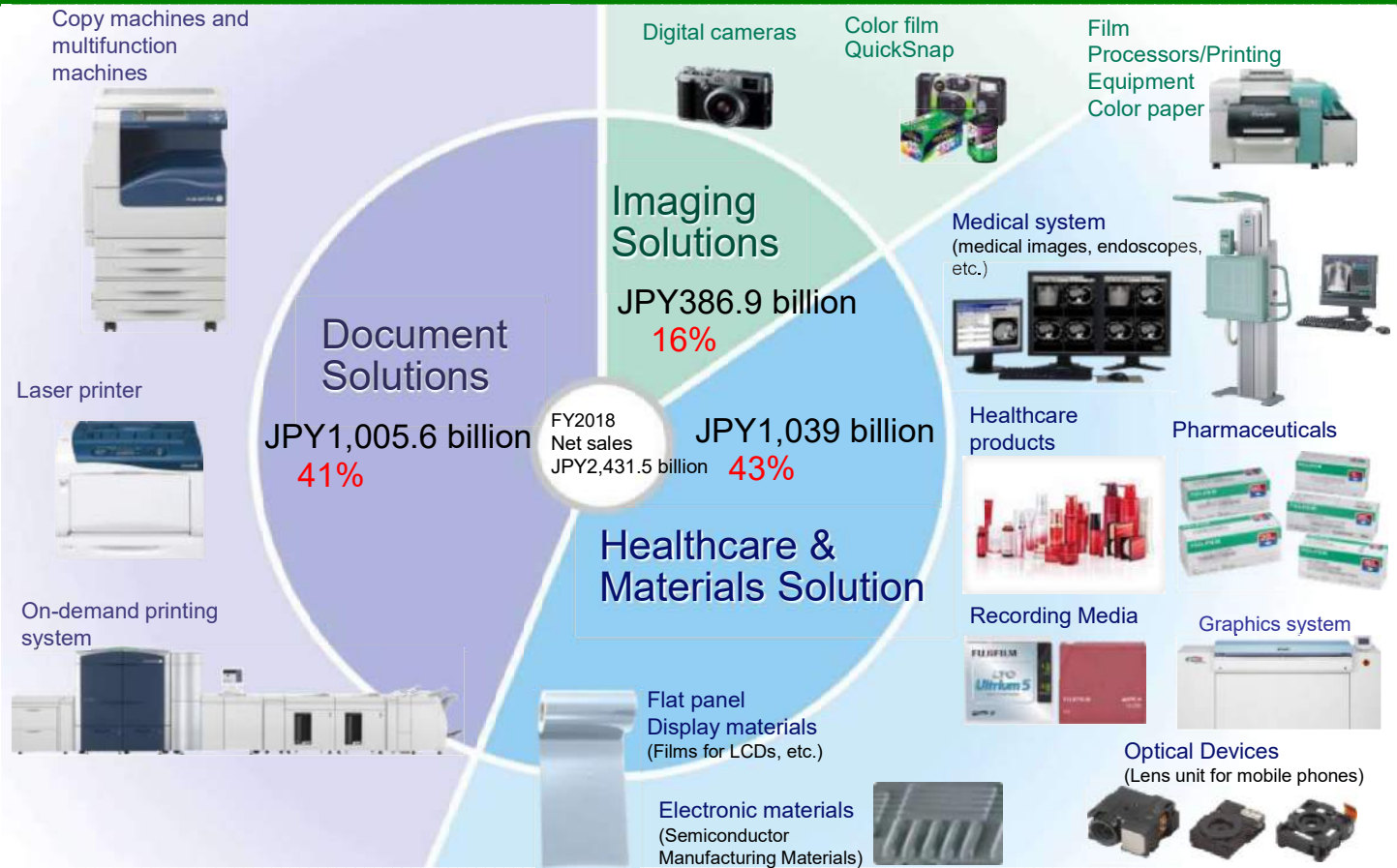
## 5. Future Challenges and Plans

- 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



## Material

- ✓ Practice Example①: FUJIFILM Holdings Corporation
- ✓ Practice Example②: Furukawa Electric Co., Ltd.



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## Risk Items in Display Business and Industrial Equipment Business

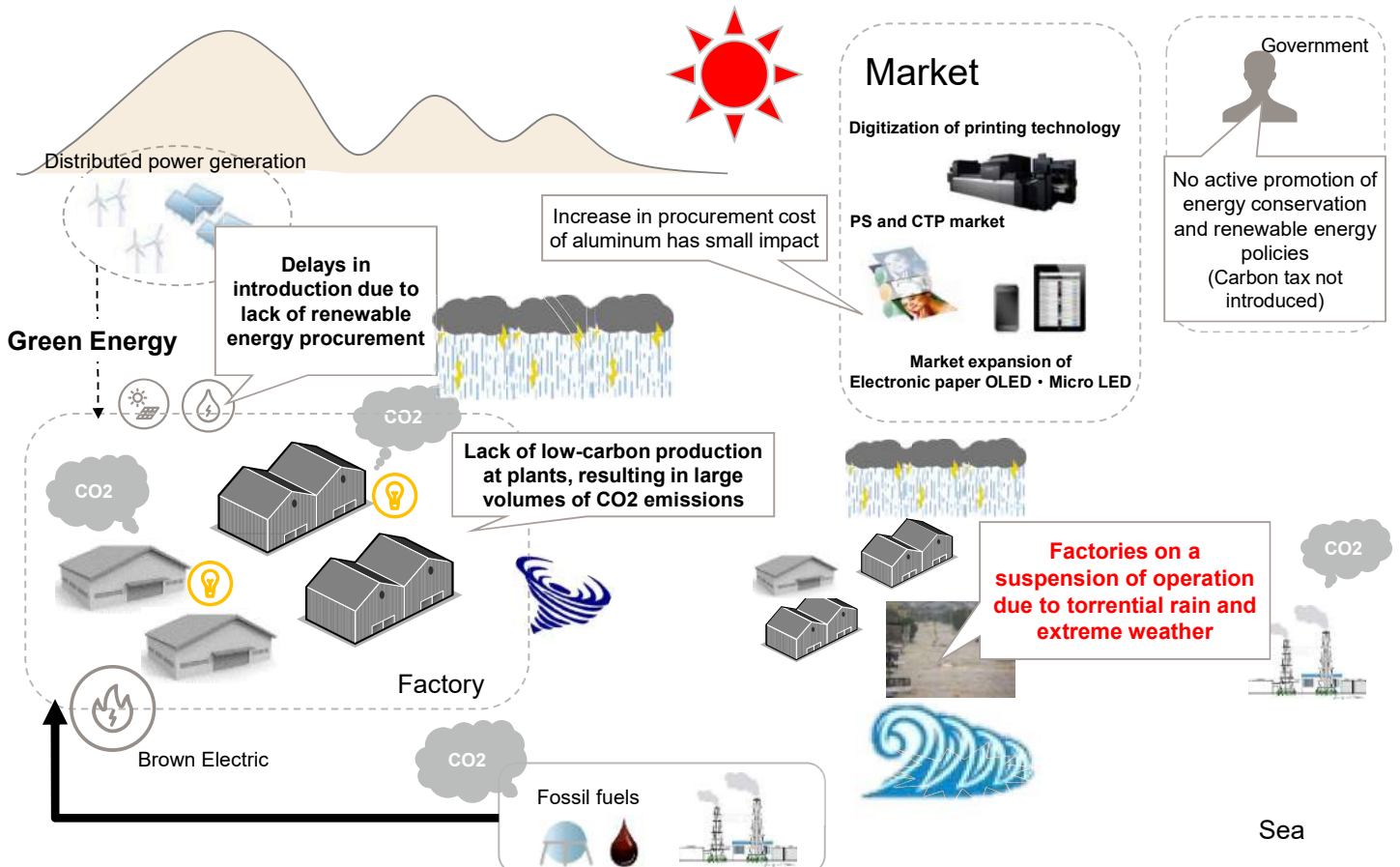
Risk Item	Business impact		Assessment
	Small classification	Index	
Plastic regulations	Spending	> Regulations on plastics are progressing led by Europe, and expenditures for replacement of alternative materials, upgrading of recycling, introduction of tracking systems, etc. are increasing, which has 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	Expenditure	> investment 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	> Impact on PL/BS due to increased CO2 emissions from in-house manufacturing facilities, increased expenses related to SDGs (including reduction of costs)	
Increase in the average temperature	Expenditures and assets	> 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	Small
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 divestment 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.	Small

3-107

		At present	2030		Source	
			4°C world	2°C world		
Carbon Emissions Targets/Policies in Each Country	Introduction of carbon tax	13 Million tCO <sub>2</sub> (2017)	401 Million tCO <sub>2</sub>	401 Million tCO <sub>2</sub>	• 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	
	Regulations on the use of recycled plastics	Rate of recycled aluminum Production of aluminum	37% 80%	51% 138Mt	• Estimated from IEA WEO 2018	
Plastic regulations	Promotion of CCS	Recycled plastics Utilization ratio	1 t	1.7 Times	• Estimated from IEA WEO 2018	
Developing next-generation technologies	Increasing severity of extreme weather conditions	CO <sub>2</sub> 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

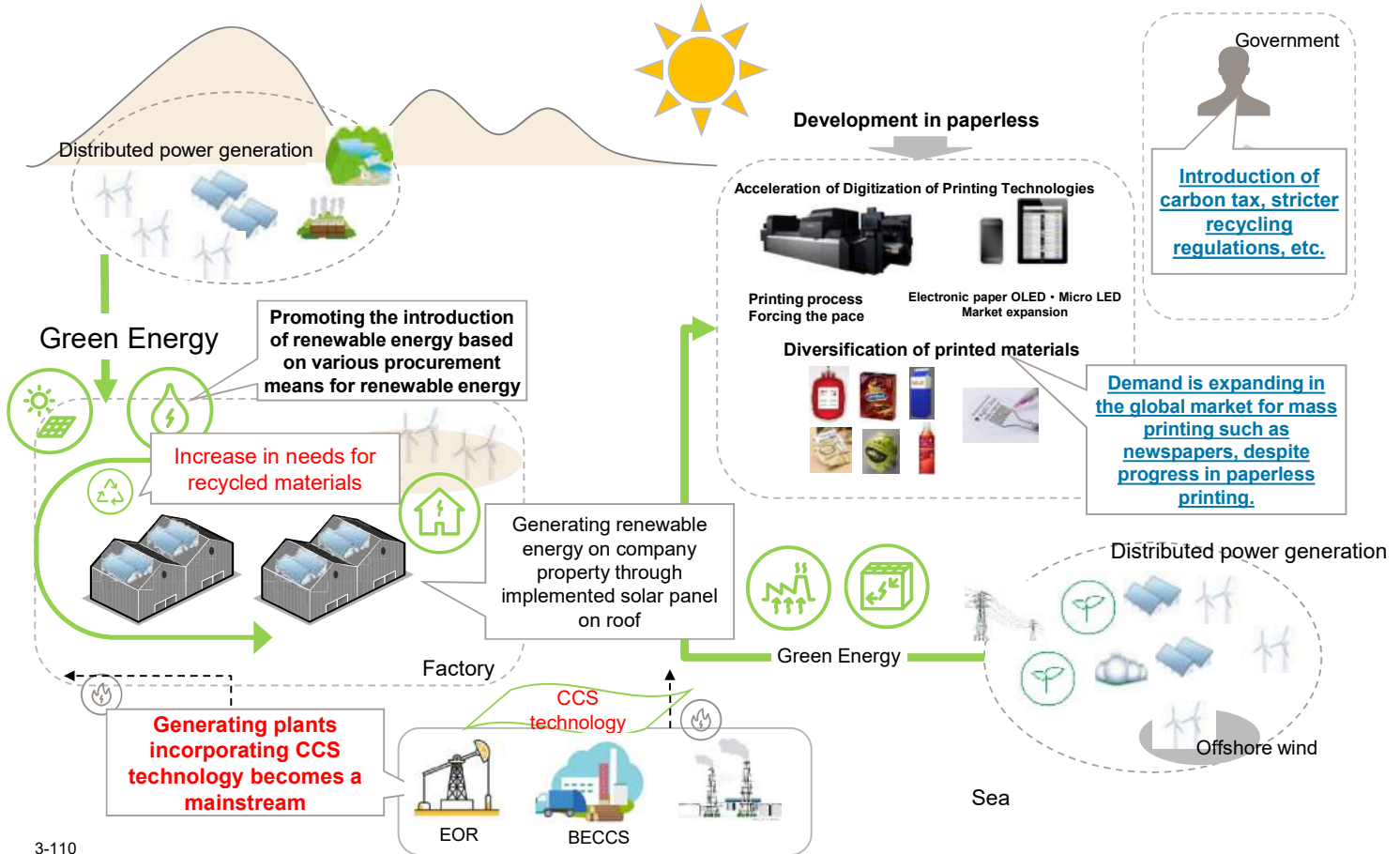
3-108

4°C world: Low carbon/decarbonisation is not promoted and physical risks increase



3-109

In the 2°C world: Advanced decarbonization accelerates the progress of adopting renewable energy, recycled plastics, and CCUS.

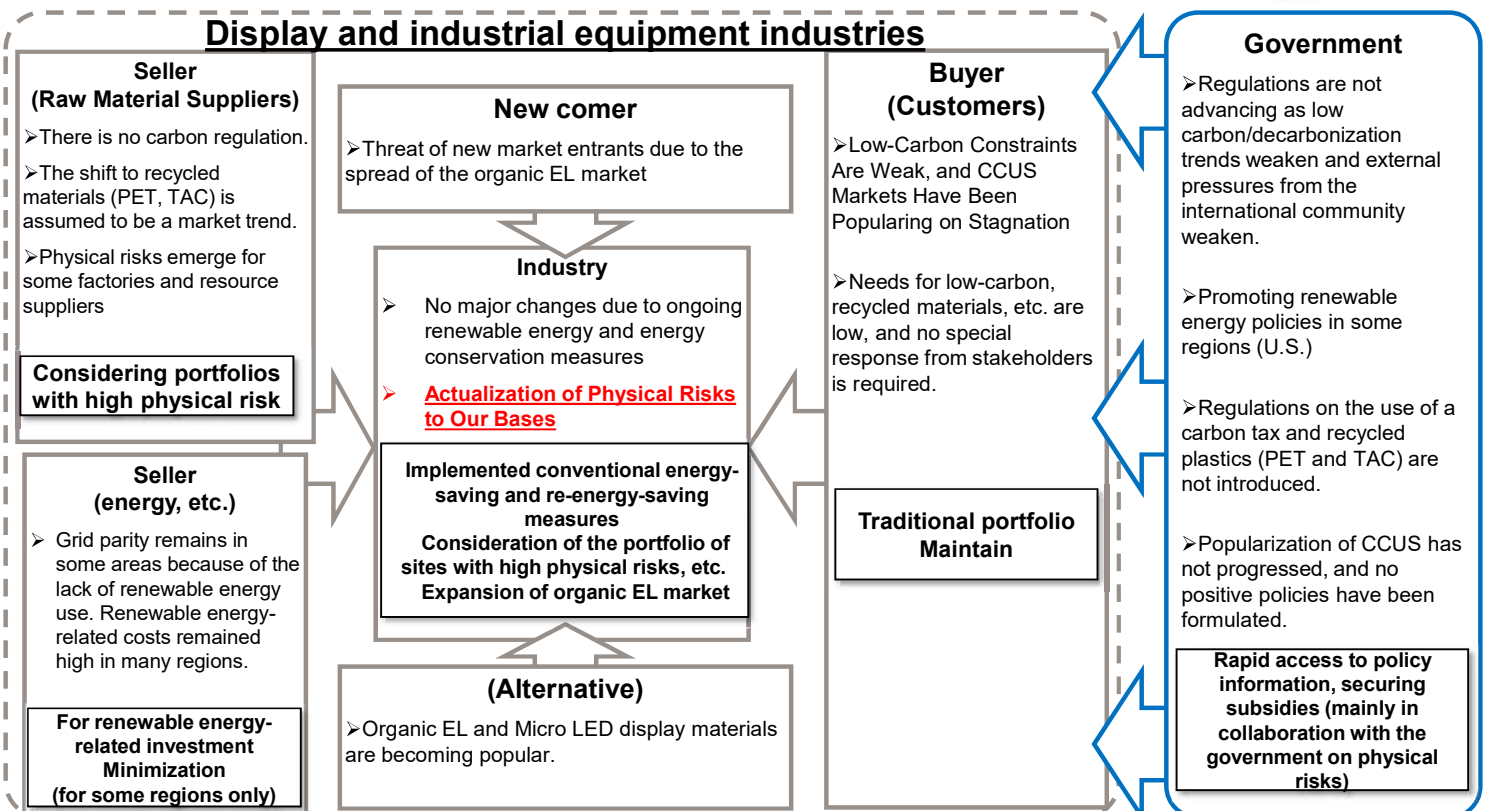


3-110

In the 4°C world: Low carbon/decarbonisation is not promoted and physical risks increase

### 4°C worldview @2030s (Example)

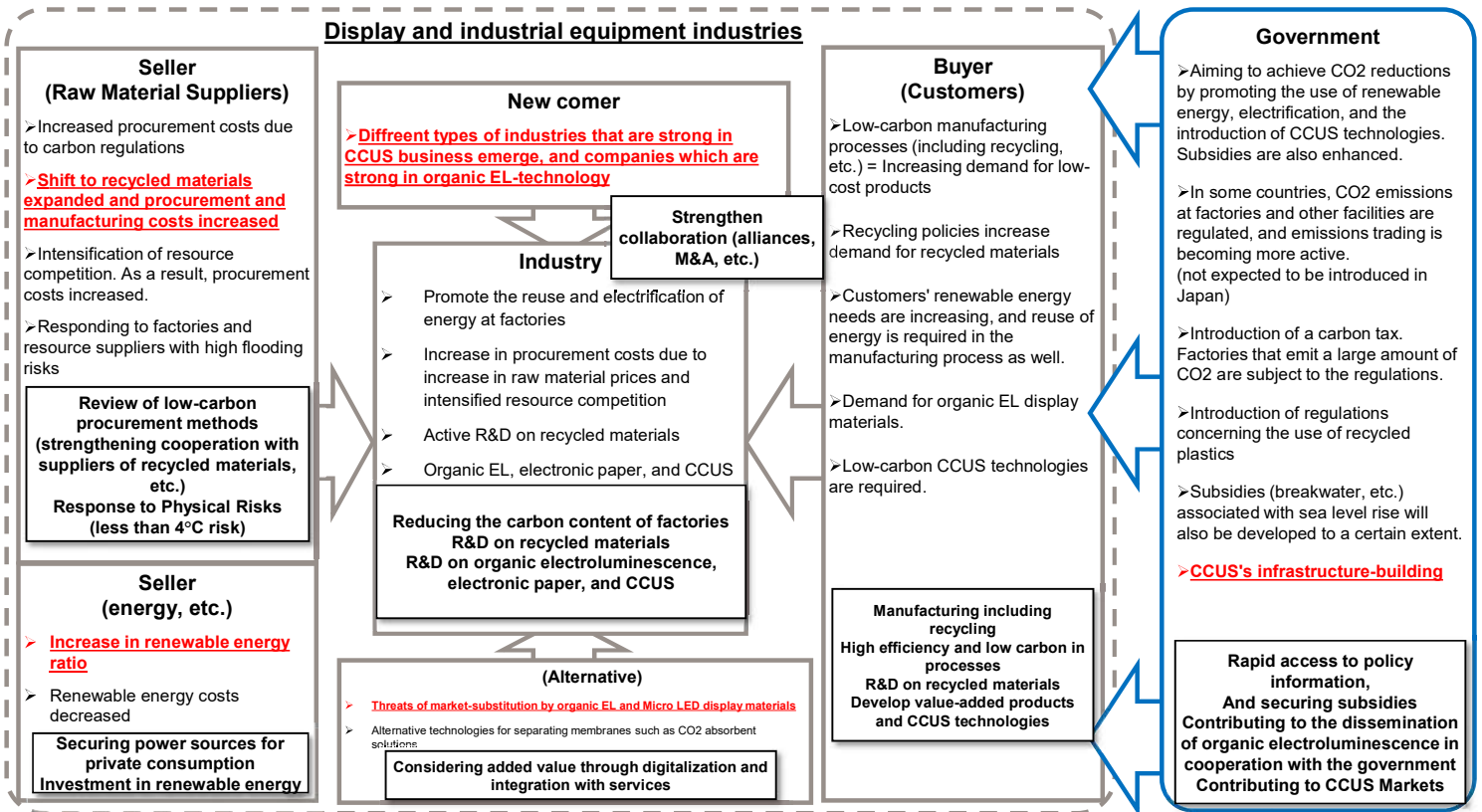
: What to do



3-111

**2°C worldview @2030s (Example)**

: What to do



3-112

**Business Impact Assessment (Example)**

	Business impact items	Assessment
4°C	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°C	<b>Cost for improving the rate of recycled plastics usage</b>	- ×× 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°C]

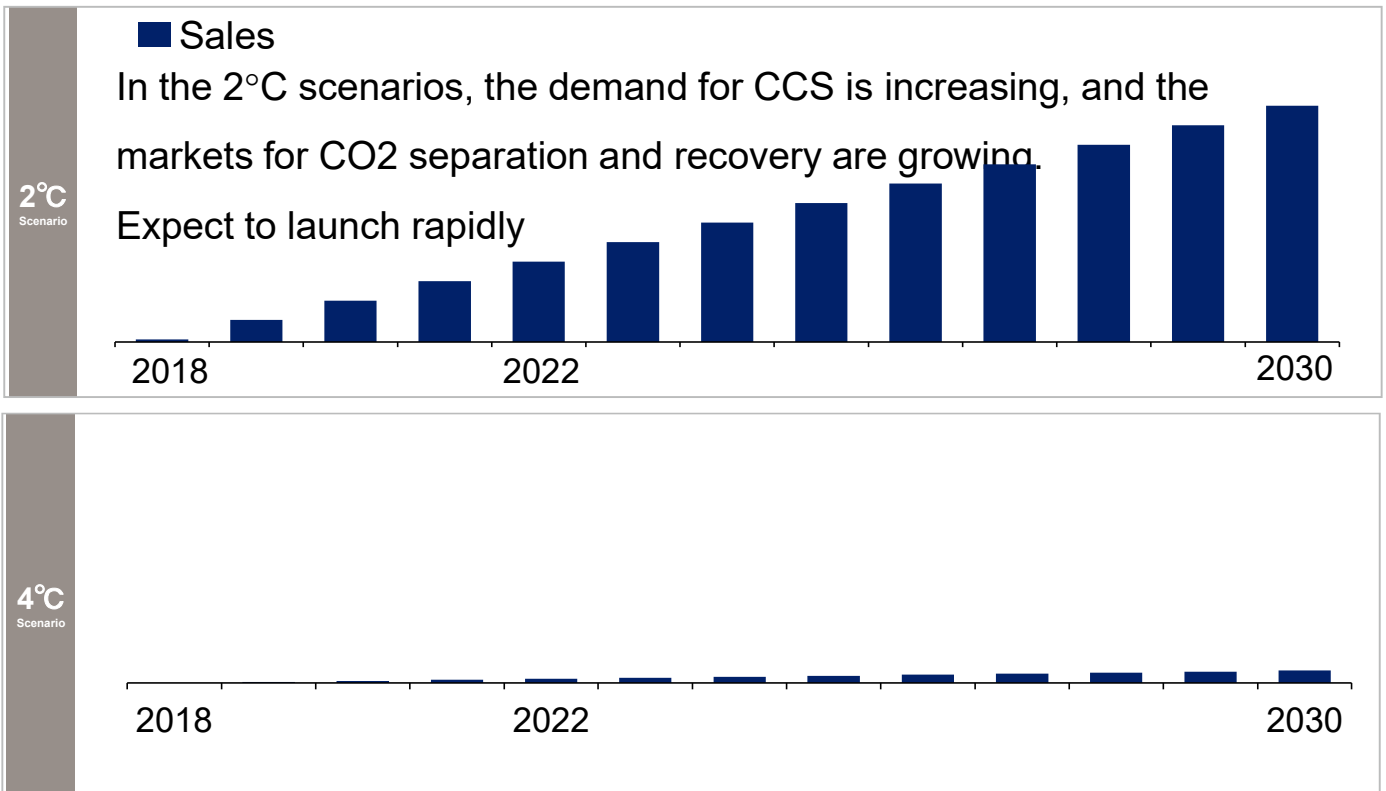
- Physical risks increase in a 4°C world, and costs increase in response to heavy rains and floods
- Increasing need for non-destructive testing services from the perspective of preventive maintenance

[2°C]

- Regulatory 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

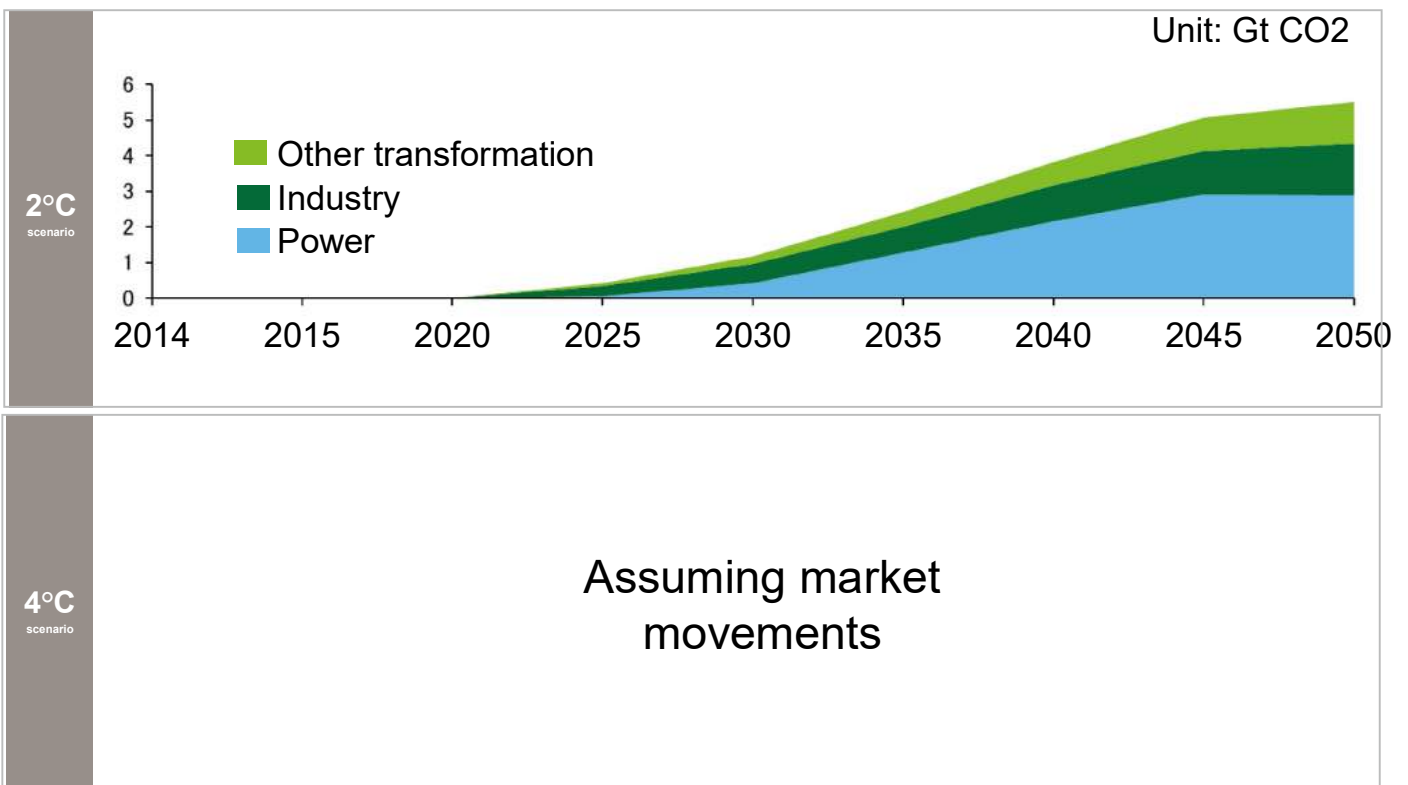
3-113

CCS-Related Market Forecasts



3-114 Source: Compiled from IEA ETP2017, etc.

CO2 self-storage forecast



Source: Prepared by IEA ETP2017

### Possible "risk preparations" for future scenarios

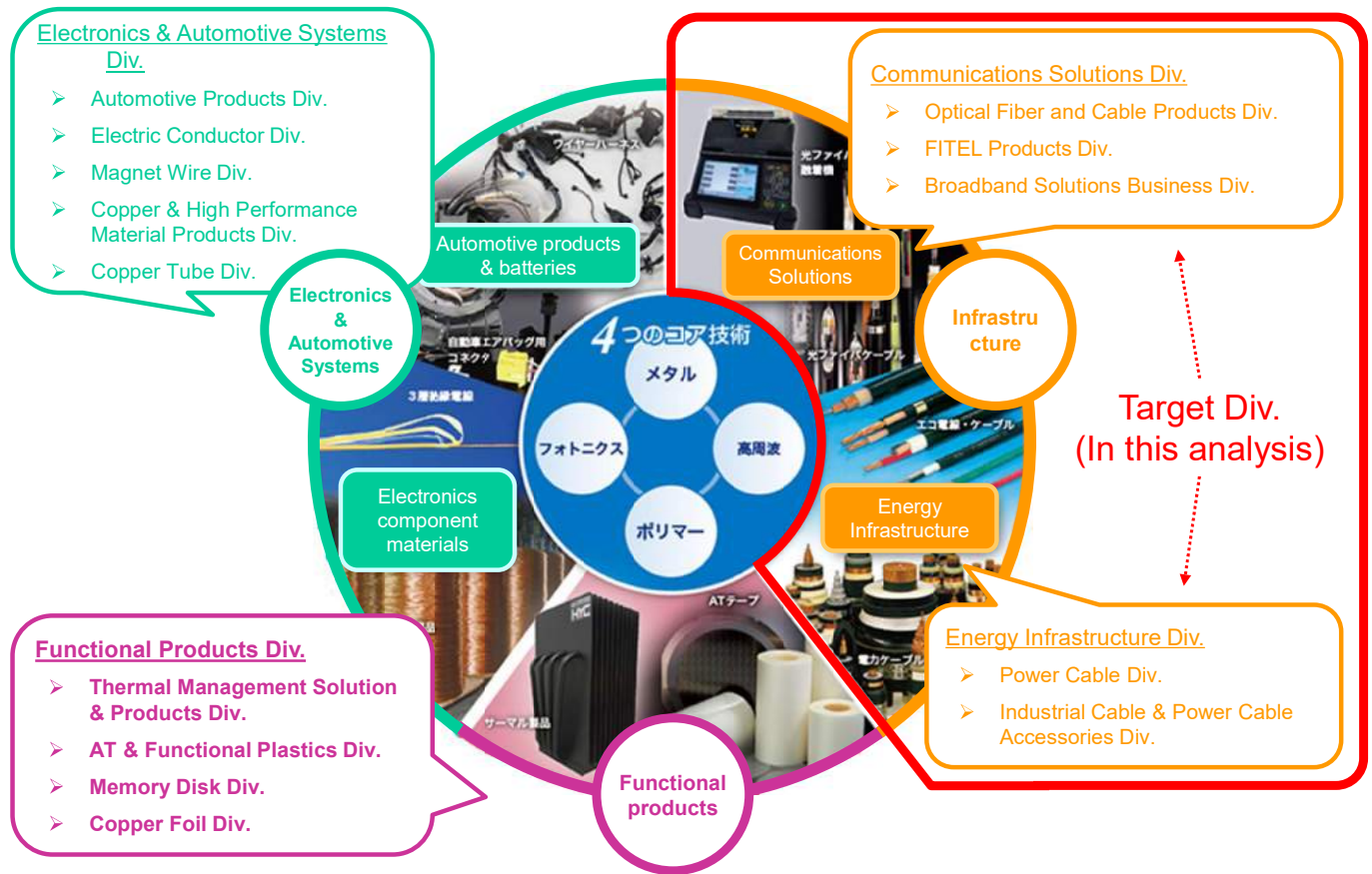
Important items	Current Initiatives	Examples of risk countermeasures
<b>Carbon price</b>	<ul style="list-style-type: none"> <li>Reduce CO2 emissions by 30% by FY2030 (compared to FY2013)</li> <li>Contribute to reducing social CO2 emissions by 50 million tons by FY2030</li> <li>Setting targets for the rate of renewable energy usage</li> </ul>	<ul style="list-style-type: none"> <li><b>Reducing CO2 Emissions by Introducing Internal Carbon Pricing</b></li> <li><b>Accelerate investment in environmental facilities by issuing green bonds</b></li> </ul>
<b>Plastics Regulation</b>	<ul style="list-style-type: none"> <li>Reduce waste generated by the Group by 30% by FY2030 (compared to the same level as in the previous year)</li> <li>30% improvement in resource input per unit of production by our group by FY2030 (compared to the same level above)</li> <li>Recycling of PET/TAC at Plants</li> </ul>	<ul style="list-style-type: none"> <li>Strengthened monitoring of regulatory trends related to chemical recycling for PET/TAC films and other display materials</li> <li>Investigation of setting targets at the recycling PCR rate *1, including external recycling</li> </ul>
<b>Developing next-generation technologies</b>	<ul style="list-style-type: none"> <li>Demonstration of gas separation membranes at overseas gas fields</li> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li><b>To further develop and study methods for CO2 separation and recovery</b> (In-house development or alliance)</li> <li>Transform business by developing and utilizing AI and other technologies in non-destructive inspection solutions</li> </ul>
<b>Increasing severity of extreme weather conditions (Flood damage)</b>	<ul style="list-style-type: none"> <li>Identify water risks using indicators for water stress, water input, and business impact in each country and region.</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of specific action guidelines for floods and disasters</li> <li>Preparation for long-term infrastructure disruption (response to power outages, etc.)</li> <li>Establishment of procurement strategy to minimize procurement risk</li> <li>Anti-liquefaction, anti-seismic reinforcement and anti-tsunami measures</li> </ul>

\* 1: post-consumer recycling ratio: Percentage of commercially recovered materials used in recycled materials.


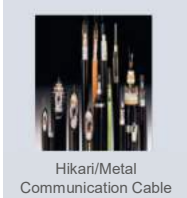
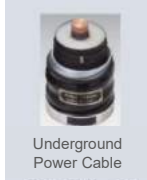

## Material

✓ Practice Example①: FUJIFILM Holdings Corporation

✓ Practice Example②: Furukawa Electric Co., Ltd.



Characteristics of Target Businesses

Item	Communications Solutions Business	Energy Infrastructure Business
Target product category	<ul style="list-style-type: none"> <li>• <b>Optical fiber cables</b></li> </ul>  	<ul style="list-style-type: none"> <li>• <b>Power Cables</b></li> </ul>  
Materials used	<ul style="list-style-type: none"> <li>• <b>Glass materials (optical fiber)</b></li> <li>• <b>Plastics (fiber, cable dressings, etc.)</b></li> <li>• <b>Copper (metal communication cable)</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Copper (Conducting material)</b></li> <li>• <b>Plastics (cable dressings)</b></li> </ul>
Energy Amount used	<ul style="list-style-type: none"> <li>• Large amount used in optical fiber manufacturing process</li> </ul>	<ul style="list-style-type: none"> <li>• Be relatively small</li> </ul>
Bases	<ul style="list-style-type: none"> <li>• Expansion of production bases globally (Asia, North and South America, EMEA)</li> </ul>	<ul style="list-style-type: none"> <li>• Japan, China</li> </ul>



Analysis step	② Assess materiality of climate-related risks	③ Identify and define range of scenarios	④ Evaluate business impacts	⑤ Identify potential responses
	Questions	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?
Analysis level				
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	<ul style="list-style-type: none"> <li><b>Communications solutions</b></li> <li><b>Energy infrastructure</b></li> </ul> Identify high-priority risks in the 2 businesses	<ul style="list-style-type: none"> <li><b>4°C (business as usual)</b></li> <li><b>2°C (strict measures)</b></li> </ul> Define 2 scenarios	<ul style="list-style-type: none"> <li><b>Estimated impact on net sales and operating income</b></li> <li><b>Estimated Impact of Carbon Tax and Copper Price Rise</b></li> </ul>	<ul style="list-style-type: none"> <li><b>Insurance, etc.</b></li> <li><b>Consider conversion to other materials</b></li> </ul>
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3-120

## Assess materiality of climate-related risks (Communications Solutions Business)

### ② Assess 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.

Major classification	Risk Item		Business impact		Asses sment
	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	➢ <a href="#">Depending on the amount of CO<sub>2</sub> discharged by the plant, the conversion to renewable energy is required, and the corresponding costs for purchasing facilities and green power, etc. are increasing.</a>		Large
	Dissemination of renewable energy and energy-saving technologies	Revenue Assets	➢ <a href="#">Acceleration of introduction of renewable energy, etc. and increase of renewable energy ratio of electricity supplied to manufacturing plants</a>		
	Carbon price	Spending	➢ <a href="#">When a carbon tax is introduced, taxes are levied on fuel procurement costs.</a>		
	Energy conservation, regulations in each country	Spending	➢ <a href="#">If the energy conservation policy is not achieved, the company's environmental image will be damaged by the announcement of the company name.</a>		
	Changes in the energy mix	Spending	➢ In order to achieve CO <sub>2</sub> 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	➢ <a href="#">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.</a>		
Physical Risk	Rising sea level	Spending	➢ <a href="#">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.</a>		Large
	Drought: changes in rainfall and weather patterns	Spending	➢ <a href="#">Drought, increased production costs due to water restrictions, additional investments for system development, etc.</a>		
	Typhoon: Increasingly severe extreme weather conditions	Spending Assets	➢ <a href="#">Due to plant damage caused by typhoons, additional investments were made to shut down operations, reduce production, and restore facilities. Increase in the premium</a>		
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

3-121

# Examples of definitions based on scientific grounds such as IEA

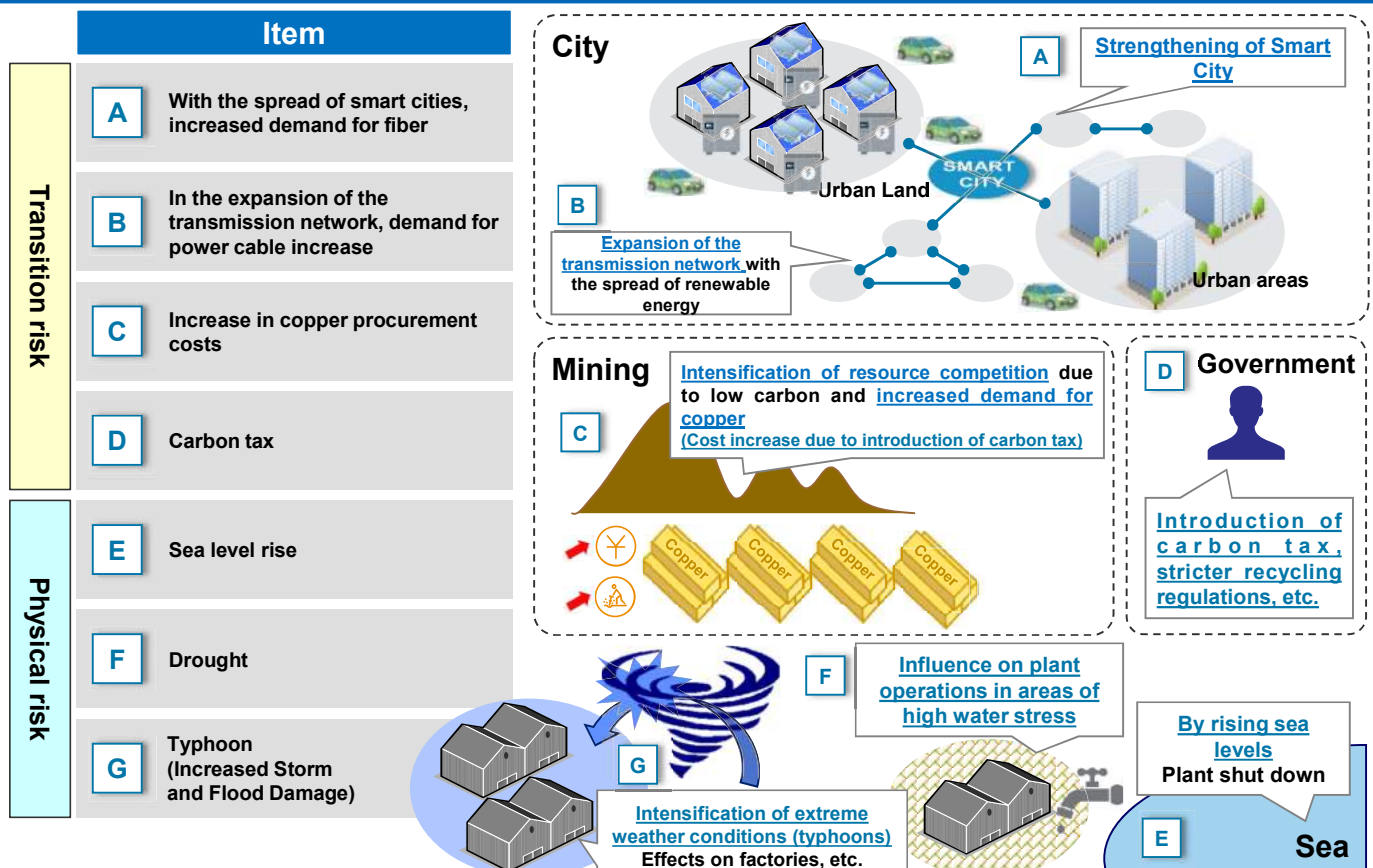
③ Identify and define range of scenario

		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 <sub>2</sub> (2017)	401 Million tCO <sub>2</sub>	401 Million tCO <sub>2</sub>	• 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 exabytes (10 <sup>18</sup> )/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 Deelman 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 **)	-	• 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

3-122 \*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.

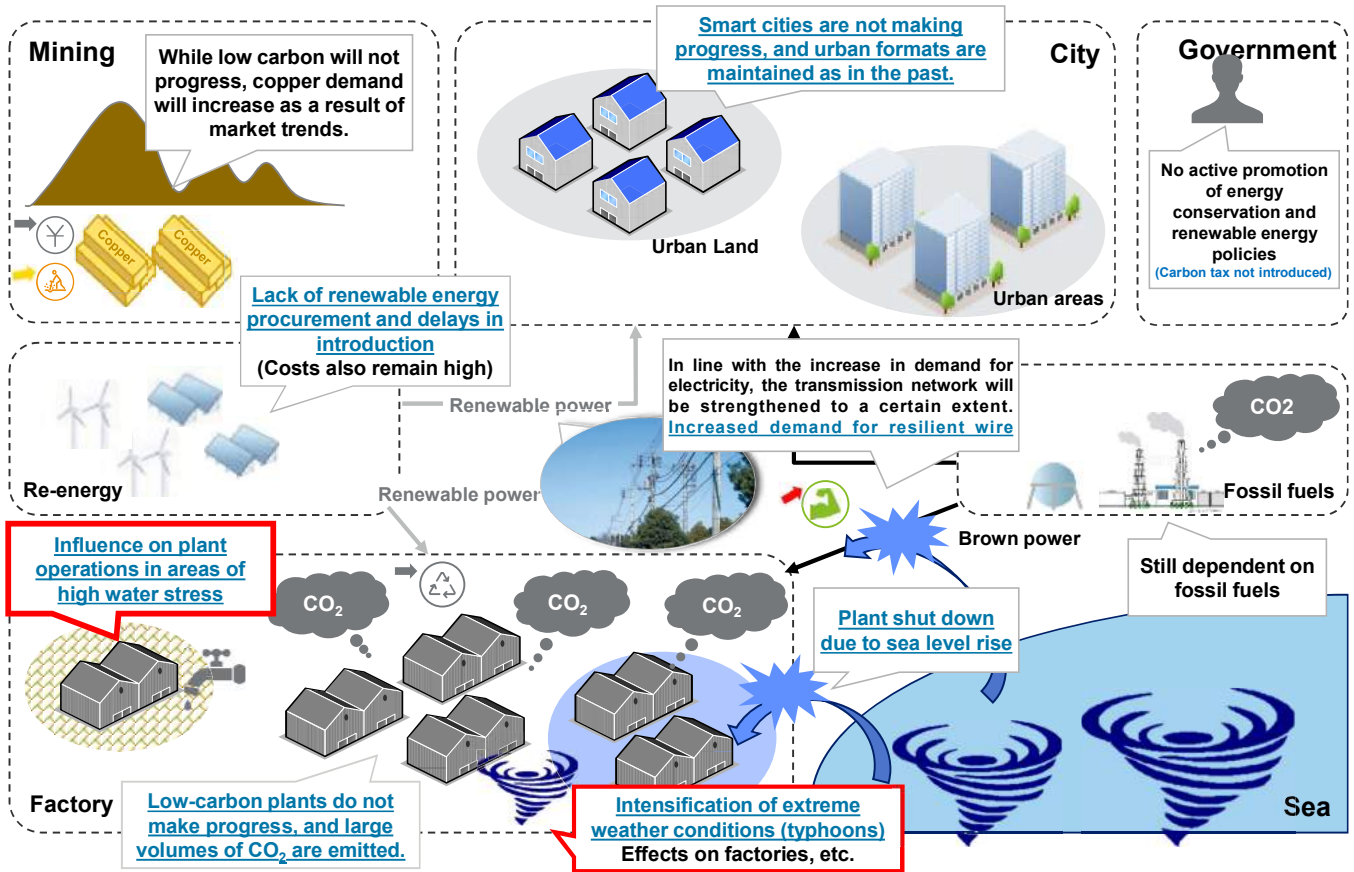
## Select the evaluation items for business impact

③ Identify and define range of scenario



**In the 4°C world, low carbon/decarbonization is not promoted, Increased physical risk (business as usual)**

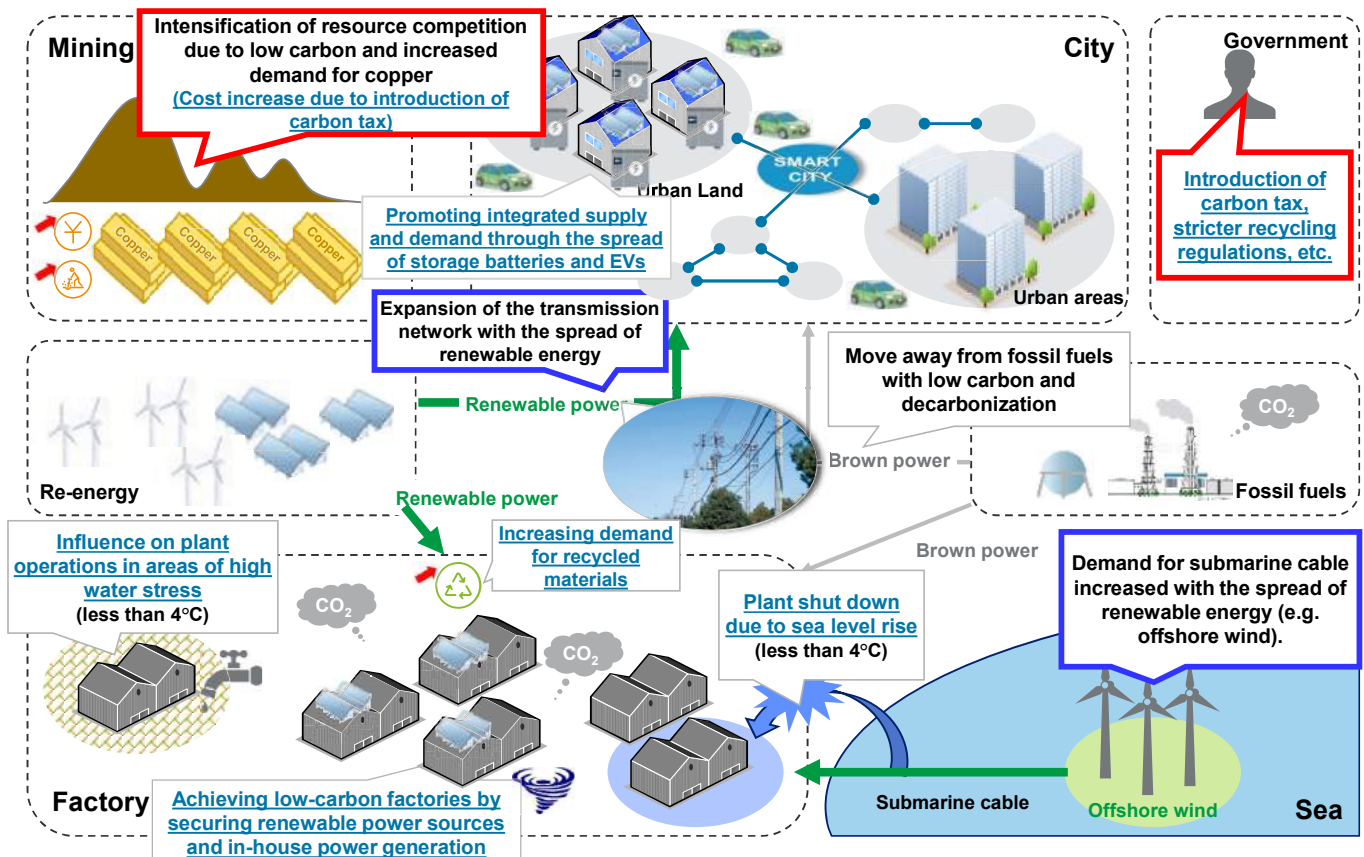
③ Identify and define range of scenario



3-124

**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

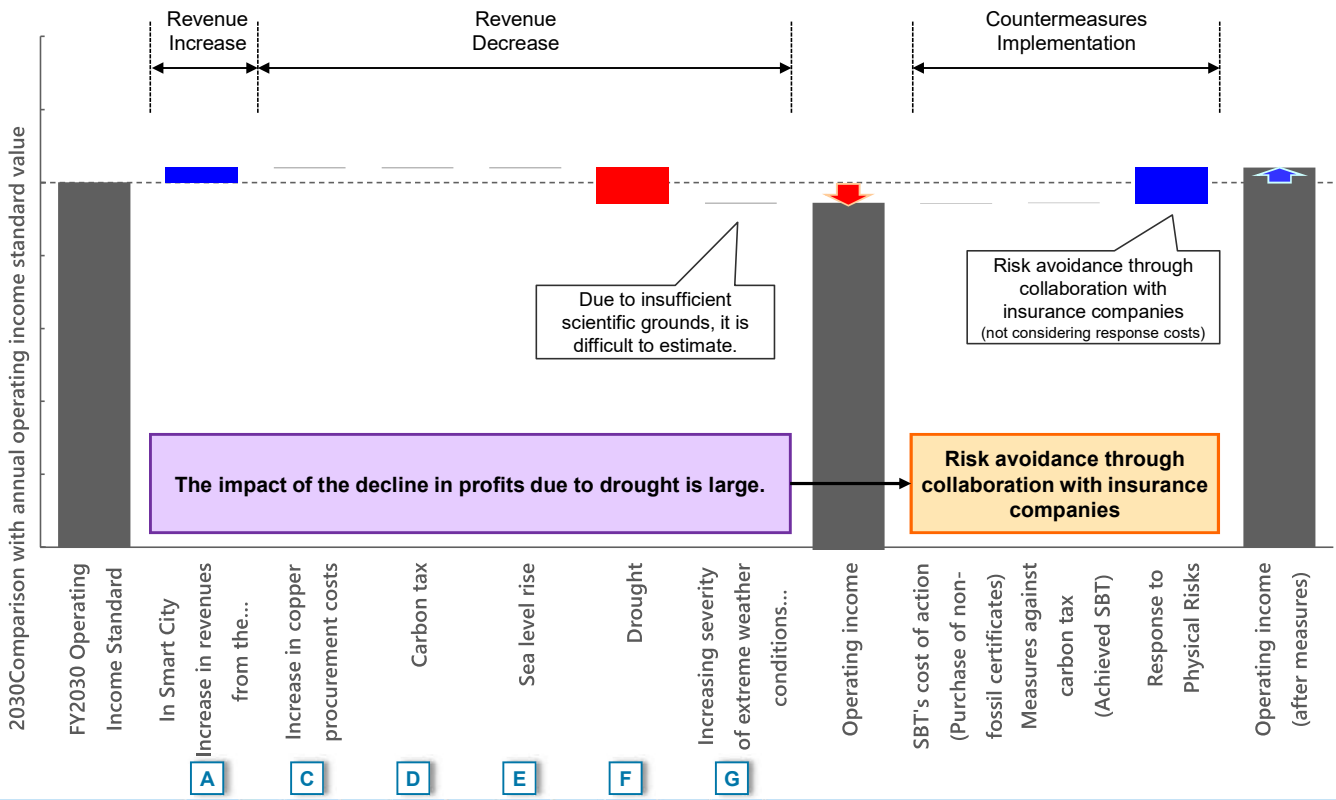


3-125

# Communications Solutions Business: 4°C (business as usual)

- ④ Evaluate business impacts
- ⑤ Identify potential responses

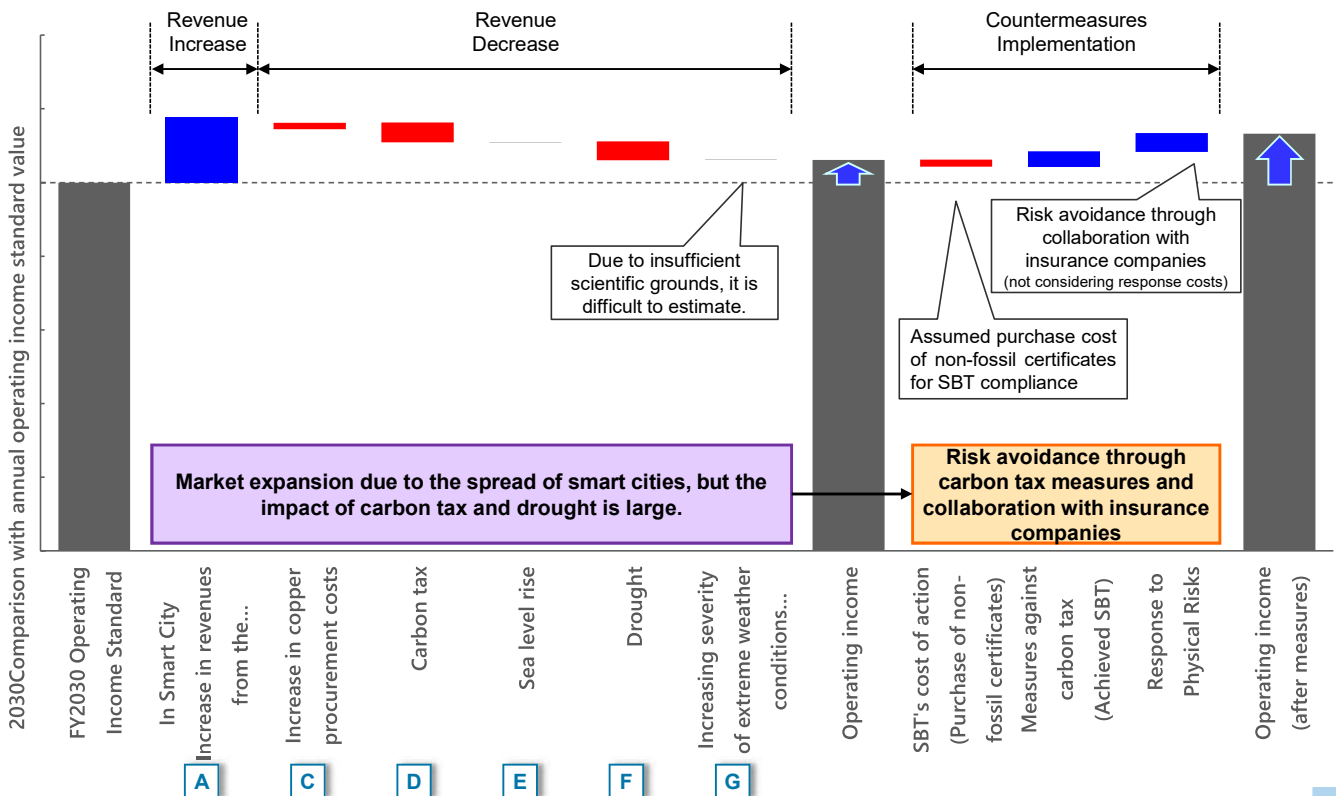
□ Working with insurance companies to avoid risks and secure increased profits.



# Communications Solutions Business: 2°C (strict response)

- ④ Evaluate business impacts
- ⑤ Identify potential responses

□ Reduce greenhouse gas emissions and collaborate with insurance companies to avoid risks and recover the increase in revenues.



- Carbon tax and physical risks need to be addressed in a timely manner.

	Item	Risk response measures
Transition risk	<b>C</b> Cost of procuring copper Increase	<ul style="list-style-type: none"> <li>➤ 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.</li> </ul>
	<b>D</b> Carbon tax	<ul style="list-style-type: none"> <li>➤ <a href="#">Re-energy introduced</a> at headquarters, factories and value chains</li> <li>➤ Implementation of ambitious target setting (SBT, etc.)</li> </ul>
Physical risk	<b>E</b> Sea level rise	<ul style="list-style-type: none"> <li>➤ Consider <a href="#">collaboration with insurance companies</a> that have in-house tools to minimize risk</li> <li>➤ Strengthen preventive measures against existing assets (breakwater, etc.)</li> </ul>
	<b>F</b> Drought	<ul style="list-style-type: none"> <li>➤ Consider <a href="#">collaboration with insurance companies</a> that have in-house tools to minimize risk</li> <li>➤ Implementation of preventive measures for existing assets (water supply towers and reservoirs)</li> <li>➤ Relocation of some bases</li> </ul>
	<b>G</b> Typhoon	<ul style="list-style-type: none"> <li>➤ Be scientifically examined in the future, including the quantification of risks</li> </ul>

3-128

## Food

- ✓ Practice Example①: Kagome CO.,LTD.
- ✓ Practice Example②: Calbee, Inc.
- ✓ Practice Example③: 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. <b>Kagome Inc.</b> United Genetics Holdings LLC Vegetalia 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)

- Head Office
- Innovation Division (Research Institute)
- Branches and Offices
- Factory

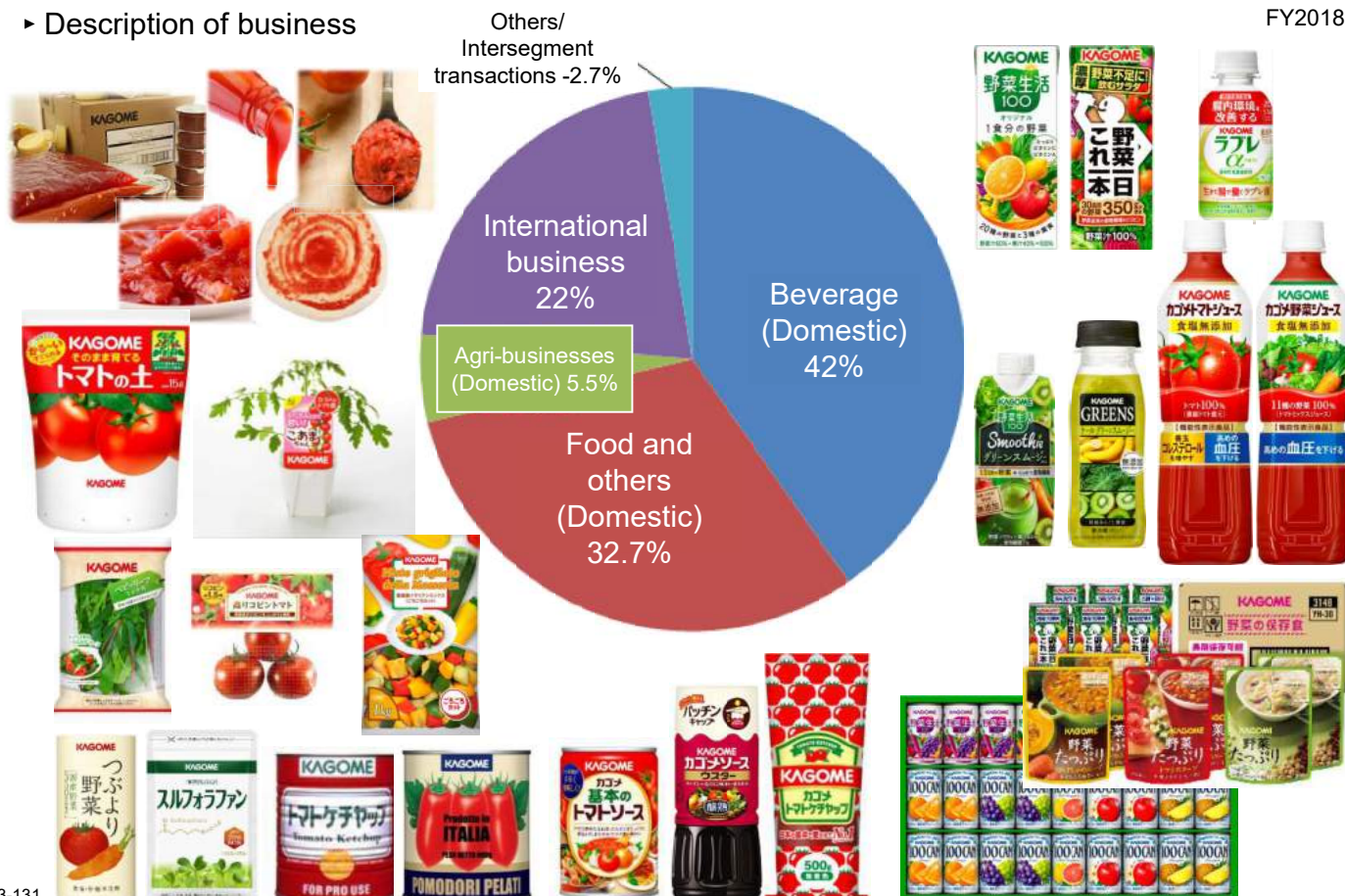


3-130

# Introduction of Kagome (Manufacture and sale of beverages and foodstuffs, development of vegetable varieties, and cultivation)

## ▶ Description of business

FY2018



3-131

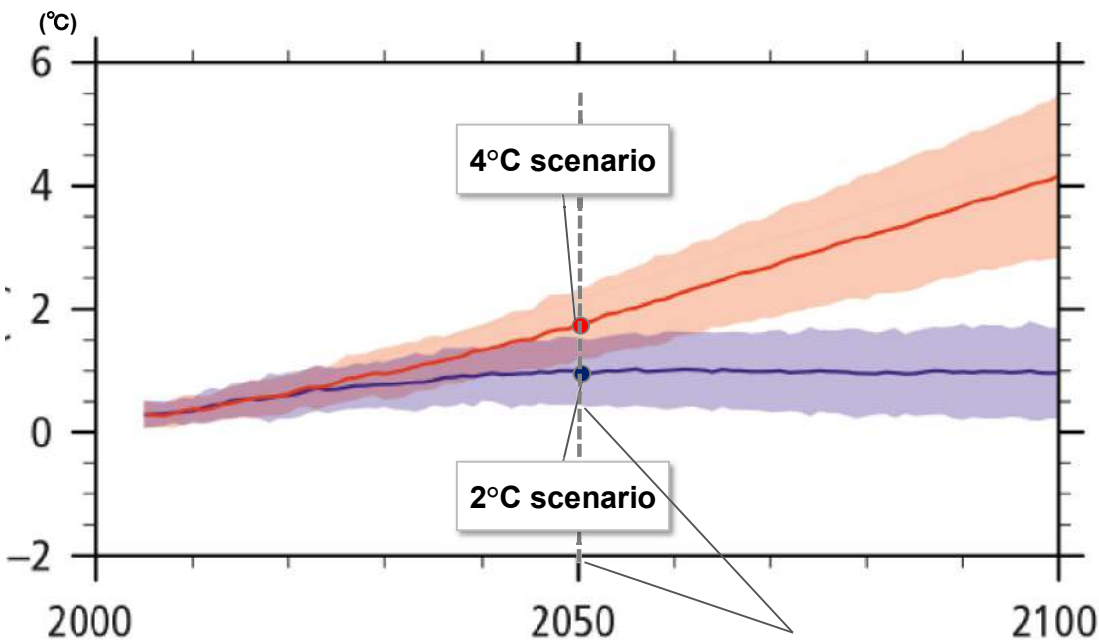
**Extract the risk of Kagome, evaluate the impact on a large, medium, or small scale, and identify those with the greatest impact.**

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

3-132

**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.**

**Set 2050-year time horizon for transition risk and physical risk**

Source: AR5 SYR Diagram SPM.6

3-133

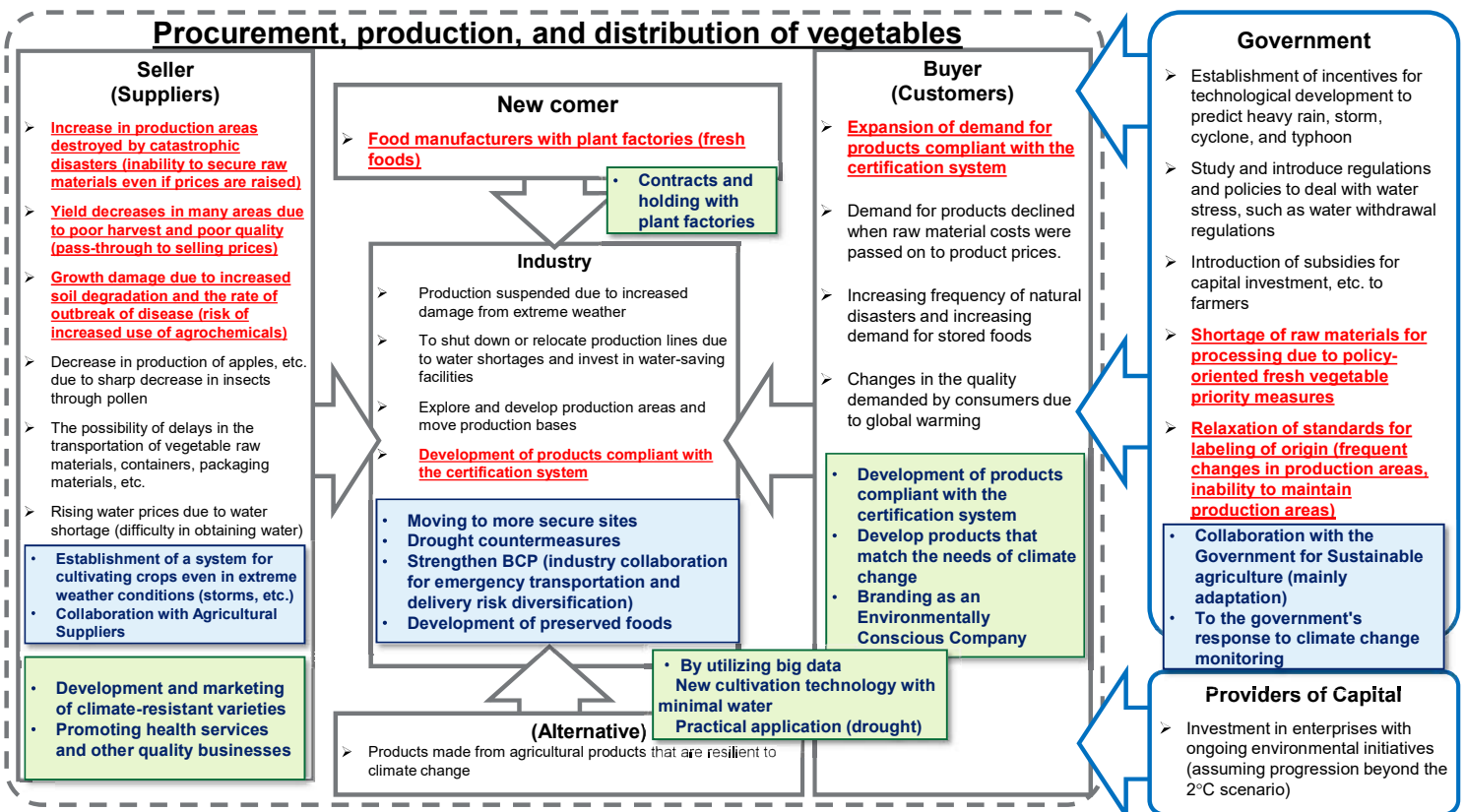
## Collect scientific evidence on the situation for 2050 (use in calculating the future impact amount)

		At present	2050		Source
			4°C world	2°C world	
<b>Carbon price</b>	Carbon tax	-	<b>53USD/tCO2 (EU)</b>	<b>180 USD per tCO2 (developed countries)</b>	• IEA WEO 2019
<b>Changes in consumer behavior</b>	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"
<b>Increase in the average temperature</b>	Changes in tomato yields	-	<b>-17~7%</b>	<b>-2~10%</b>	• GAEZ (yield per hectare)
	Change in carrot yield	-	<b>-0.1~2%</b>	<b>-2~1%</b>	
<b>Changes in rainfall and weather patterns</b>	Orange yield change	-	<b>4%</b>	<b>5%</b>	
	Changes in apple yield	No data			
<b>Reduction of biodiversity</b>	Reduction of pollen-borne organisms	No data			
<b>Decrease in production due to water stress</b>	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: <b>7</b>	• WIRI Aqueduct
<b>Increasing severity of extreme weather conditions</b>	Annual occurrence of heavy rain Incremental days	2.5 days	<b>4.3 days</b>	<b>2.9 days</b>	• "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	-	<b>+8~+15%</b>	<b>+8~+15%</b>	
	Flood damage increase rate	-	<b>5.9 times</b>	<b>2.2 times</b>	• Supplemental to WRI 2030 annual data

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## Using Michael Porter's 5Forces to forecast the 2050 worldview

### 4°C worldview @2050s (Example)

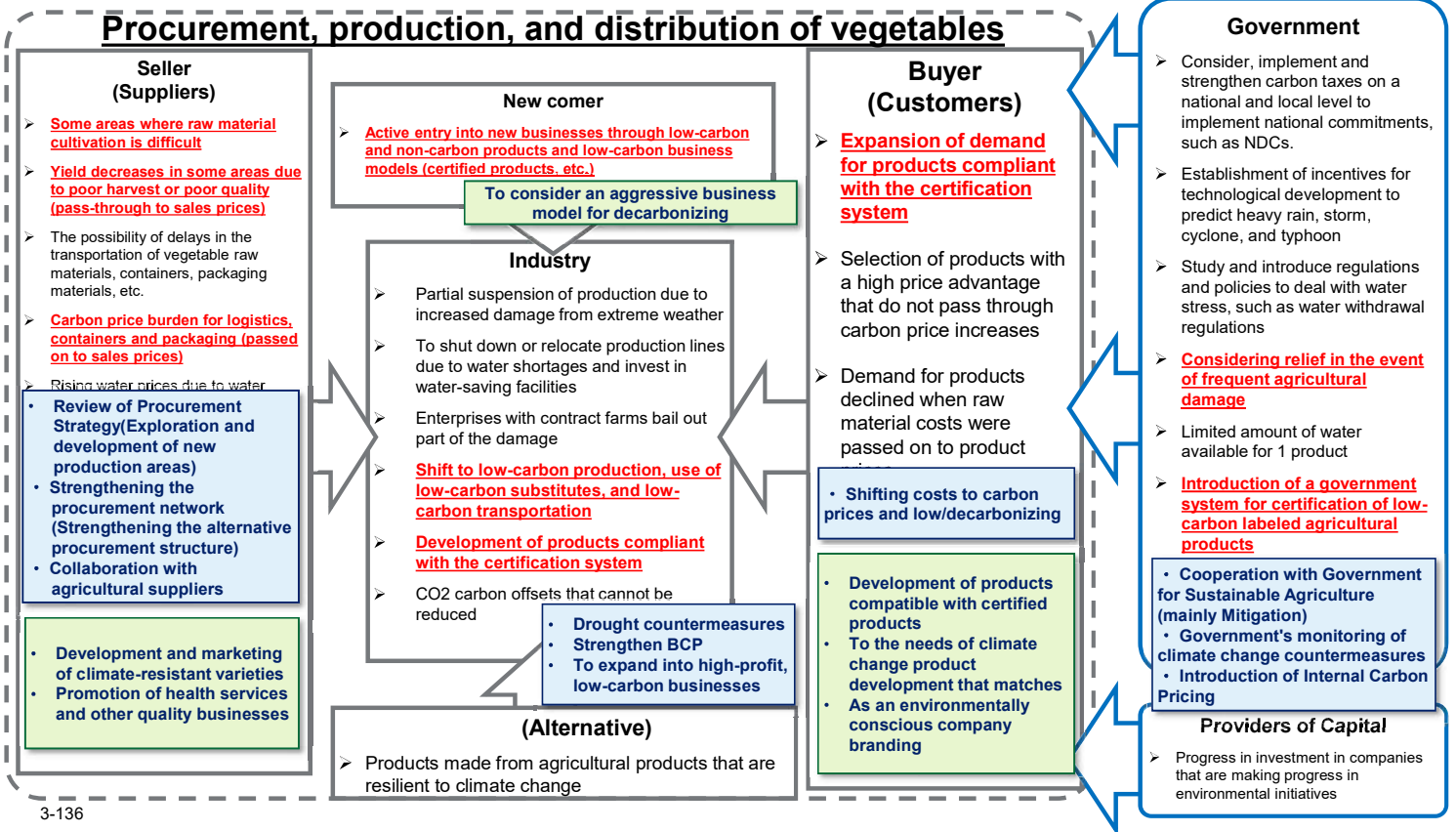


3-135



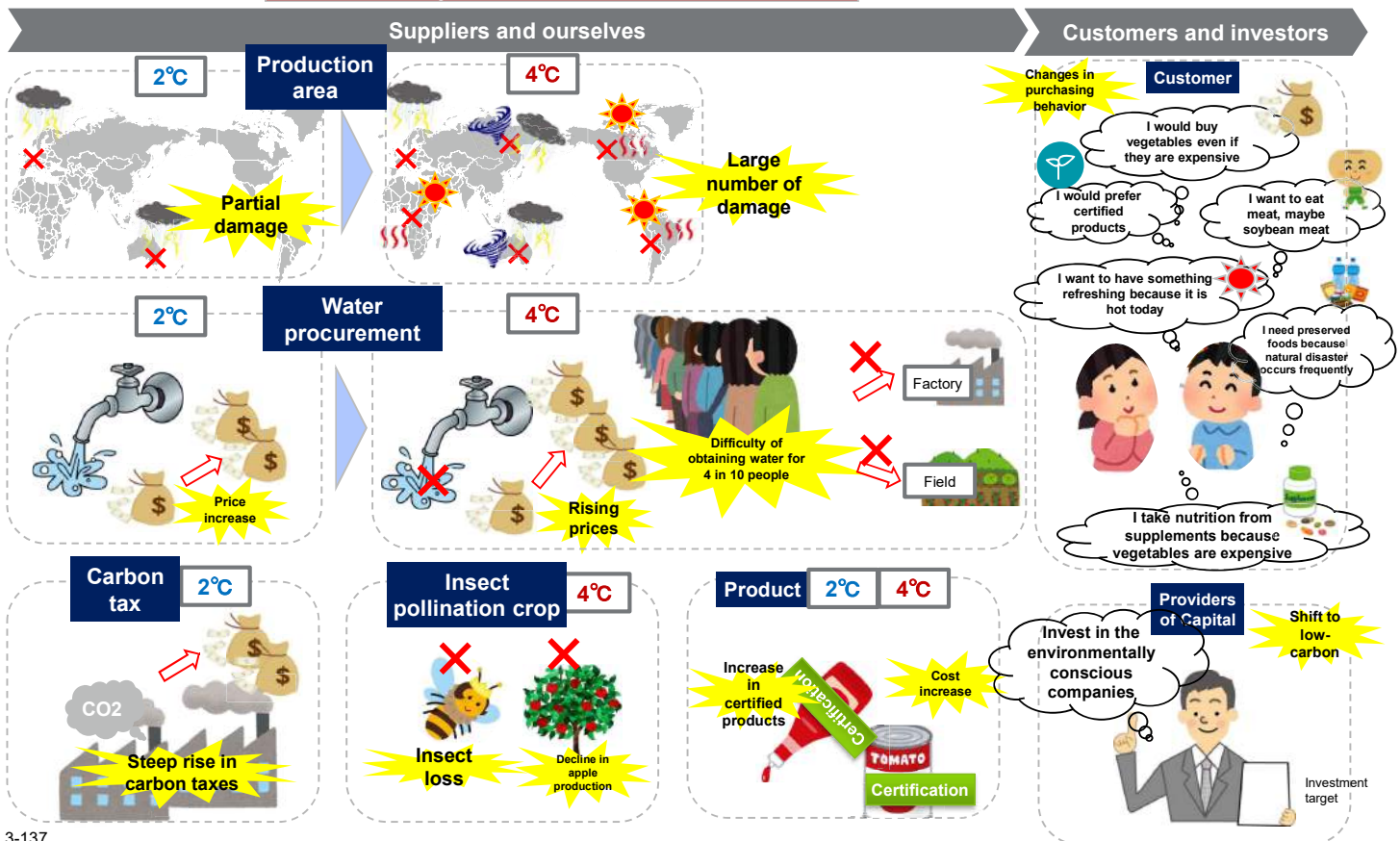
# Using Michael Porter's 5Forces to forecast the 2050 worldview

## 2°C worldview @2050s (Example)



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



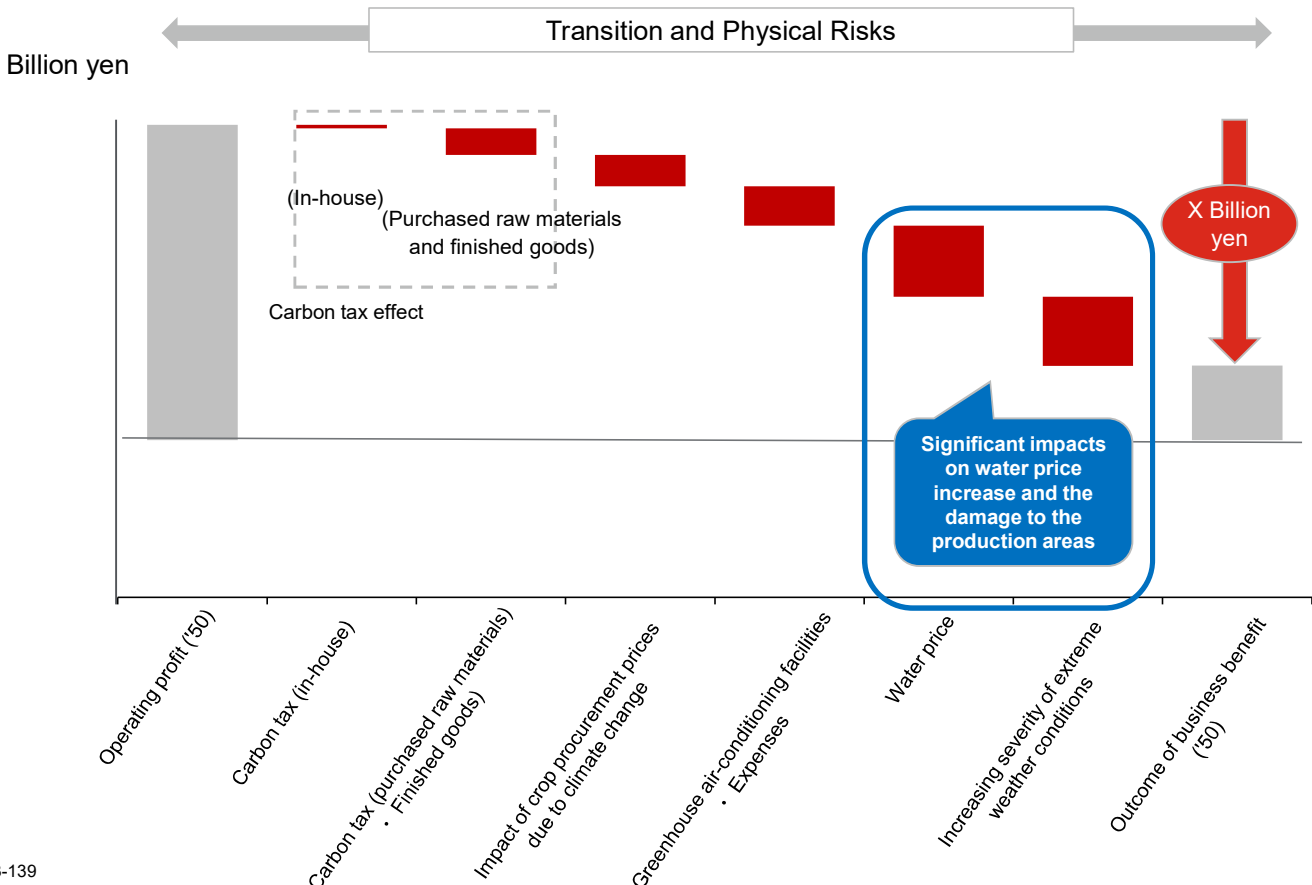
**Summary of estimated risk items**

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°C	2°C	
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
			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
<b>Total</b>							

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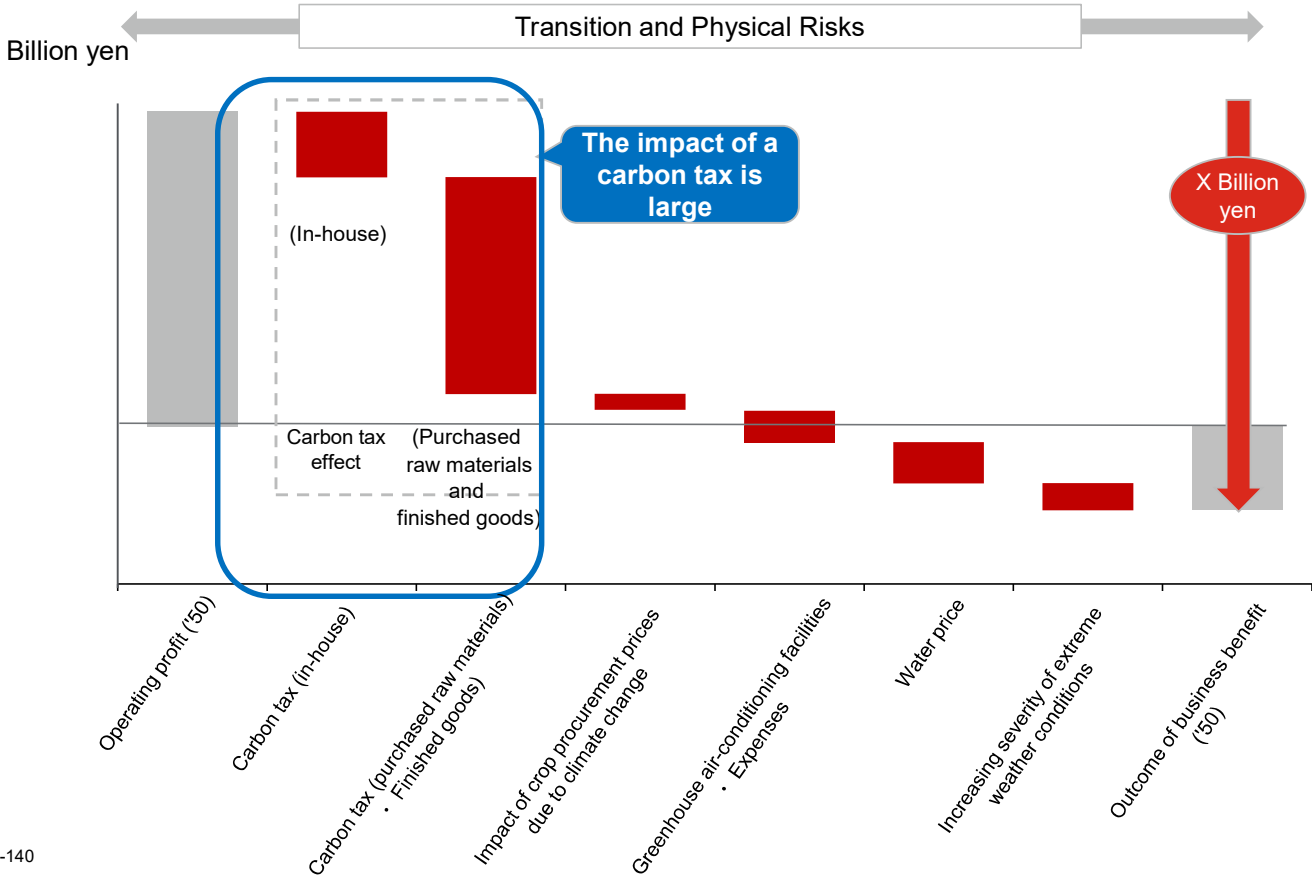
**In the 4°C world, business profit will decrease by X billion yen due to water price increase and damage to production areas.**



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[Step 4: Evaluate business impacts]

In the world of 2°C, the impact of a carbon tax is large, and the business profit will decrease by X billion yen.



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[Step 5: Identify potential responses]

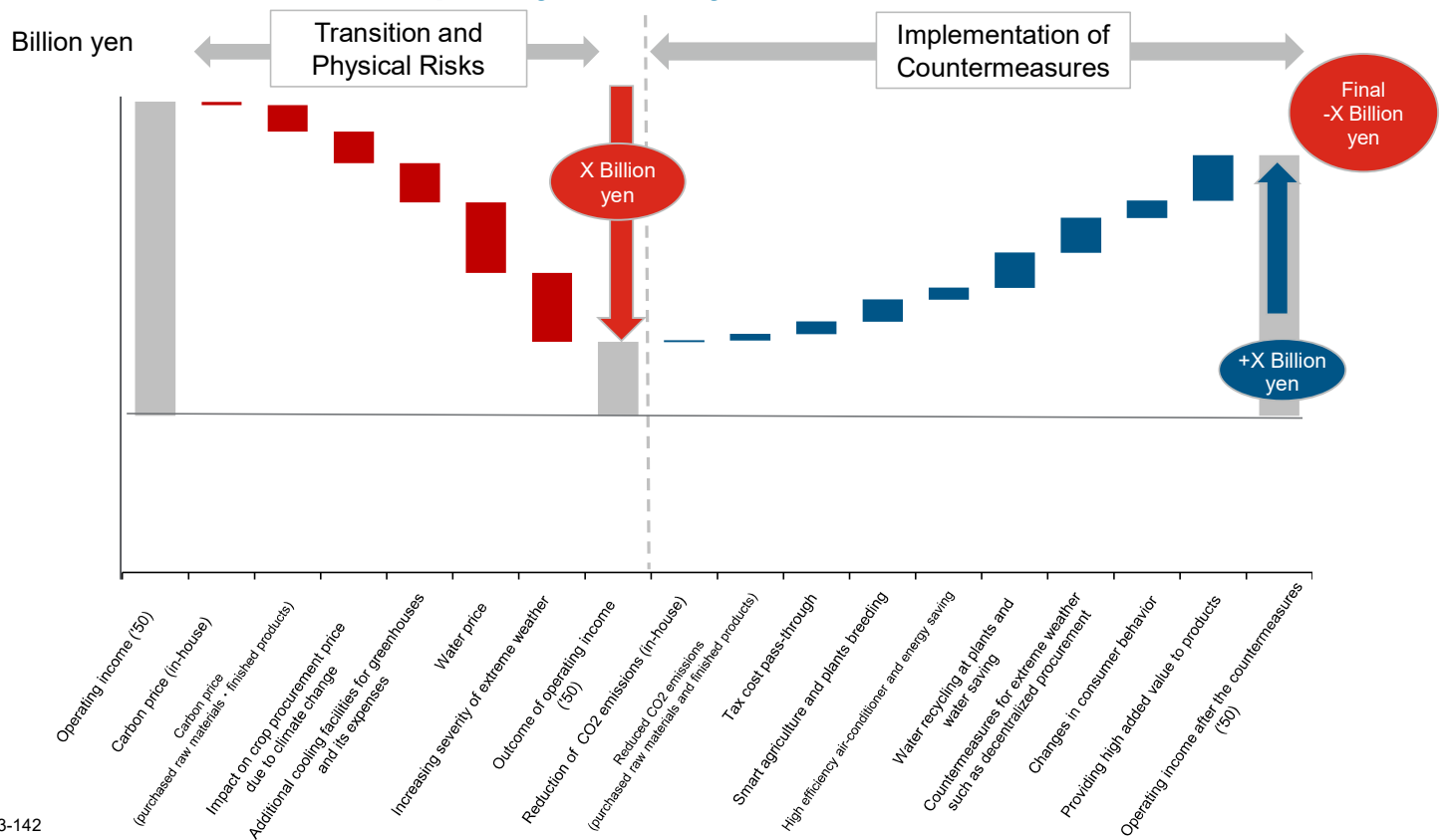
**Summary of estimated countermeasures**

The following measures are necessary in order to recover the business impact that decreasing operating profits

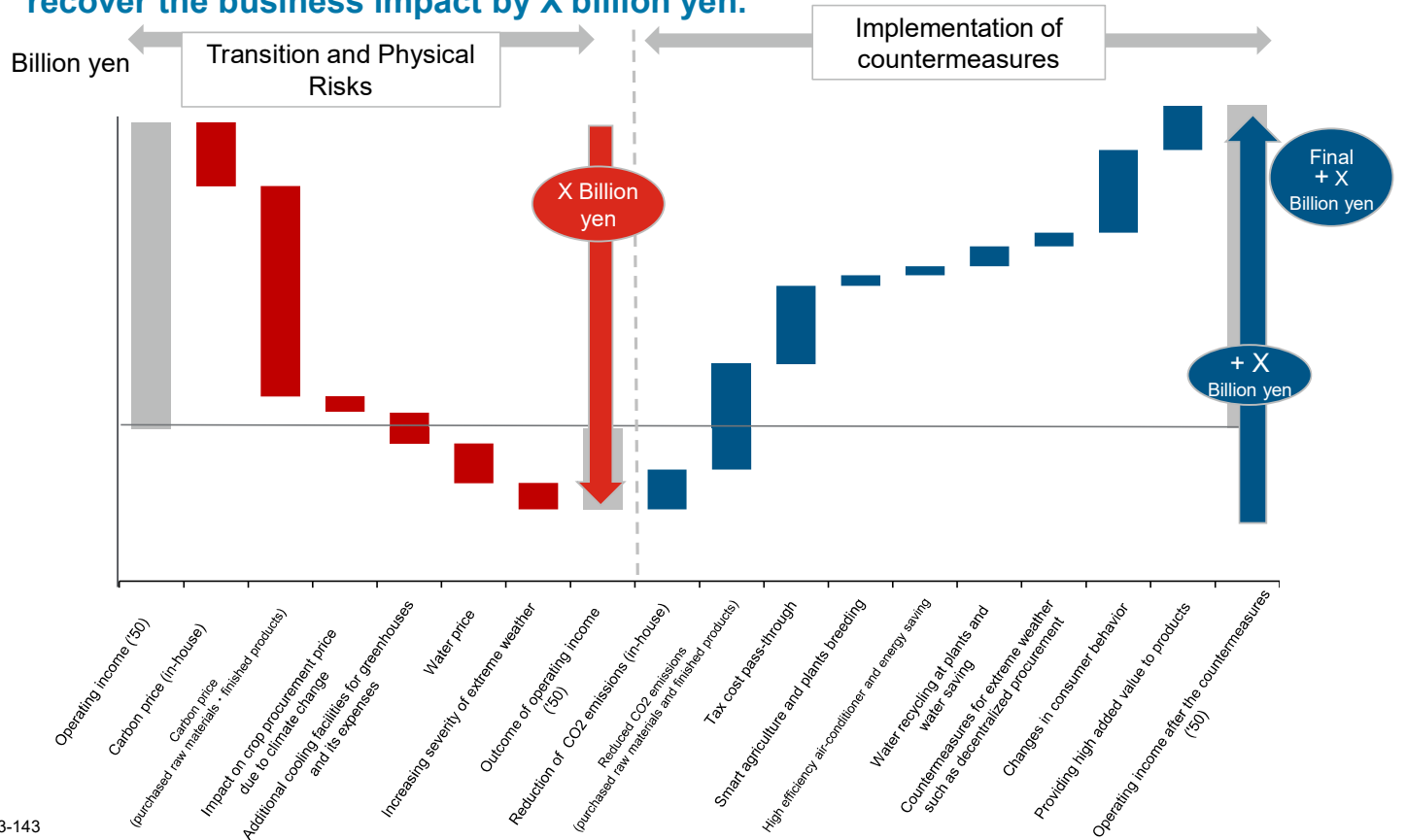
Risk Item	Assumed parameter	Means of recovering the business impact	Effect factor	Impact (Billions of yen)		Pricing logic
				4°C	2°C	
Reduced CO2 emissions	Carbon tax	Achieve the 2050 CO2 reduction target for Scope 1 and 2 (in-house) (50% reduction)	Cost of sales			Estimate the avoided costs of a carbon tax if CO2 target of 2050 CO2 emissions is at the current 50% level.
	⑥ 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)
<b>Total of measures</b>						

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**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**



**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.**



**Practical measures at Kagome to restore business impact**

Item	Specific risk countermeasures	Opportunity
<b>A</b> Carbon price Increase	<ul style="list-style-type: none"> <li>✓ Achieve the goal of reducing CO2 emissions by 50% by 2050 through energy conservation, energy creation, and energy purchase within the Kagome Group</li> <li>✓ Reduce CO2 through collaborating with suppliers</li> <li>✓ Formulate and implement cost-shifting measures for each product</li> <li>✓ Raise in-house CO2 reduction target (emissions 50% → 0%)</li> </ul>	
<b>B</b> Consumer Behavioral change	<ul style="list-style-type: none"> <li>✓ Understanding of consumers' purchasing behavior and accurate sales activities</li> <li>✓ Development of environmentally conscious products and certified products proactively</li> </ul>	<ul style="list-style-type: none"> <li>✓ Develop and sell products that meet the needs of customers under extreme weather conditions</li> </ul>
<b>C</b> Average temperature Increase Rainfall and weather conditions Shifts in patterns	<ul style="list-style-type: none"> <li>✓ Respond to climate change through smart agriculture, such as data utilization</li> <li>✓ Acquire vegetable varieties that can cope with climate change (such as high temperature resistance and pest resistance)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Global expansion of sales of vegetable varieties that can cope with climate change</li> </ul>
<b>D</b> Biodiversity decrease	<ul style="list-style-type: none"> <li>✓ Propose and disseminate agriculture that coexists with all living things</li> </ul>	<ul style="list-style-type: none"> <li>✓ Promote a tomato cultivation that does not use bees in greenhouses</li> </ul>
<b>E</b> To water stress production by decrease	<ul style="list-style-type: none"> <li>✓ Promote water recycling and water conservation efforts at plants (membrane treatment, etc.)</li> <li>✓ Develop and use a tomato cultivation system that can be produced with minimal water</li> <li>✓ Promote recycling-oriented agriculture (use of factory wastewater and rainwater in agricultural land)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Global expansion of a tomato cultivation system capable of producing with minimal water</li> </ul>
<b>F</b> In extreme weather conditions, increasing severity	<ul style="list-style-type: none"> <li>✓ Upgrade procurement strategies (reviewing and diversifying production areas)</li> <li>✓ Create a system that can be cultivated even during storms</li> <li>✓ Upgrade BCP measures (assuming climate change)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Transition to Koto Businesses (To be a service business that is not susceptible to cost fluctuations)</li> </ul>

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# Food

- ✓ Practice Example①: Kagome CO.,LTD.
- ✓ Practice Example②: Calbee, Inc.
- ✓ Practice Example③: Meiji Holdings Co., Ltd.

# History of the Calbee Group

## History of the Calbee Group

Founded in 1949, we celebrated our 70th anniversary in 2019. The path we have taken so far has been truly a continuity of innovations. Beginning with our first hit product Kappa Arare, we have created new value through a number of innovative products that capture social background and changing needs, such as Kappa Ebisen, which uses raw seed products for materials, Jagarico, a handy cup-type snack.

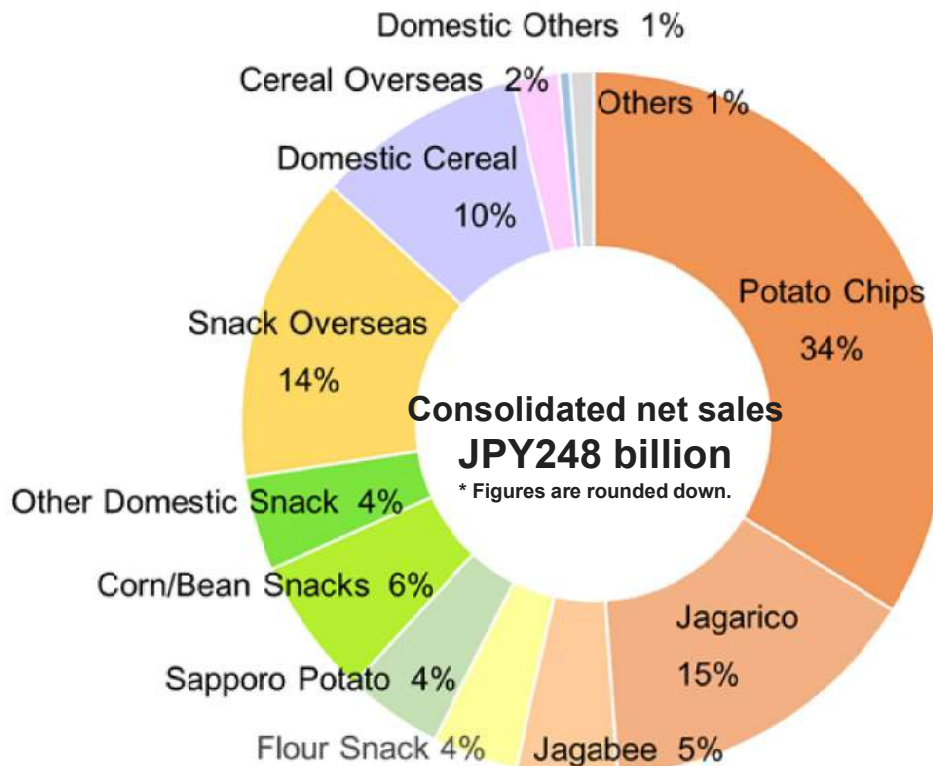
In addition, we have worked to create an integrated agricultural and industrial system centered on raw material potato, as well as to establish quality management and logistics infrastructure to deliver fresh products.

At the foundation of all innovations is Calbee's corporate philosophy, "We are committed to harnessing nature's gifts, to bringing taste and fun, and to contributing to healthy life styles."



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# Product Mix ( Fiscal year ended March 2019 )

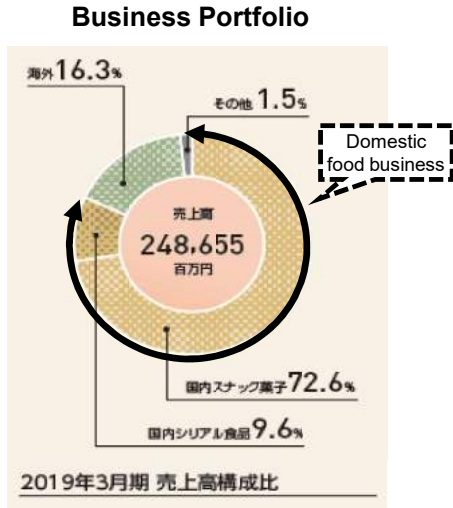


More than 50% of total sales consist of products made from potato.

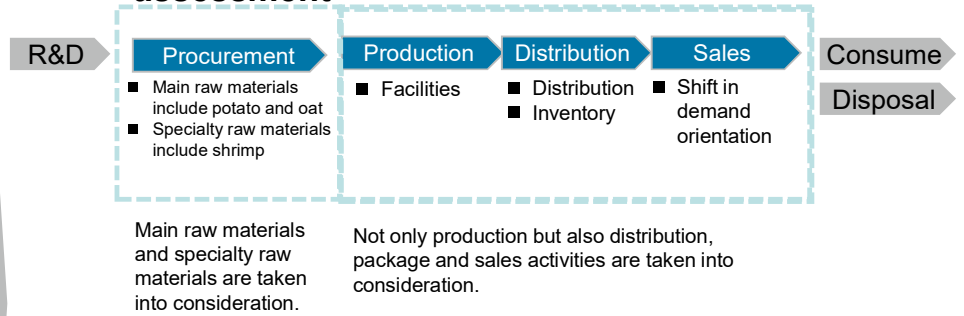
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Assessed Material Risks in Major Value Chain of Domestic Food Business

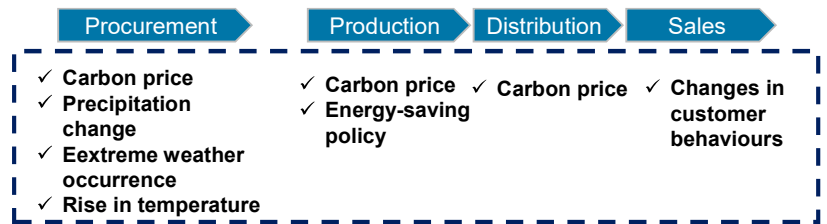
① Selected domestic food business for materiality assessment because it consists of more than 80% of total business



② Selected procurement, production, logistics and sales as key value chains for materiality assessment



Referenced to the list of important parameters of each value chain

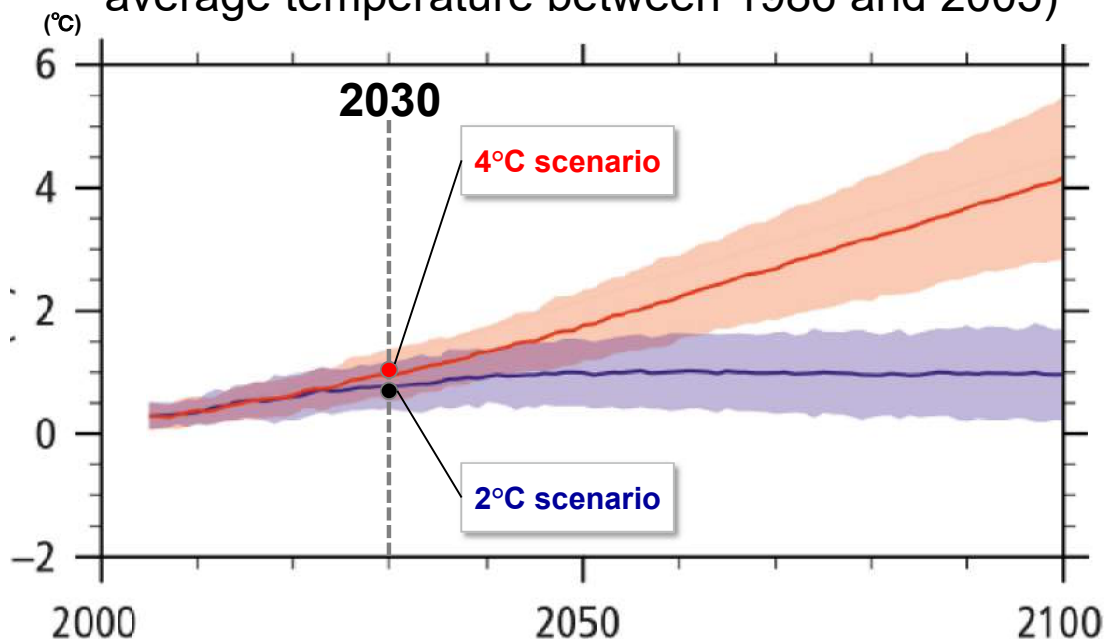


Listed Material Risks Related to Climate Change

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

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

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Defined Worldview of 2 Scenarios Based on Scientific Grounds of IEA

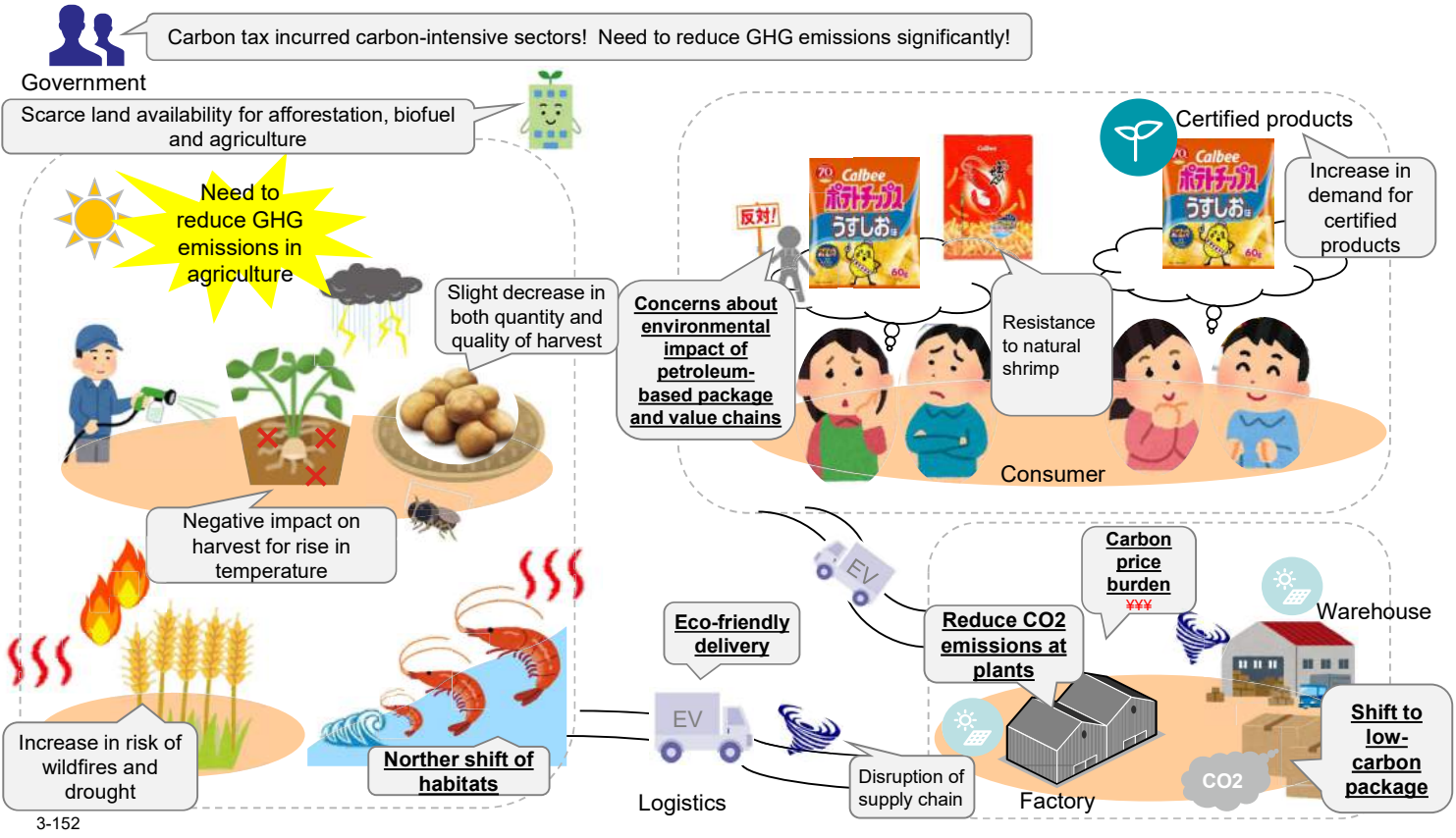
		At present	2030		Source
			2°C world	4°C world	
<b>Carbon price</b>	Carbon tax	※ Average successful bid in the European EU-ETS: Approx. \$8 per tonne	For the developed countries 88 USD per tonne CO2	Assumed no carbon tax in Japan	IEA WEO 2016 (450, NPS Scenario)
<b>Changes in customer behaviours</b>	Response to certification	No procurement	Certification price + ●●%	Assuming no certification	Private research firm (No scenario)
<b>Raw material impacts due to precipitation changes caused by rise in temperature</b>	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)
<b>Change in ocean environment</b>	Changes in fishery	(Base year)	Assume no change	Japan - ●% U.S. import - ●% China import - ●%	Academic literature (A2 scenario)
<b>Occurrence of extreme weather events such as heat waves, tropical cyclones, floods, etc.</b>	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.

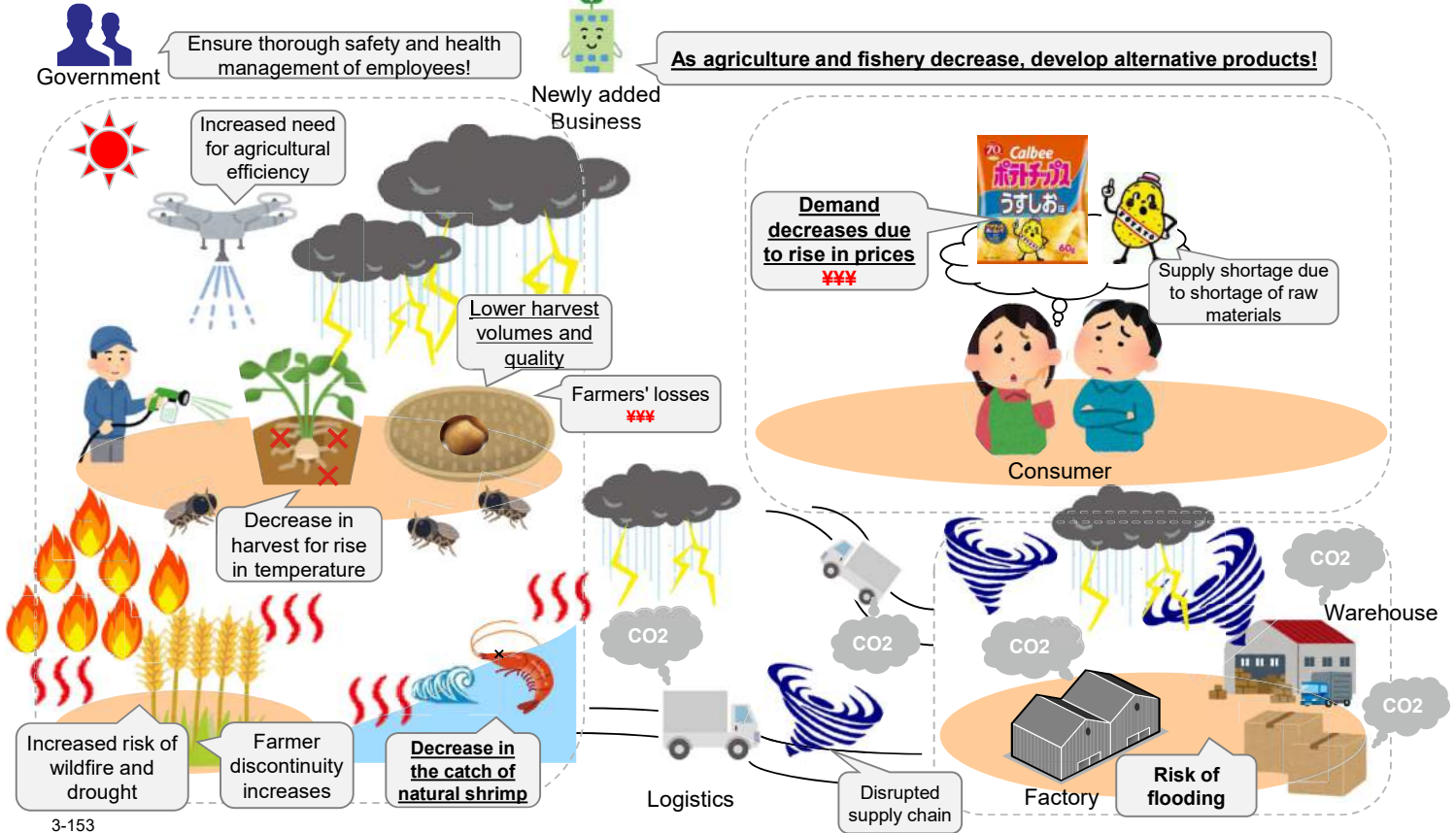
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2°C scenario



4°C scenario



[Step 4: Evaluate business impacts]

Evaluate the impact of transition and physical risks based on sales, market size, etc. in 2030. **Calbee**

Risk Item		Parameter		Impact		Estimated assumptions (common for 2°C and 4°C)	
				2°C	4°C		
Transition risk	Policy	Carbon price	① Carbon tax			<ul style="list-style-type: none"> <li>CO2 Emissions from Manufacturing Sites × Carbon-Prices</li> <li>CO2 emissions from use of cardboard and packaging materials × carbon prices</li> <li>CO2 emissions on logistics × carbon prices</li> </ul> → 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			<ul style="list-style-type: none"> <li>Decrease in sales of products not certified for sustainability × sales</li> </ul>	
Physical risk	Chronic	Changes in precipitation, Impact on raw material harvest	③ Changes in potato yields			<ul style="list-style-type: none"> <li>Shift harvest area to make up for potential decline in yields</li> </ul>	
			④ Changes in oat yields			<ul style="list-style-type: none"> <li>Other factors would allegedly exist to hinder the correlation between the increase in yields and the price increase in the market principle,</li> </ul>	
	Acute	Changes in ocean environment	⑤ Changes in fishery			<ul style="list-style-type: none"> <li>Estimated changes in procurement from each area by referring to the fluctuations of fishery in Japan, the U.S., and China.</li> </ul>	
			⑥ Response to drought and wildfires			<ul style="list-style-type: none"> <li>Insufficient parameters of palms and oats (not estimated)</li> </ul>	
				⑦ Increasing number of days of heavy rain per year			<ul style="list-style-type: none"> <li>Damage from past heavy rain × Increase rate of heavy rain</li> </ul>
					⑧ The number of typhoons and cyclones		
					<ul style="list-style-type: none"> <li>Damage from past typhoons × Rate of increase in typhoons</li> </ul>		

Impact assessments are performed using parameters of 2°C and 4°C.

[Step 5: Identify potential responses]

Consider initiatives for multiple scenarios **Calbee**

Item	Existing Initiatives	Additional counter measures against risks
<b>Carbon price increase</b>	<ul style="list-style-type: none"> <li>✓ CO<sub>2</sub> Reduction Target (30% Reduction by 2030)</li> <li>✓ Conversion to liquefied natural gas (LNG)</li> <li>✓ Implementation of high-efficiency operation of biomass boilers</li> <li>✓ Aggressive introduction of energy-saving equipment and energy-saving activities at offices</li> <li>Improve load factor by standardizing cases</li> <li>✓ Low and decarbonized logistics                             <ul style="list-style-type: none"> <li>– Promoting joint delivery and modal shifts</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>✓ Integration of production lines and factories to improve energy efficiency</li> <li>✓ Implementation of carbon offset by credit, tree-planting and blue-carbon offsetting</li> <li>✓ Achieve 100% renewable energy</li> </ul>
<b>Sales decrease for shifting consumer behavior</b>	<ul style="list-style-type: none"> <li>✓ Reducing packaging materials and eliminating plastics</li> <li>✓ Assessing and obtaining certification</li> <li>✓ Expansion of best before date to reduce food losses</li> </ul>	<ul style="list-style-type: none"> <li>✓ Actively participating in the initiative</li> <li>✓ Obtaining sustainability certification and establishing voluntary certification system</li> </ul>
<b>Harvest change due to rise in temperature</b>	<ul style="list-style-type: none"> <li>✓ Diversification of farming areas for potato and other raw materials</li> <li>✓ Promotion of field storage management system</li> <li>✓ Development of varieties resilient to climate change and environmental change</li> <li>✓ Product development using materials other than potato</li> </ul>	<ul style="list-style-type: none"> <li>✓ Utilization of development tools of and collaboration with research institutions, etc. to mitigate risks</li> <li>✓ Promotion of consortia and initiatives in Japan and participate in working groups to consider countermeasures</li> <li>✓ Lobbying to deregulations on agriculture</li> <li>✓ Diversification of product portfolio and raw materials</li> <li>✓ Storage of carbon in soil, innovation in cultivation methods and enhancement of variety cultivation</li> <li>✓ Strengthening BCP with alignment among production and logistics sites globally</li> </ul>
<b>Change in precipitation</b>		
<b>Increase in extreme weather events</b>		
<b>In the marine environment Change</b>		

# Food

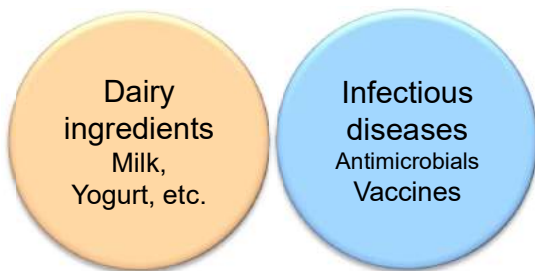
- ✓ Practice Example①: Kagome CO.,LTD.
- ✓ Practice Example②: Calbee, Inc.
- ✓ Practice Example③: Meiji Holdings Co., Ltd.

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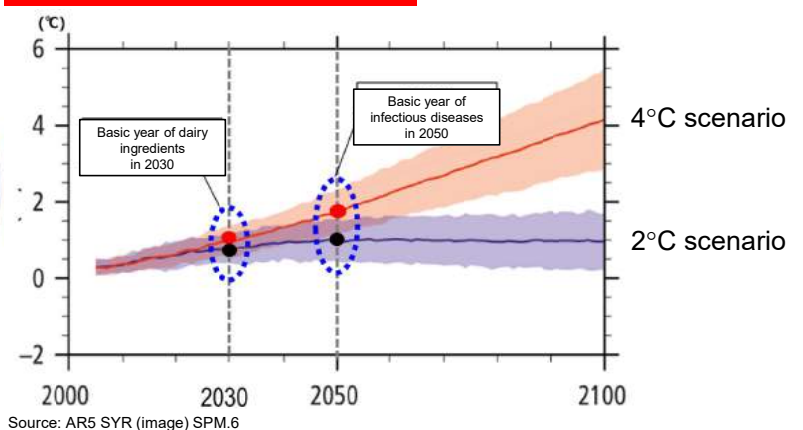
## TCFD scenarios (summary)



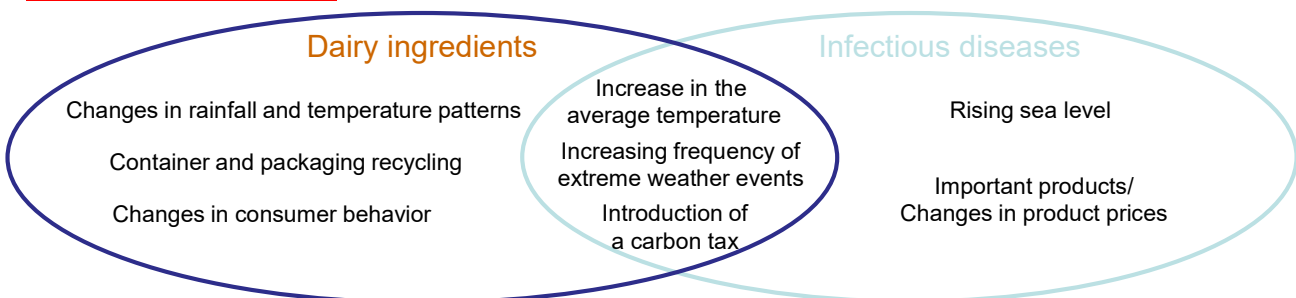
### Themes to be analyzed



### Scenario setting at 2°C and 4°C



### Important risk items



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# Risk assessment for dairy ingredients



Risk Item	Business impact		Assessment
Small classification	Index	Discussion	
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 <sub>2</sub> 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.	

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# Risk Assessment in Infectious Diseases



Risk Item	Business impact		Assessment
Small classification	Index	Discussion (Example)	
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.	

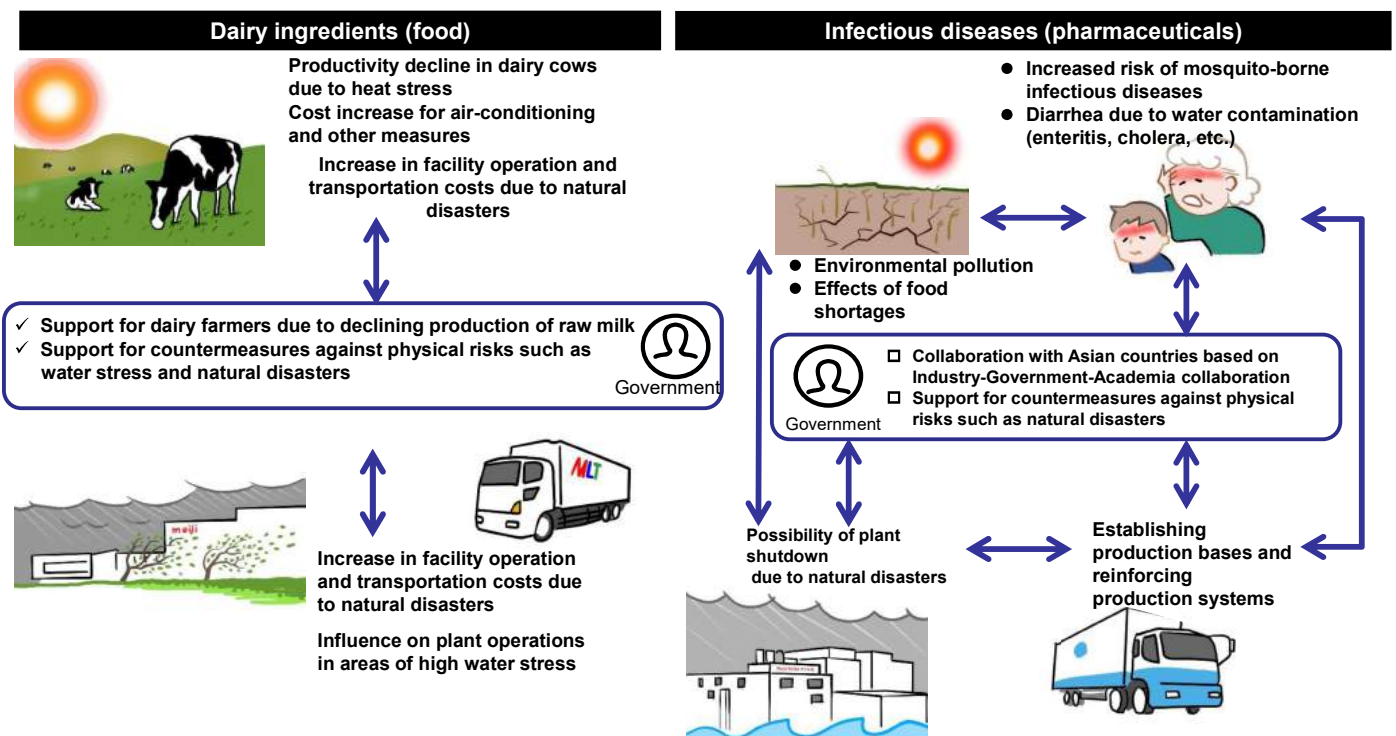
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		At present	Dairy ingredients (food)		Infectious diseases (pharmaceuticals)		Source
			2030		2050		
			4°C world	2°C world	4°C world	2°C world	
Carbon price	Carbon tax	-	EU \$23 per tonne China \$23 per tonne Japan not yet introduced	Japan and Europe \$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

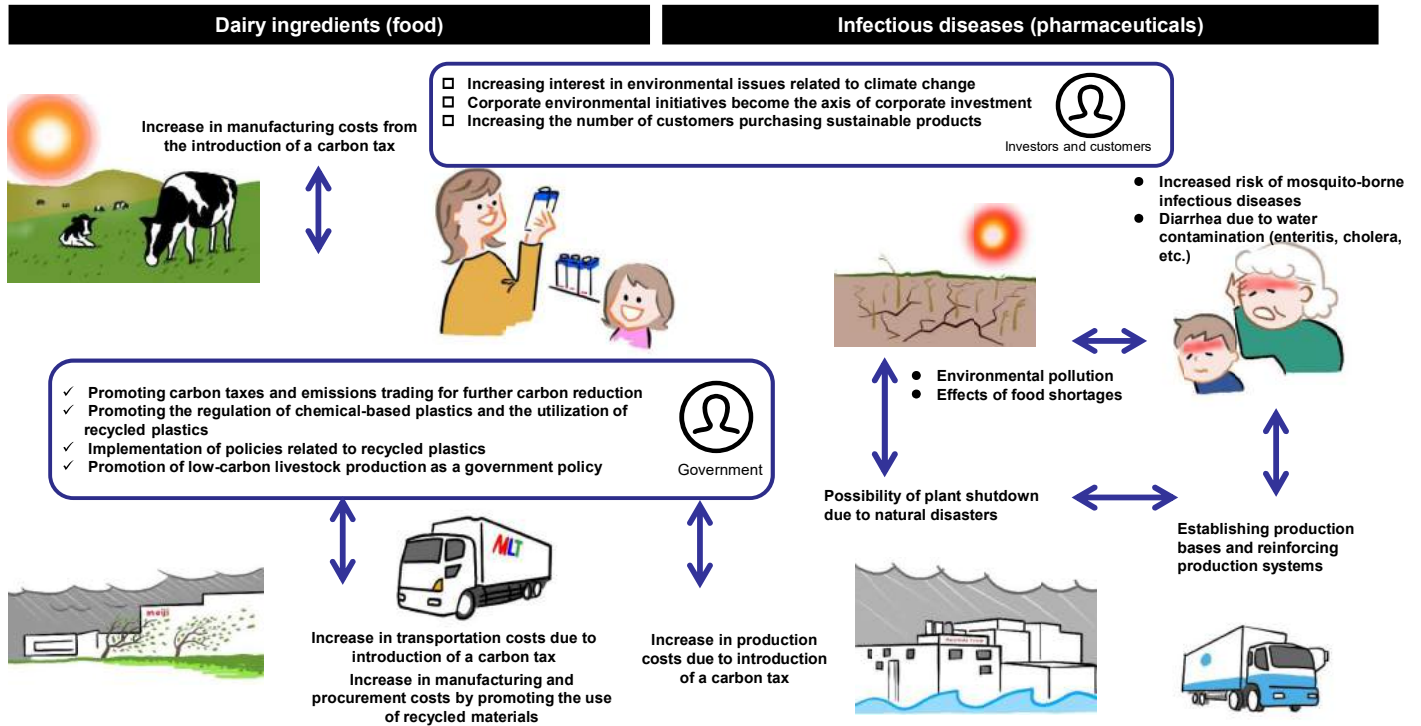
While low carbon/decarbonization is not promoted (business as usual) and the physical risk increases, the possibility of the market expansion of infectious diseases is considered.



# 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.



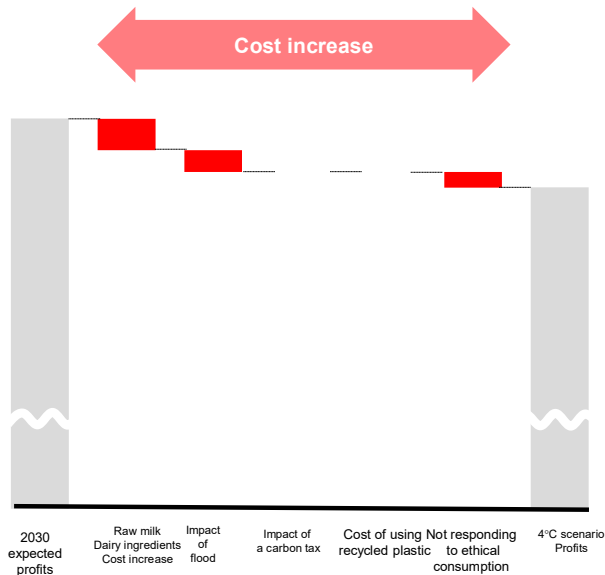
3-162

# Important risk items and evaluation of business impacts on dairy ingredients

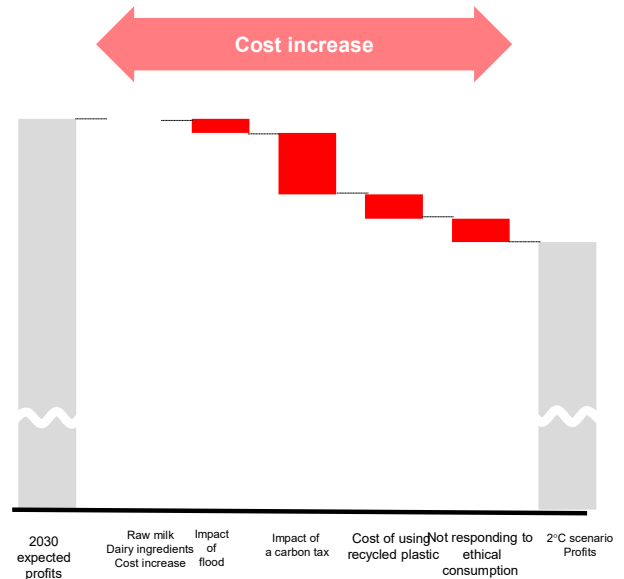
Risk item	Expected business impact	Impact value
Changes in average temperature	Nurturing cows by <b>preventing hot weather (feeding management, cattle barn environment)</b>	Increased cost of raw milk, dairy raw materials
	<b>Increase in the price of cattle feed ingredients due to a decrease in crop yield</b>	
	Increased demand for products to prevent <b>thirst</b> due to temperature increase, <b>and increased heatstroke due to temperature increase</b>	Increased demand for products for prevention of thirst and heatstroke
Changes in precipitation patterns	<b>Need to improve quality of water in manufacturing and rearing</b> due to water quality deterioration*not in 2030	Increased cost due to water risk responses
	<b>Increase in the unit price for water supply in animal-rearing areas due to drought</b>	
Frequency of extreme weather events (typhoons, floods, etc.)	<b>Lost opportunities due to suspension of production and logistics</b>	Decreased opportunity because of stopped supply chain
	<b>Restoration of damaged facilities for production and logistics due to flood</b>	
Carbon price	<b>Introduced a carbon tax in manufacturing sites (plants)</b>	Increased cost due to a carbon tax
	<b>Introduced a carbon tax in logistics</b>	
Recycling of packages	<b>Introducing recycled plastics</b> due to plastics ban	Increased cost due to replacement with recycled plastics
Changes in customer behaviors	<b>Growing environmental consciousness (reduction of environmental burden - environmentally-friendly) due to increased frequency of extreme weather and environmental regulation (such as CO2 and plastics).</b>	Increased ethical consumption

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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
<p>Seize opportunities</p> <p>Expansion of ethical consumption</p> <p>Expansion of demand for responding to temperature increases, etc.</p>	<ul style="list-style-type: none"> <li>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</li> <li>Shift to environmentally conscious raw materials FSC-certified paper and recycled paper: FY2018 Result 55.3% Certified palm oil: FY2019 Plan Use approx. 10%</li> </ul>	<ul style="list-style-type: none"> <li>Examination of products that meet the possibility of expanding demand for products with minimal environmental impact</li> <li>Considering expansion of anti-thirst and anti-heat stroke products</li> <li>Aggressive use of environmentally friendly raw materials in response to heightened environmental awareness due to extreme weather and various regulations</li> </ul>
<p>Risk mitigation</p> <p>Raw material price increase</p> <p>Plastic regulations</p> <p>Increased water risk</p> <p>Introduction of a carbon tax</p>	<ul style="list-style-type: none"> <li>Reduction in plastic consumption due to thinning, etc.</li> <li>Introduce solar power facilities for renewable energy</li> </ul> <p>Completion drawing (image) the solar facilities of Meiji Co., Ltd. Kyushu Plant</p>	<ul style="list-style-type: none"> <li>Significant reduction in plastic consumption due to thinner-walled plastics and shift to paper, and replacement with recycled plastics.</li> <li>Considering the use of raw materials with minimal logistics impact</li> <li>Efficiency of water consumption in production and flood countermeasures</li> <li>Further promotion of energy conservation and shift to renewable energy</li> <li>Considering support for heat countermeasures to maintain milk production for dairy farmers</li> </ul>

# 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	<b>Japanese encephalitis, malaria, dengue fever, West Nile fever, and Rift Valley fever</b> Tick-borne Encephalitis Hantavirus Pulmonary Syndrome Plague Schistosomiasis japonica
	Water/ Soil-borne	Water Soil contamination	<b>Diarrhea (cholera, etc.)</b> Anthrax
	Food (animal derived) - borne	Meat Fish meat	Enterohemorrhagic E. coli O157 infection, salmonellosis Anisakiasis



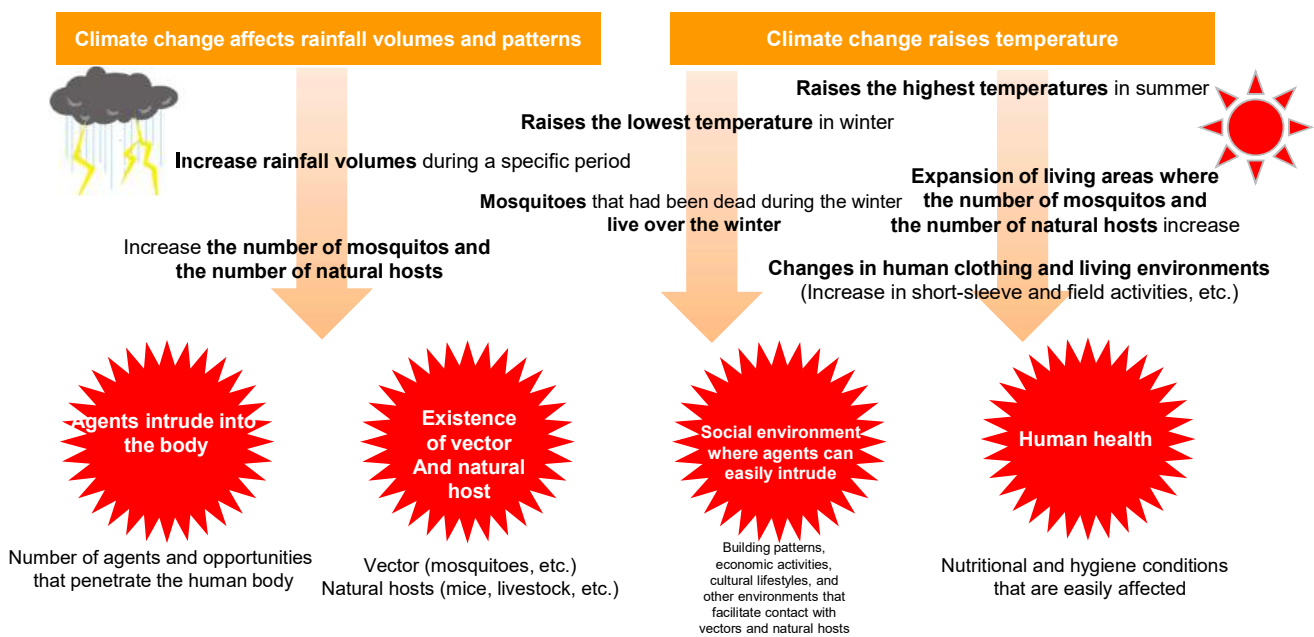
Infectious Diseases assumed to be impacted by global warming



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 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)



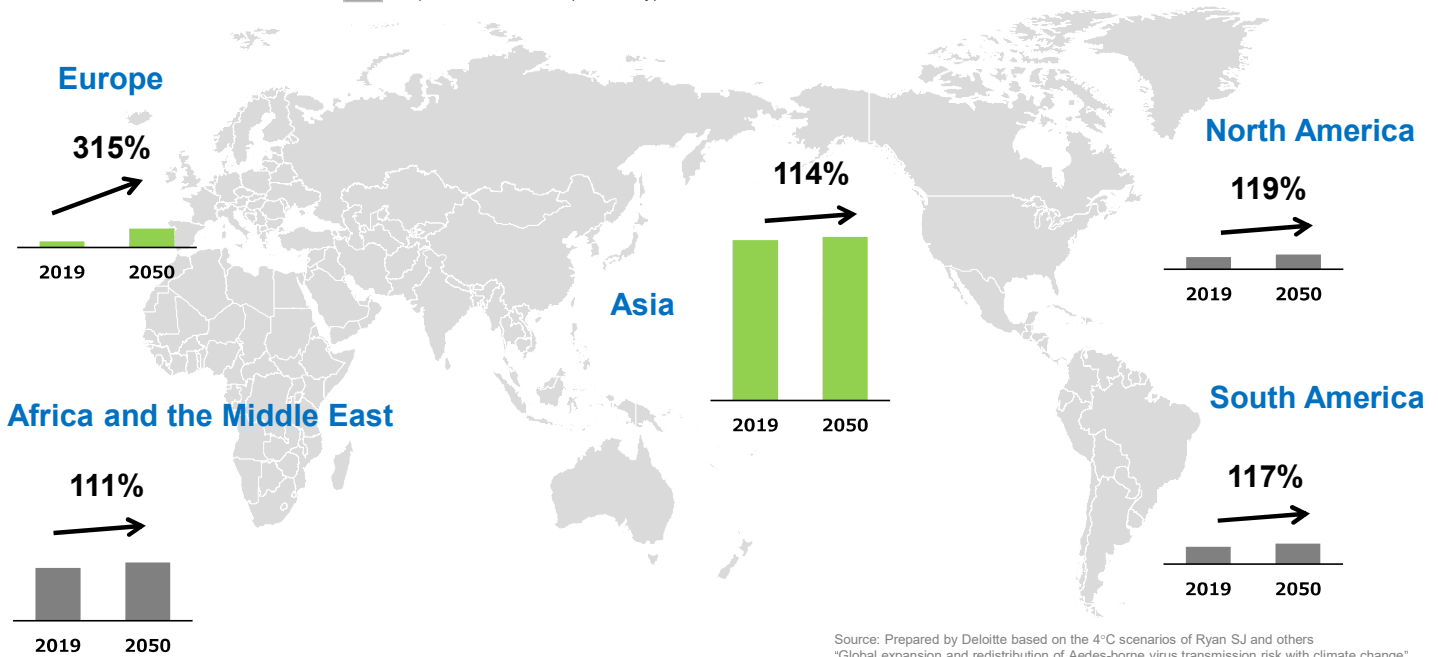
# Population growth rate at risk due to increased temperature of mosquito-borne infectious diseases (4°C scenario)



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"

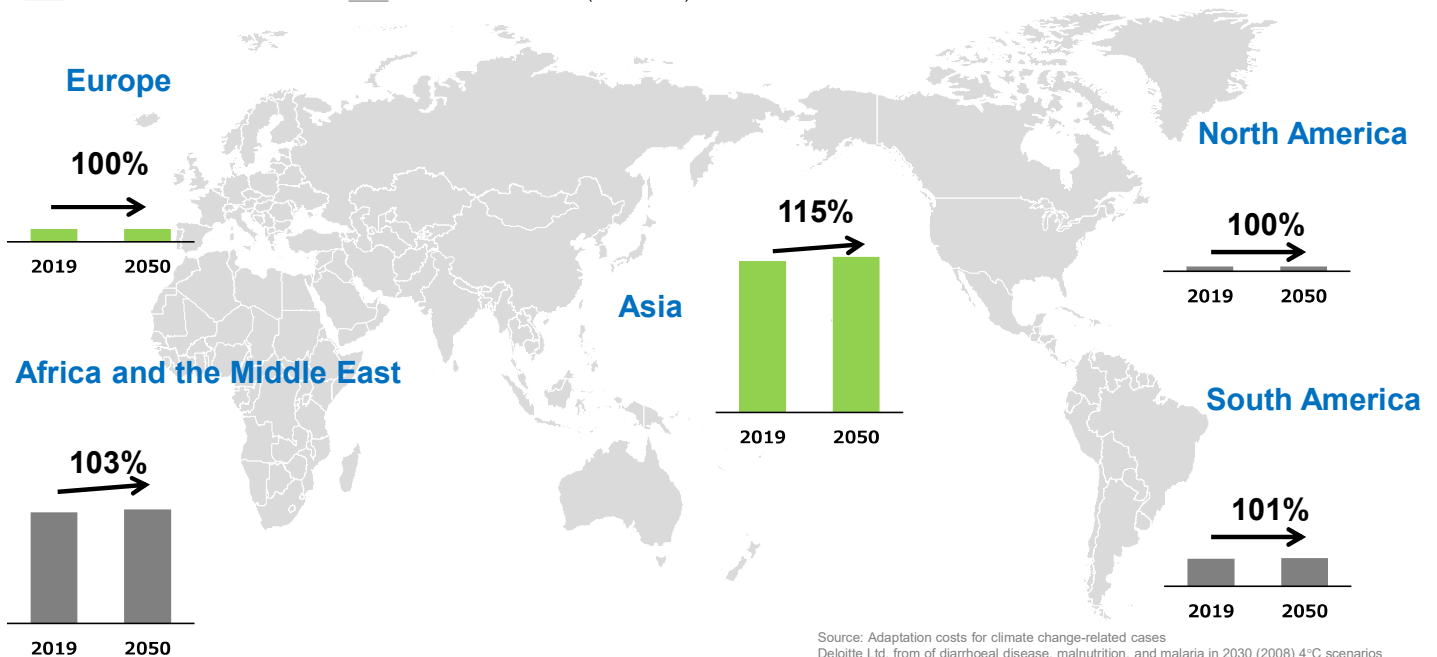
# Increasing rate due to number of diarrhea and temperature increases (4°C scenario)



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

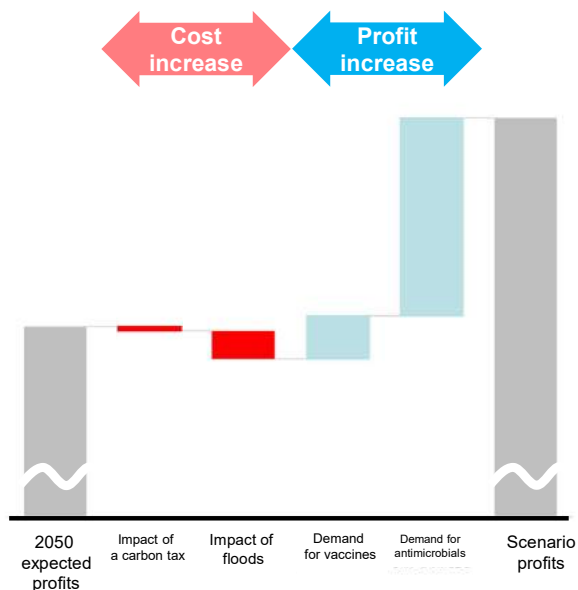
# Important risk items and evaluation of business impacts on Infectious Diseases

Risk item	Expected business impact		Impact value
Changes in average temperature	Increased risk for Mosquito-borne infection	Increased demand for vaccine and antimicrobials	4°C : XX billion USD 2°C : XX billion USD
	Increased cases of diarrhea		
Frequency of extreme weather events (typhoons, floods, etc.)	<u>Lost opportunities due to suspension of production and logistics</u>	Decreased opportunity because of stopped supply chain	4°C : XX billion USD 2°C : XX billion USD
	<u>Restoration of damaged facilities for production and logistics due to flood</u>		
Carbon price	<u>Introduced a carbon tax in manufacturing bases (plants)</u>	Increased cost due to a carbon tax	4°C : XX billion USD (only in China) 2°C : XX billion USD
	<u>Introduced a carbon tax in logistics</u>		
Rising sea level	<u>Increased flood damage due to the sea level rise</u>	Increase cost due to cancelled manufacturing	4°C : Assume no damage due to rising sea level 2°C : Assume no damage due to rising sea level

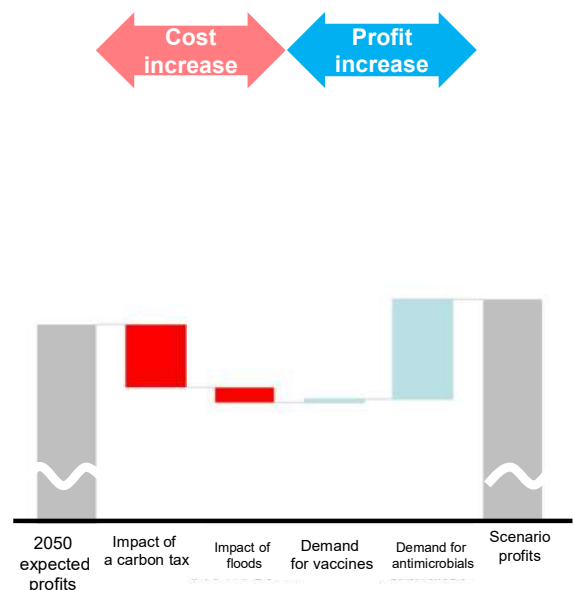
3-170

# Profit simulation in Infectious diseases by Scenario

Simulation under the 4°C Scenario






Simulation under the 2°C Scenario



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# Outline of Business Risks and Opportunities for Infectious Diseases



	Existing Initiatives	Future Initiatives
Seize opportunities	<ul style="list-style-type: none"> <li>□ Increase in sales volume of products due to the expansion of infectious diseases</li> </ul>	<ul style="list-style-type: none"> <li>□ Strengthen business development in Asian countries with subsidiaries as bases.</li> </ul>
Growing demand for infectious disease drugs and vaccines	<ul style="list-style-type: none"> <li>□ Upgrading of production bases in Asian countries</li> <li>□ Reinforcement of product lineup</li> </ul> 	<ul style="list-style-type: none"> <li>□ Contributing to the Asian market through industry-government-academia-medical collaboration</li> </ul> 
Risk mitigation	<ul style="list-style-type: none"> <li>□ Strengthening of stable procurement system</li> <li>□ Building a Production System to Ensure Stable Supply</li> <li>□ Periodic maintenance of equipment</li> <li>□ Energy conservation promotion</li> <li>□ Ensuring the safety of plant employees</li> <li>□ Proper management of equipment using fluorocarbons</li> </ul> 	<ul style="list-style-type: none"> <li>□ Implement measures to increase the efficiency of water consumption in production and to prevent plant shutdowns due to natural disasters</li> <li>□ Promotion of energy conservation and shift to renewable energy</li> <li>□ Reinforcement of management for chemical resistance in factory wastewater</li> <li>□ Appropriate management of plant waste and total material input</li> <li>□ Reduction of plastic consumption by considering use of thinner-walled and biodegradable plastics</li> </ul>
Increased water risk Introduction of a carbon tax		

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## Other Sector

✓ Practice Example①: KYOCERA Corporation  
(Electronic Equipment)

✓ Practice Example②: Seven & i Holdings Co., Ltd.  
(Retailing)

✓ Practice Example③: Lion Corporation  
(Consumer Products)

# 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 <sup>※</sup> 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

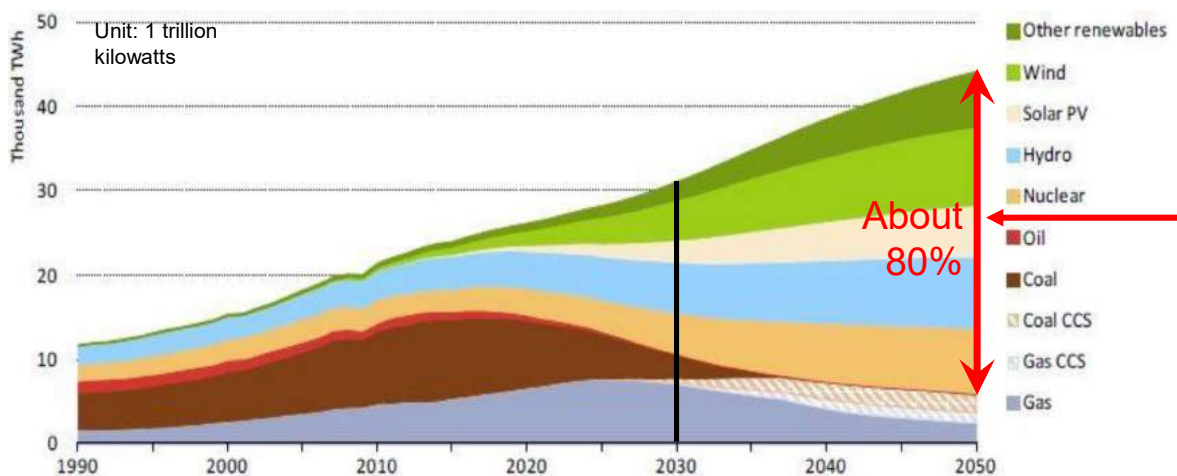
※ VPP (Virtual Power Plant): Technologies that can be used to balance power supply and demand by combining distributed energy resources possessed by factories, households, etc., and then controlling these resources remotely and in an integrated fashion.  
Since it functions like a single power plant, it is called a “virtual power plant.”

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## Assumptions for Scenario Analysis

To keep temperature increases below 2°C

Temperature increases can be limited to less than 2°C by increasing the proportion of non-fossil fuels in the world



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.

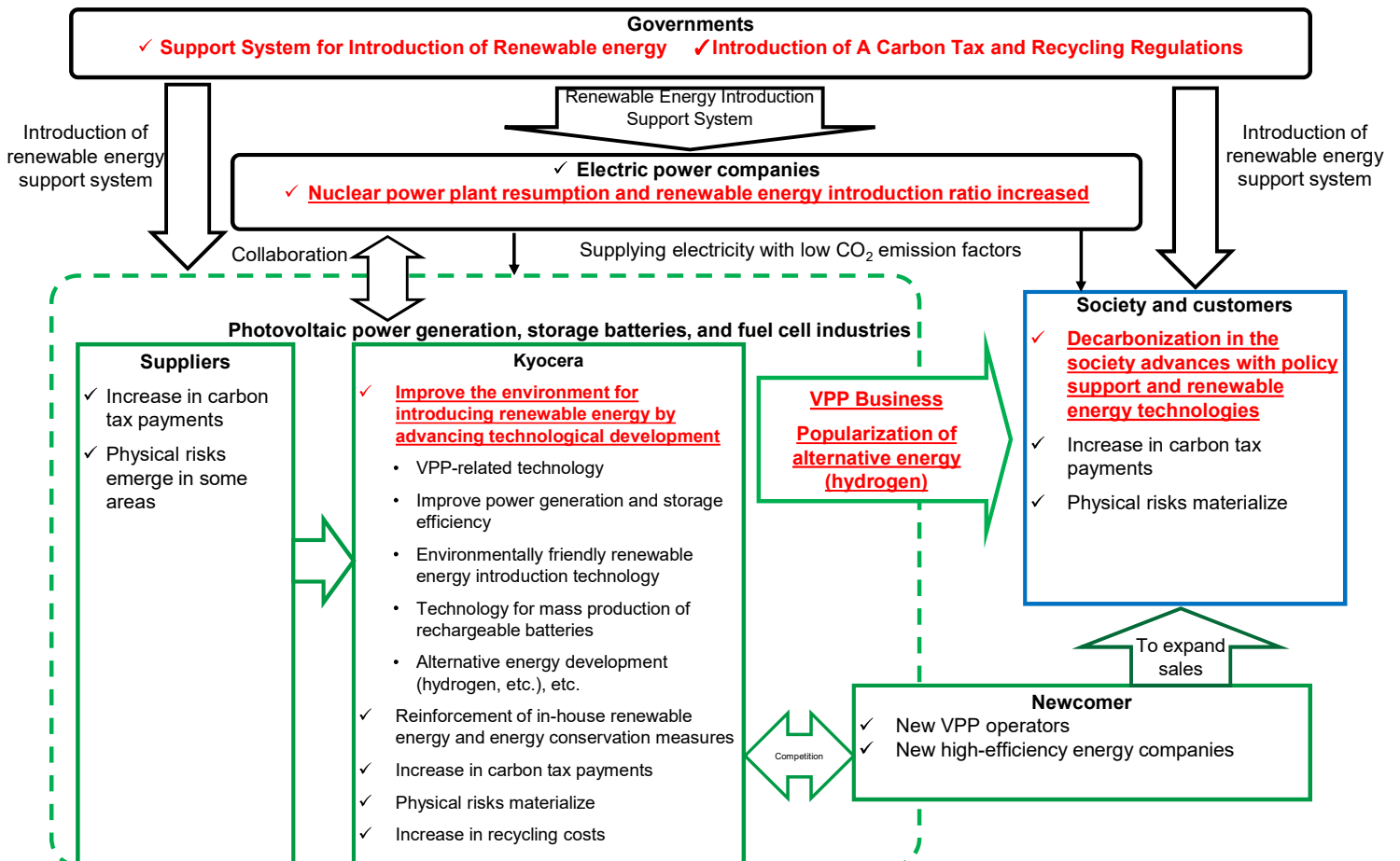
3-175

# Assumptions for Scenario Analysis

			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

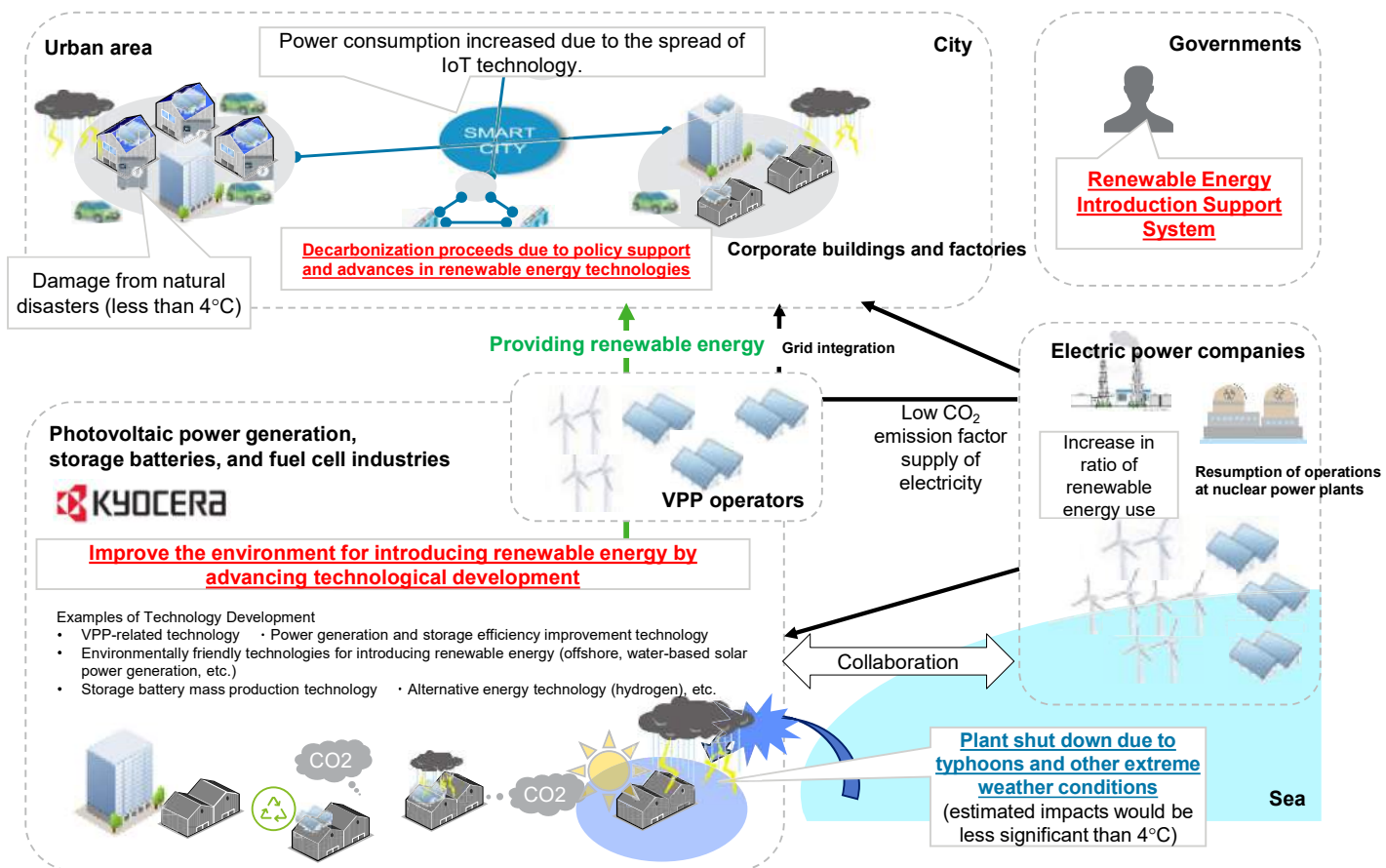
3-176

# The 2°C World: Shift toward decarbonized society



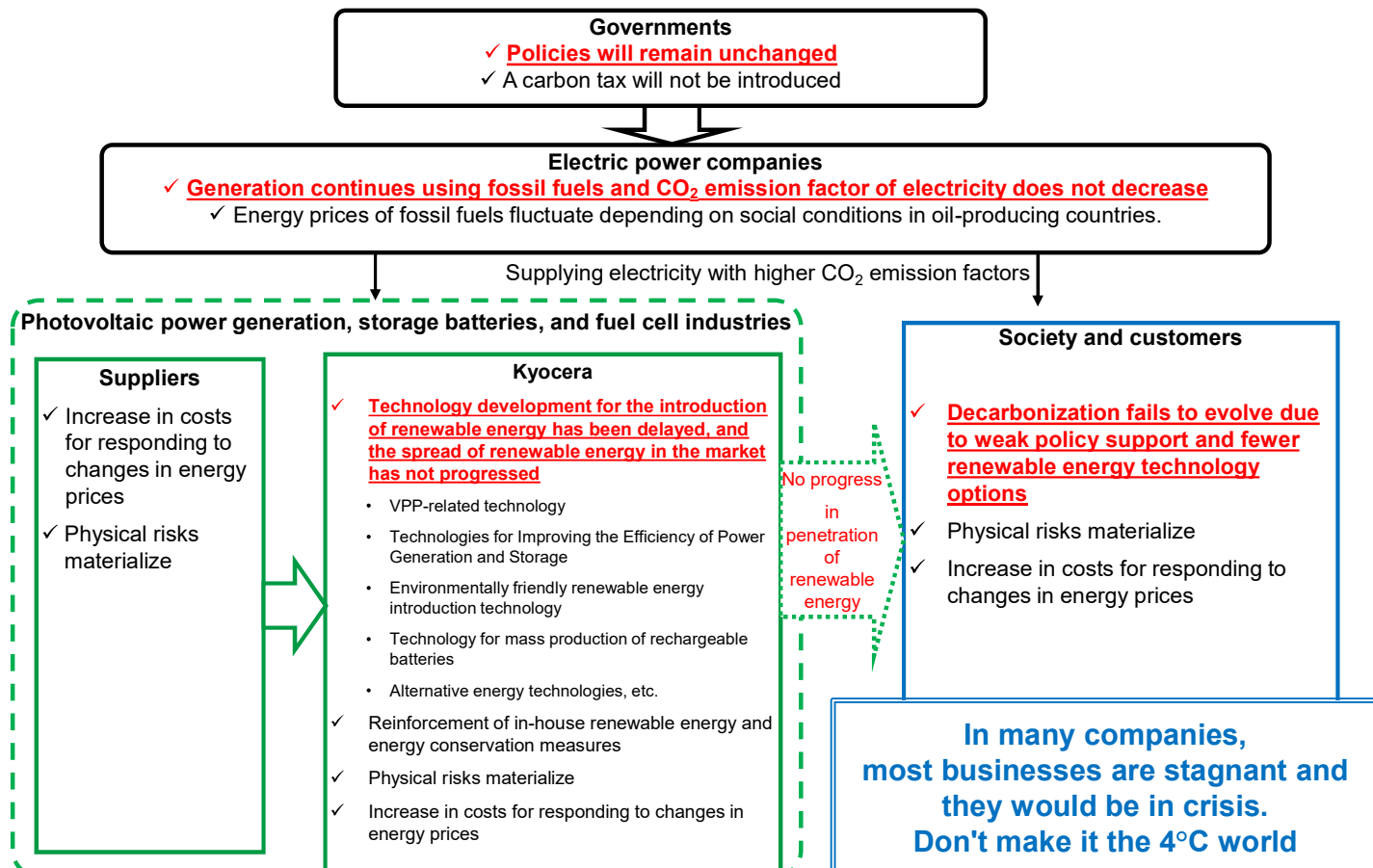
3-177

# The 2°C World: Shift toward decarbonized society



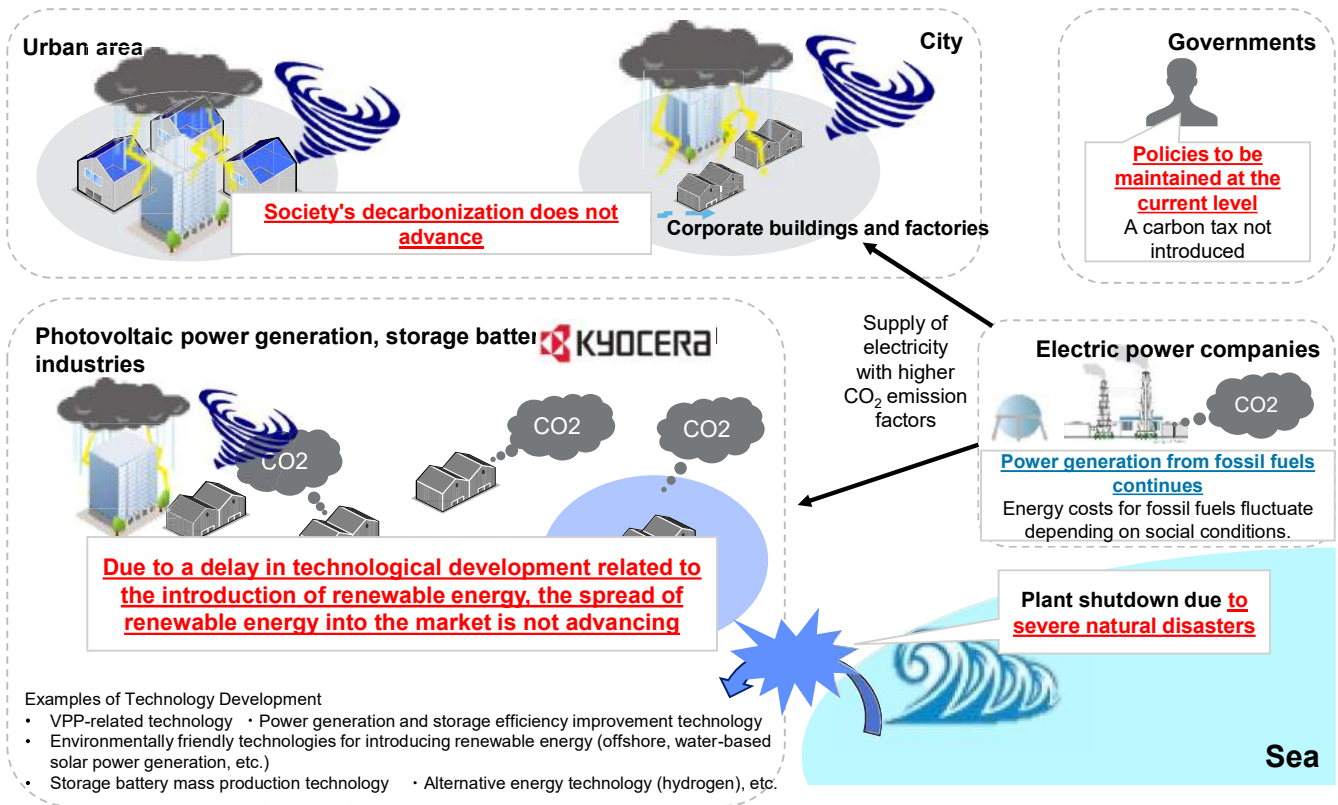
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# The 4°C World: Current Extension



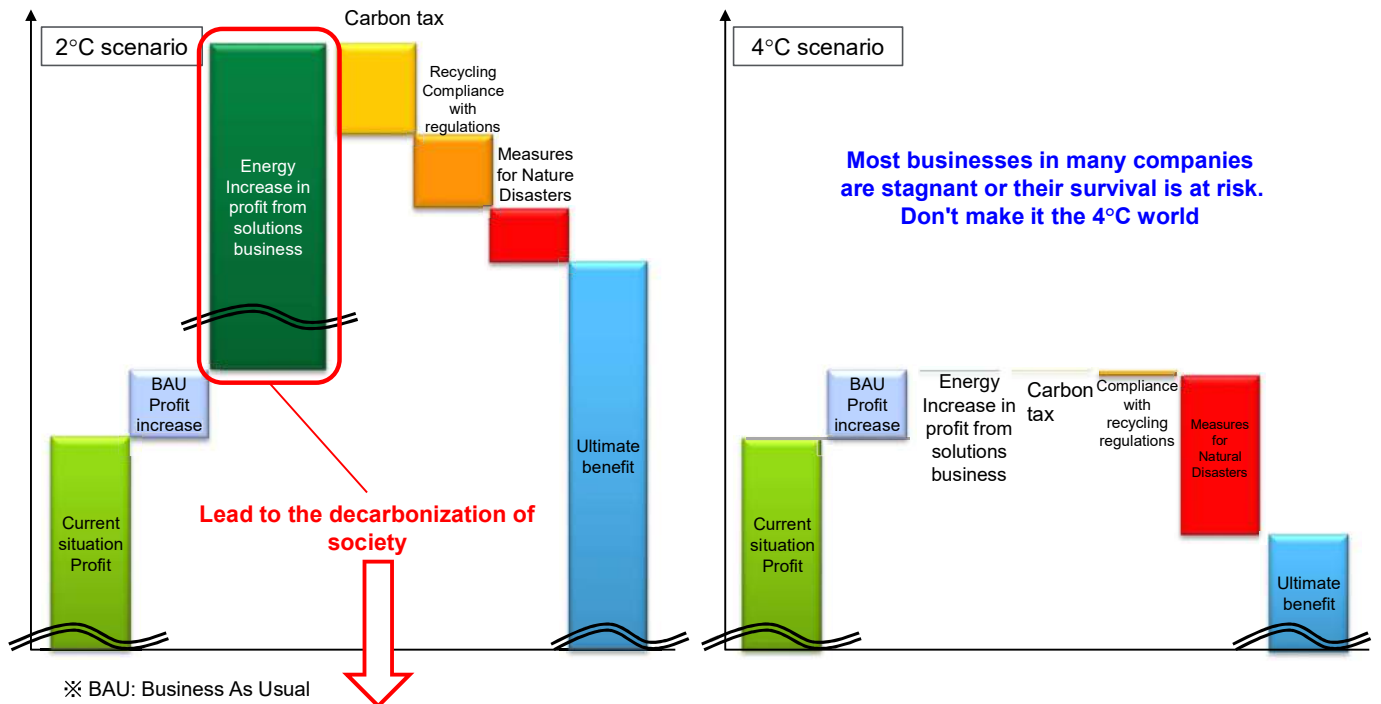
3-179

# The 4°C World: Current Extension



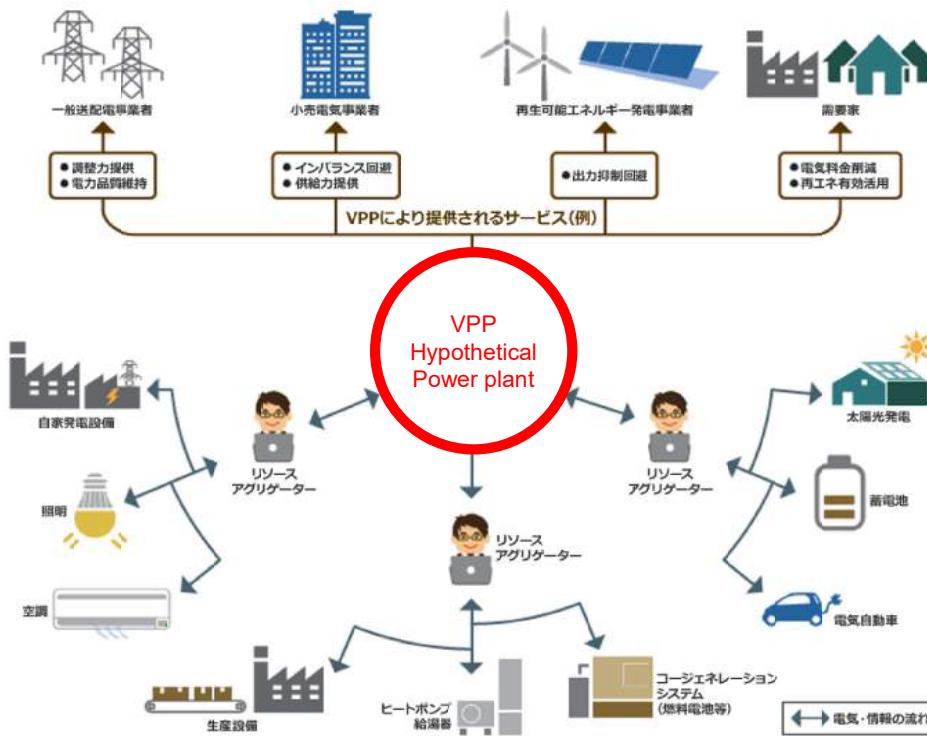
**Most businesses in many companies are stagnant or their survival is at risk. Don't make it the 4°C world**

# Evaluate business impacts



**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



## 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

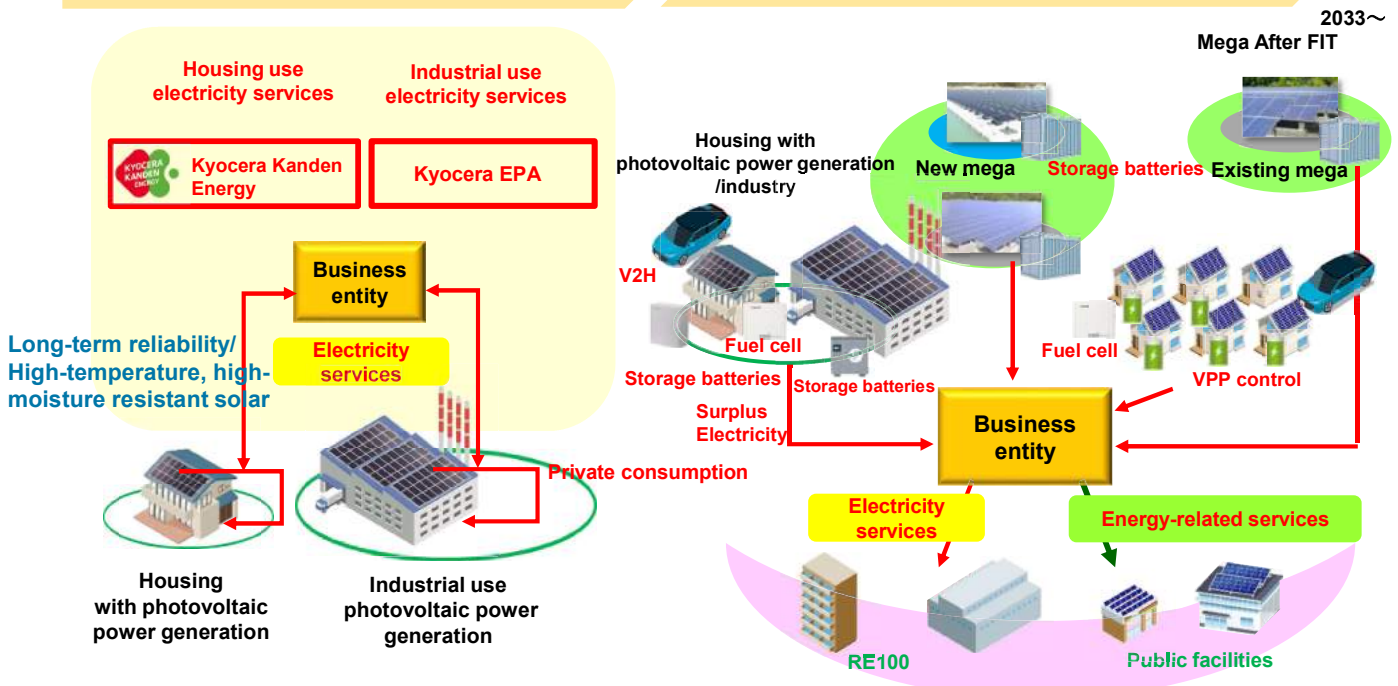
Source: Ministry of Economy, Trade and Industries Agency for Natural Resources and Energy

## Solve technical issues related to VPP and increase the rate of renewable energy use

# Countermeasure 2: Solving Economic Issues and Future Energy Utilization

Power supply by photovoltaic power generation on the roof (Private consumption)

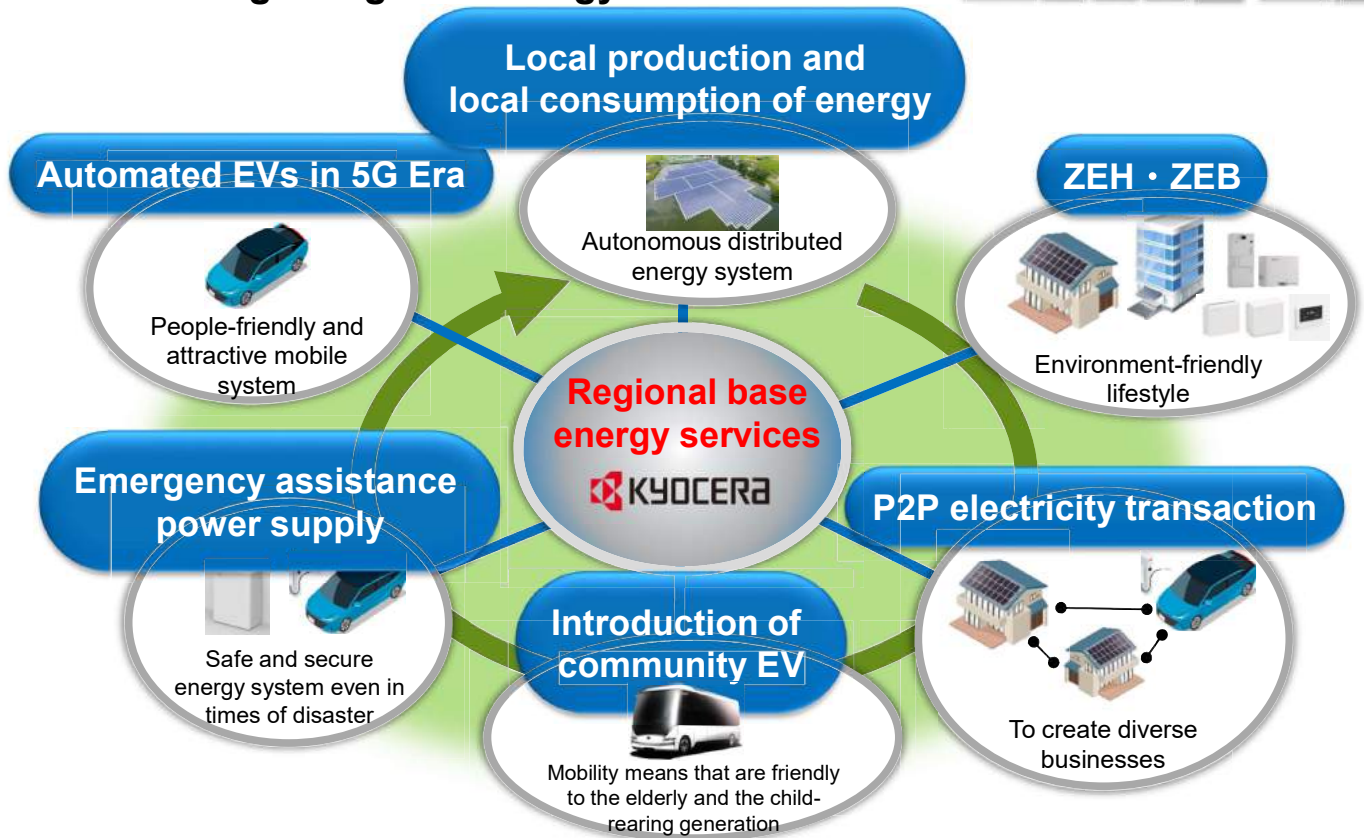
Optimization of intra-regional energy (local production for local consumption)



Launched a service that enables the introduction of photovoltaic power generation without initial investment

Promote regional energy optimization by resolving technological and economic issues





**Build regional energy service infrastructure  
by linking many services**

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## Other Sector

- ✓ Practice Example①: KYOCERA Corporation  
(Electronic Equipment)
- ✓ Practice Example②: Seven & i Holdings Co., Ltd.  
(Retailing)
- ✓ Practice Example③: Lion Corporation  
(Consumer Products)

# Scope of this analysis



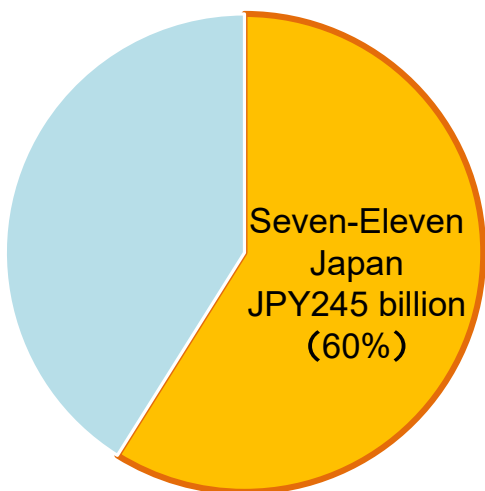
セブン&アイ HLDGS.

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



セブン&アイ HLDGS.

Risks and opportunities at Seven-Eleven Japan are extracted from the items listed in TCFD based on external views

Risks and Opportunities in TCFD

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
		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
		Increase in the average temperature
	Chronic	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

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
		Changes in rainfall and weather patterns
	Chronic	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 <b>Large</b>	[Transition risks and opportunities] <ul style="list-style-type: none"> <li>• Carbon prices</li> <li>• National carbon emissions targets and policies</li> <li>• Changing consumer reputation</li> </ul> [Physical risks and opportunities] <ul style="list-style-type: none"> <li>• Severity of extreme weather (acute)</li> <li>• Changes in precipitation and weather patterns (chronic)</li> </ul>
Significance level <b>Medium</b> ~ <b>Small</b>	[Transition risks and opportunities] <ul style="list-style-type: none"> <li>• Efficiency of resources through the introduction of technology</li> </ul> [Physical risks and opportunities] <ul style="list-style-type: none"> <li>• Rising sea level</li> </ul>
Significance level <b>Small</b>	[Transition risks and opportunities] <ul style="list-style-type: none"> <li>• Changes in investor's reputation</li> </ul>

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# Identify and define range of scenarios

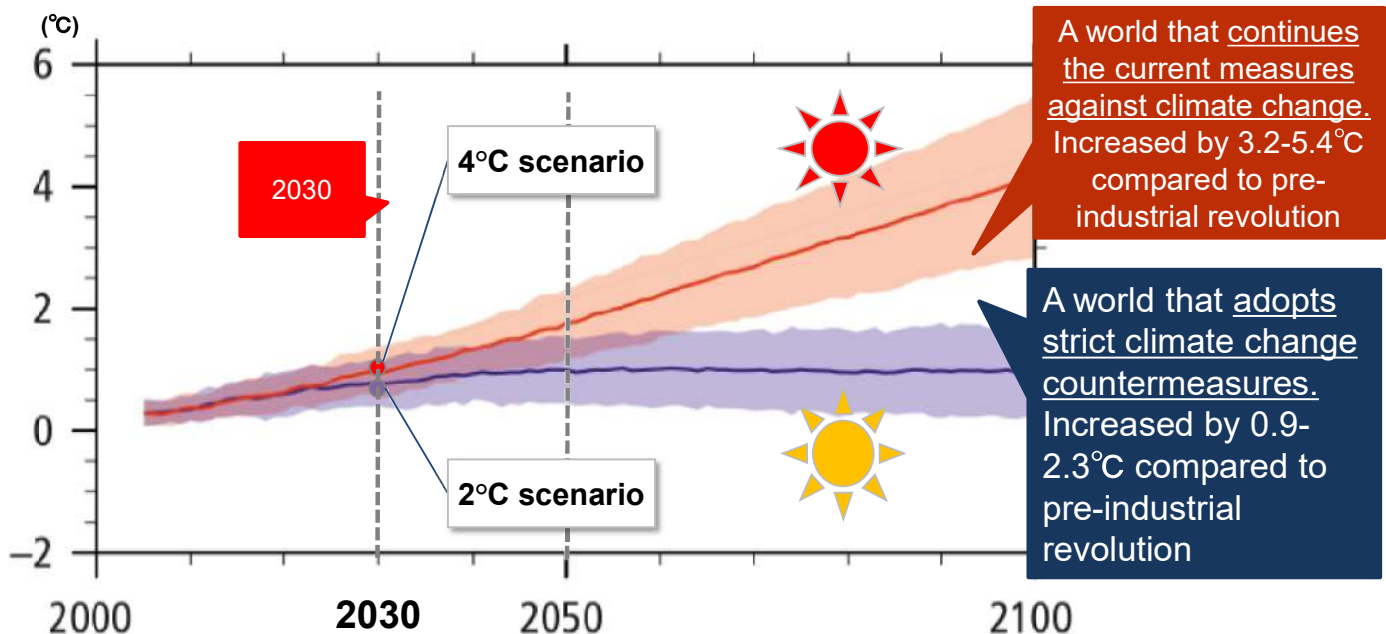


セブン&アイ HLDGS.

## 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.

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## Define a worldview based on scientific grounds such as IEA

Important items (Items of high significance)	Assumed parameter	At present	2030		Source (excerpt)
			4°C	2°C	
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

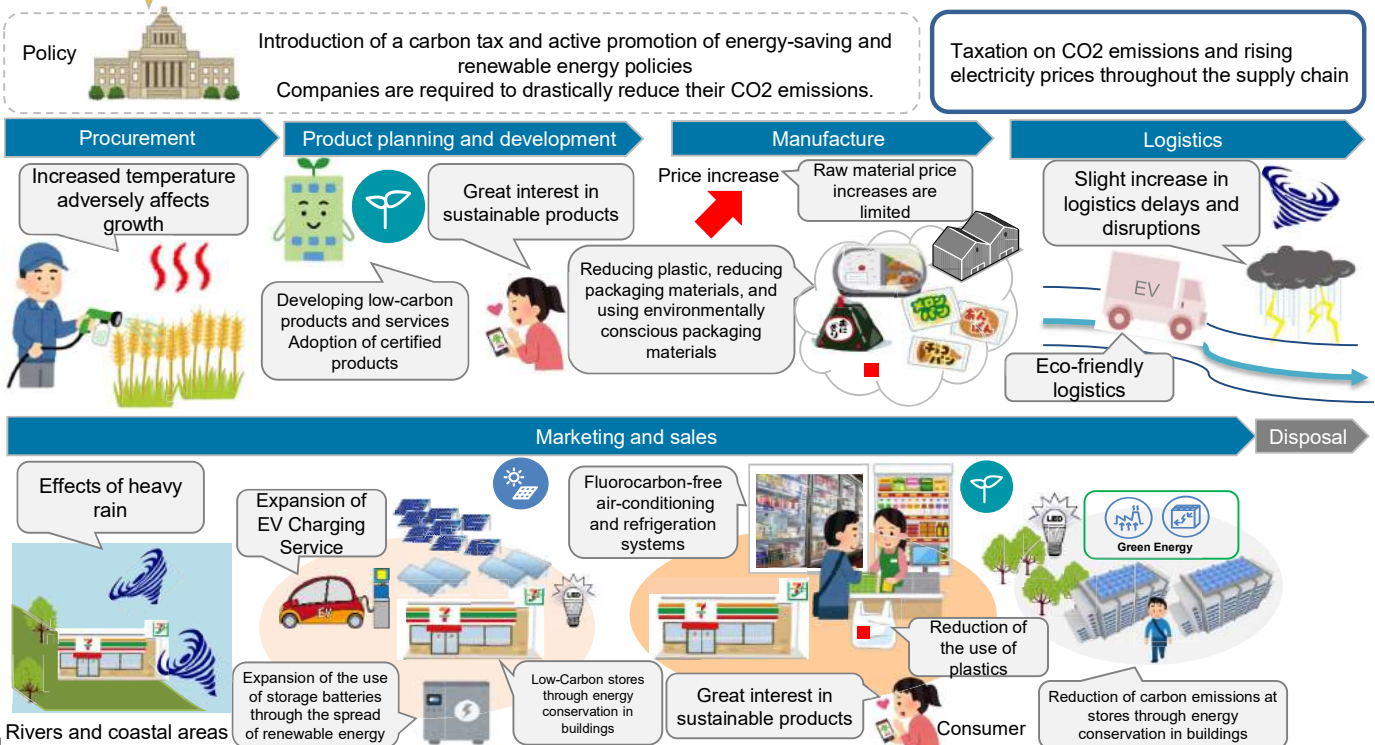
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## Identify and define range of scenarios (2°C, 2030)

### Seven-Eleven Japan in 2°C scenario



**Regulation are tightened, low and decarbonizing are advancing, and the transition risks are increasing.**



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# Identify and define range of scenarios (4°C, 2030)



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## Seven-Eleven Japan in 4°C scenario

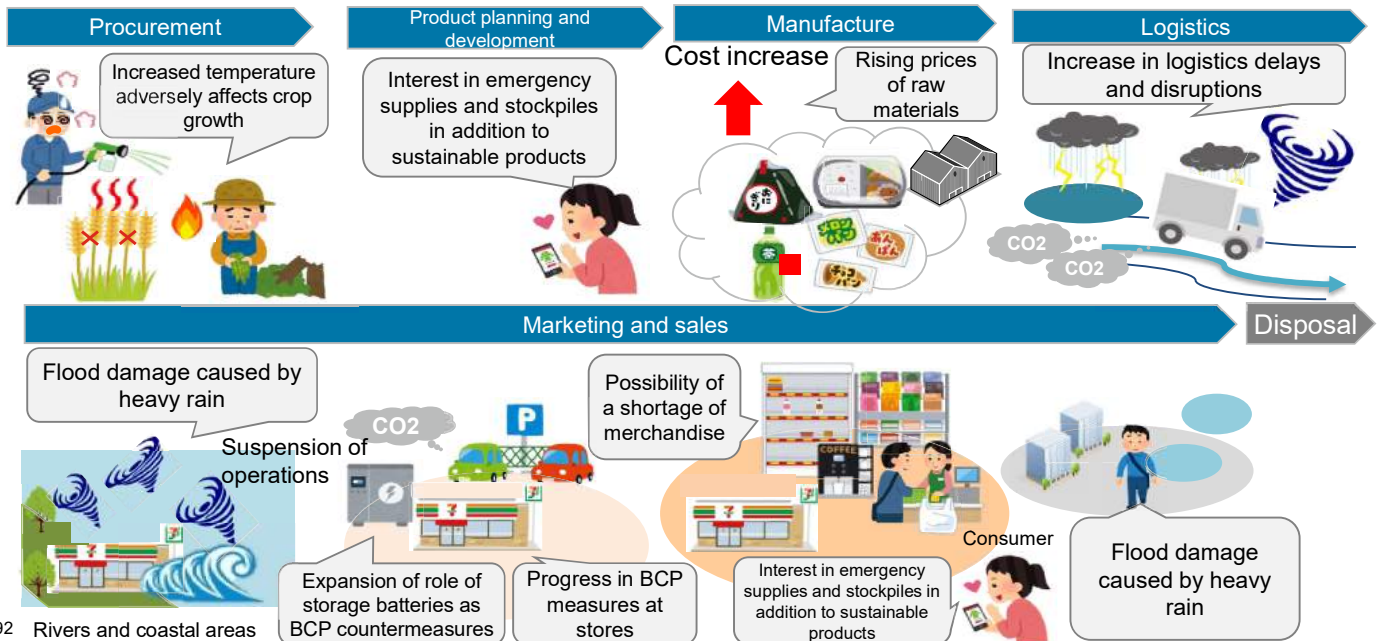


Increase **physical risks** such as extreme weather

Policy



Energy-saving and renewable energy policies are not actively promoted (carbon tax not introduced)



3-192 Rivers and coastal areas

## Evaluate business impacts (2°C, 2030)

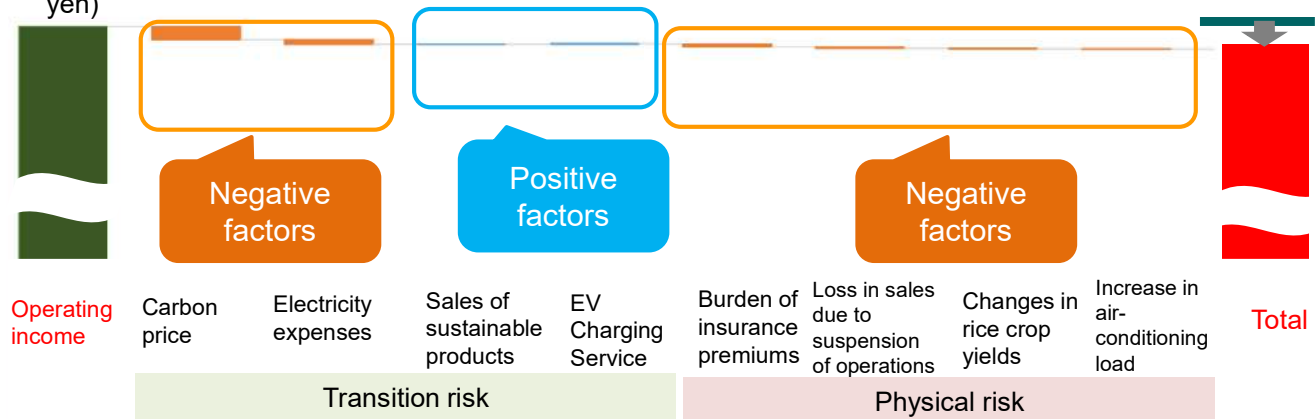


セブン&アイ HLDGS.

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

(100 millions yen)



### Increased **transition risks**

Regulations are tightened, low-carbon and decarbonization are advancing, and carbon taxes and electricity prices are rising.

# Evaluate business impacts (4°C, 2030)

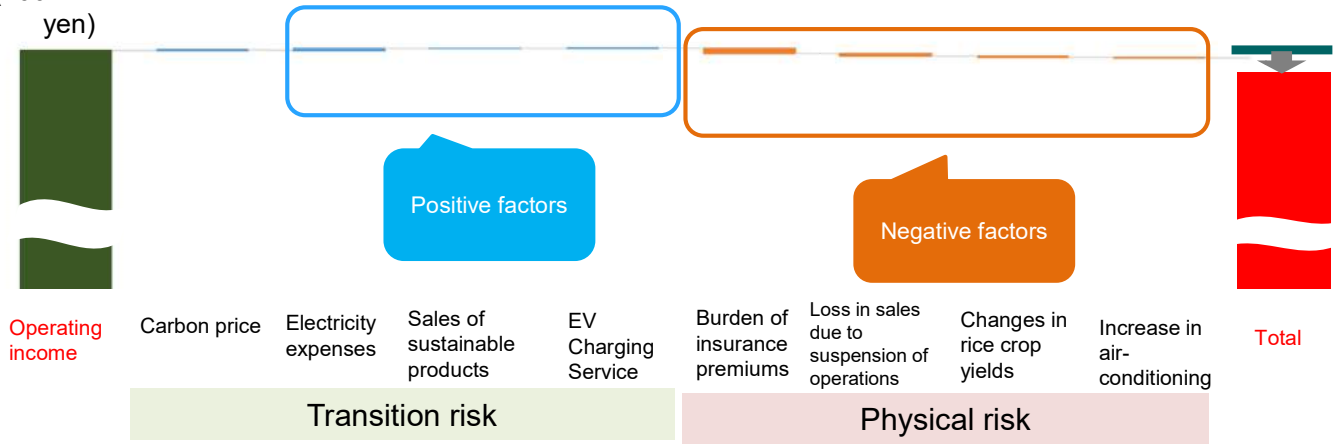


セブン&アイ HLDGS.

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

(100 millions yen)



**Increased physical risks**  
**Increase in insurance premiums and loss due to suspension of operations due to extreme weather.**

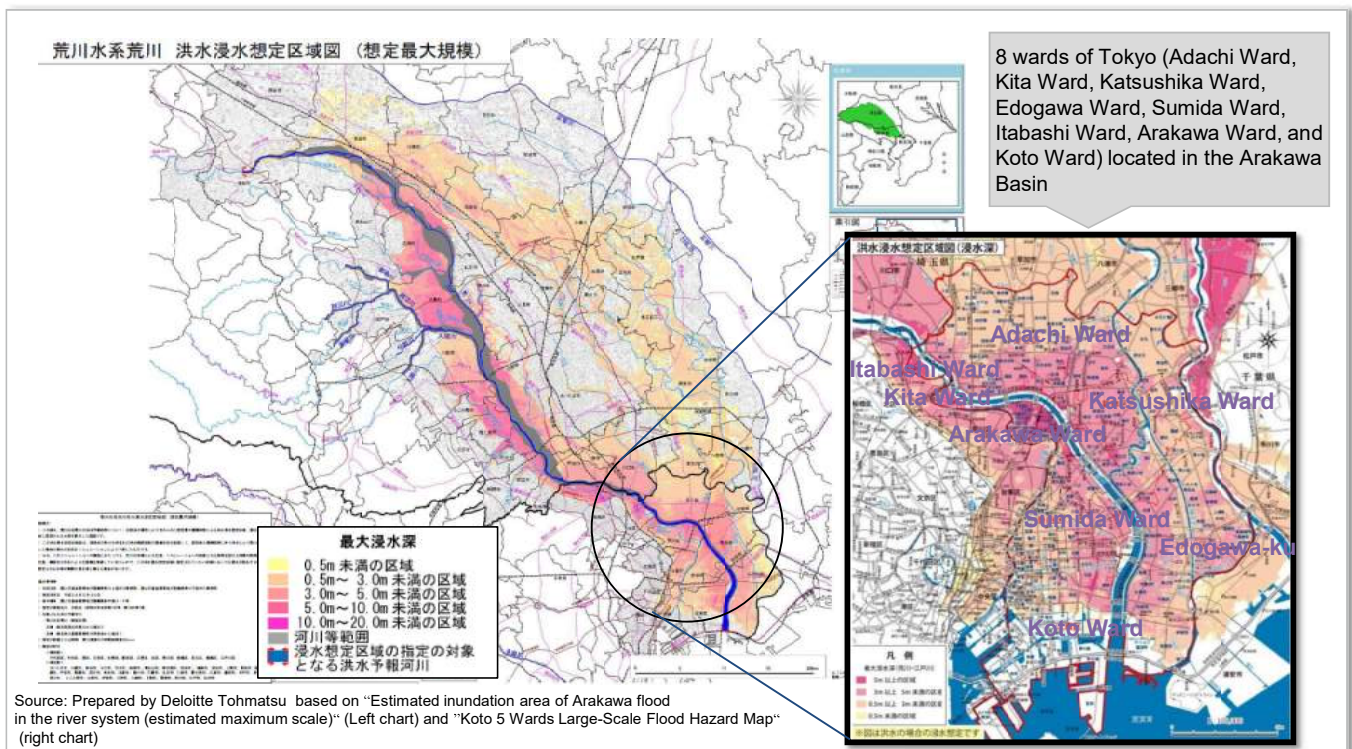
3-194

# Evaluate business impacts - flood risk assessment



セブン&アイ HLDGS.

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)

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◆ 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



Increasing importance of disaster response



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

## 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 Example①: KYOCERA Corporation  
(Electronic Equipment)
- ✓ Practice Example②: Seven & i Holdings Co., Ltd.  
(Retailing)
- ✓ Practice Example③: Lion Corporation  
(Consumer Products)

3-198



### 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)

	<b>2030 Domestic business</b>	Overseas business
<b>Risk</b>	<b>[Scope of this investigation] Mainly Oral Care Business Fabric Care Business</b> 	Not considered
<b>Opportunity</b>		

- Promotion System: Internal Project  
Corporate Planning Division (including IR), Accounting Division,  
Marketing Division, and Purchasing Division, CSV Promotion  
Department Environmental Strategy Office (Secretariat)

3-199



## 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	<ul style="list-style-type: none"> <li>Full-scale introduction of emissions trading and the application of carbon taxes by governments will increase the <b>operating costs of factories</b> and increase expenditures</li> <li>The use of low-carbon energy will enable us to <b>cope with future rises in carbon prices</b> and reduce costs.</li> </ul>	Large
	Containers	<ul style="list-style-type: none"> <li>Introduction of regulations on plastic and other packaging materials and products in each country, incurring <b>response costs</b> and increasing expenditures</li> <li>By making use of <b>low-carbon, non-plastics products</b>, it is possible to provide products that meet the ethical needs of consumers, thereby increasing corporate value and generating profits</li> </ul>	Large
Raw materials procurement	Regulations relating to land use	<ul style="list-style-type: none"> <li>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</li> <li>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</li> </ul>	Large
	Steep rise in prices	<ul style="list-style-type: none"> <li>Higher premium prices for certified palm oil (nuclear oil) and increased expenditures due to tighter regulations and demand for biofuels</li> <li>Costs associated with the switch to alternative raw materials are also incurred, resulting in an increase in expenditures</li> <li>In procuring palm oil, we can increase the sustainability of our products by helping them acquire RSPO certification. May contribute to enhancing corporate value and increasing earnings</li> </ul>	Large
Changes in customer behaviours		<ul style="list-style-type: none"> <li>As consumers become more aware of ethical consumption, demand for products using unsustainable plastics and palm oil declines and profits decline</li> <li>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</li> </ul>	Large
Changes in the investor's reputation		<ul style="list-style-type: none"> <li>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.</li> </ul>	Small

3-200

## 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

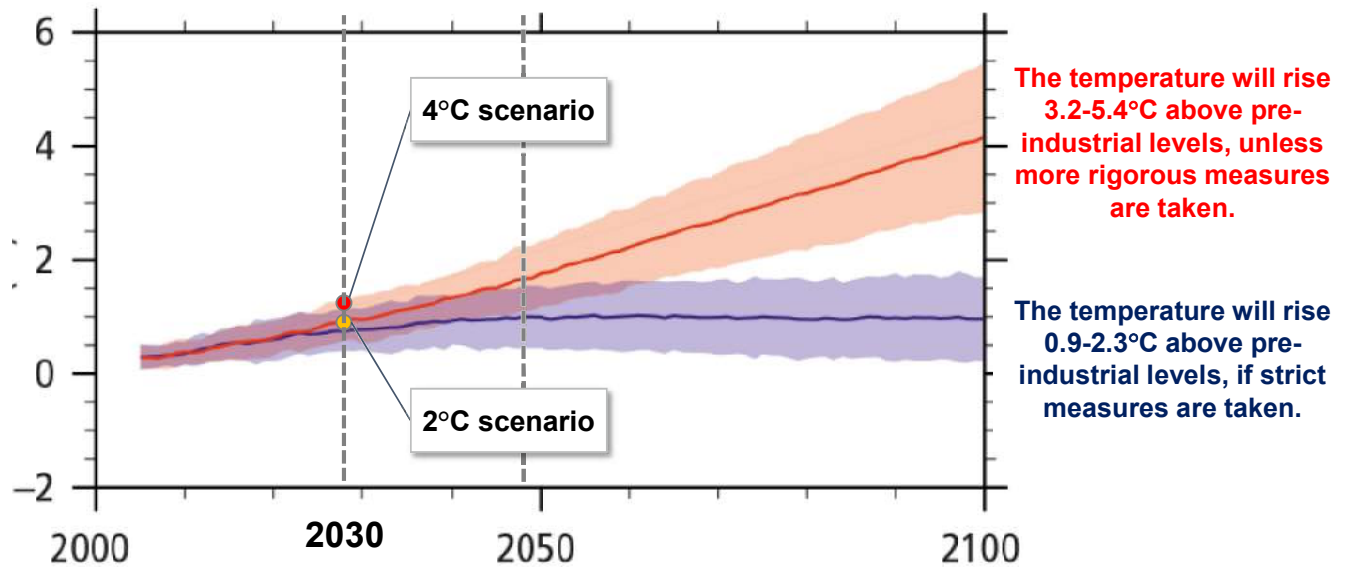
Risk Item		Business impact	Assessment
Increase in the average temperature		<ul style="list-style-type: none"> <li>Expenditures will increase due to higher operating and personnel costs resulting from increased energy costs and burdens on workers.</li> <li>Higher average temperature will increase the number of laundry operations, while demand for laundry detergents and antiperspirants will increase, leading to higher earnings.</li> <li>In some areas, a certain increase in temperature may contribute to increased crop productivity, leading to higher production and lower raw material costs</li> </ul>	Large
Raw materials procurement	Pests	<ul style="list-style-type: none"> <li>Large outbreaks of pests affect the production volume and price of plant-derived raw materials, increase raw material costs, and increase expenditures</li> <li>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</li> </ul>	Medium
	Atmospheric CO2 concentrations increase	<ul style="list-style-type: none"> <li>Increased use of herbicides due to improved water efficiency and growth efficiency of weeds and increased expenditure</li> <li>On the other hand, increased crop growth potential and increased crop yields could lead to lower raw material costs</li> <li>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</li> </ul>	Medium
Water stress (drought)		<ul style="list-style-type: none"> <li>Expenditure increases due to shortage of water supply due to drought, deterioration of water quality, and increase in operating costs</li> <li>On the other hand, demand for water-saving products and products that do not require water may increase and profits may increase</li> </ul>	Large
Increasing severity of extreme weather conditions (Direct/ Indirect effects)	Flood	<ul style="list-style-type: none"> <li>Revenue declines due to delays or disruptions in logistics caused by climate events, etc.</li> <li>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</li> </ul>	Large
	Heavy rains, typhoons and storms	<ul style="list-style-type: none"> <li>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)</li> <li>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</li> </ul>	Large

3-201

## 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)]  
(°C)



Source: AR5 SYR Diagram SPM.6

3-202

## Definition of each worldview based on scientific grounds, etc. of the IEA, etc.

Risk Item	Assumed parameter	Current situation	2030		Source
			4°C	2°C	
Carbon emission targets and policies of each country (A Carbon tax)	Carbon prices in each country	—	(Not introduced at 4° C)	<b>10,900 Yen and tCO2</b>	IEA WEO 2019
Carbon emission targets and policies of each country (Plastics)	Use rate of recycled plastics in equipment <sup>1</sup>	—	(Not introduced at 4° C)	<b>14.0%</b>	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	—	<b>+1.14°C</b>	<b>+1.02°C</b>	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 <sup>2</sup>	—	<b>4 times</b>	<b>2 times</b>	Ministry of Land, Infrastructure, Transport and Tourism, "Recommendation for Ideal Flood Control Plan Based on Climate Change"
	Population affected by floods	<b>0.704 million</b>	<b>1.03 million</b>	<b>1.154 million</b>	WRI AQUEDUCT
Increasing severity of extreme weather conditions (heavy rain, storm, typhoon)	Increasing number of days of heavy rain per year	<b>4.0 days/year</b>	<b>4.0 days/year</b>	<b>4.2 days/year</b>	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)			—

<sup>1</sup> It is assumed that regulations similar to those in Europe will be applied to Japan.

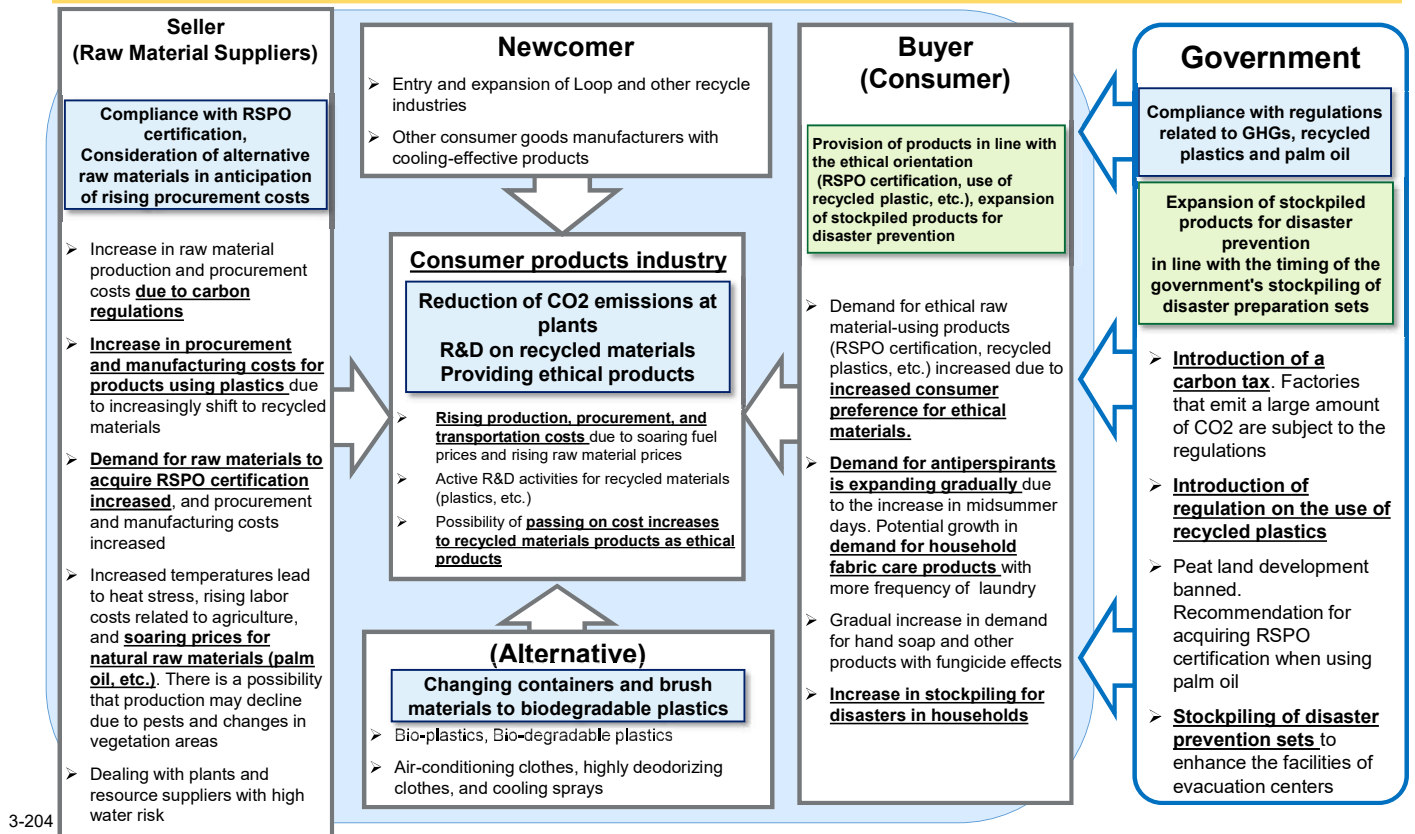
<sup>2</sup> Figures for 2040 are used as substitute for figures as of 2030.

<sup>3</sup> Converted at \$ 100 per tCO2, 109 ¥/US\$

3-203

# Identify and define range of scenarios: World View at 2°C @ 2030s

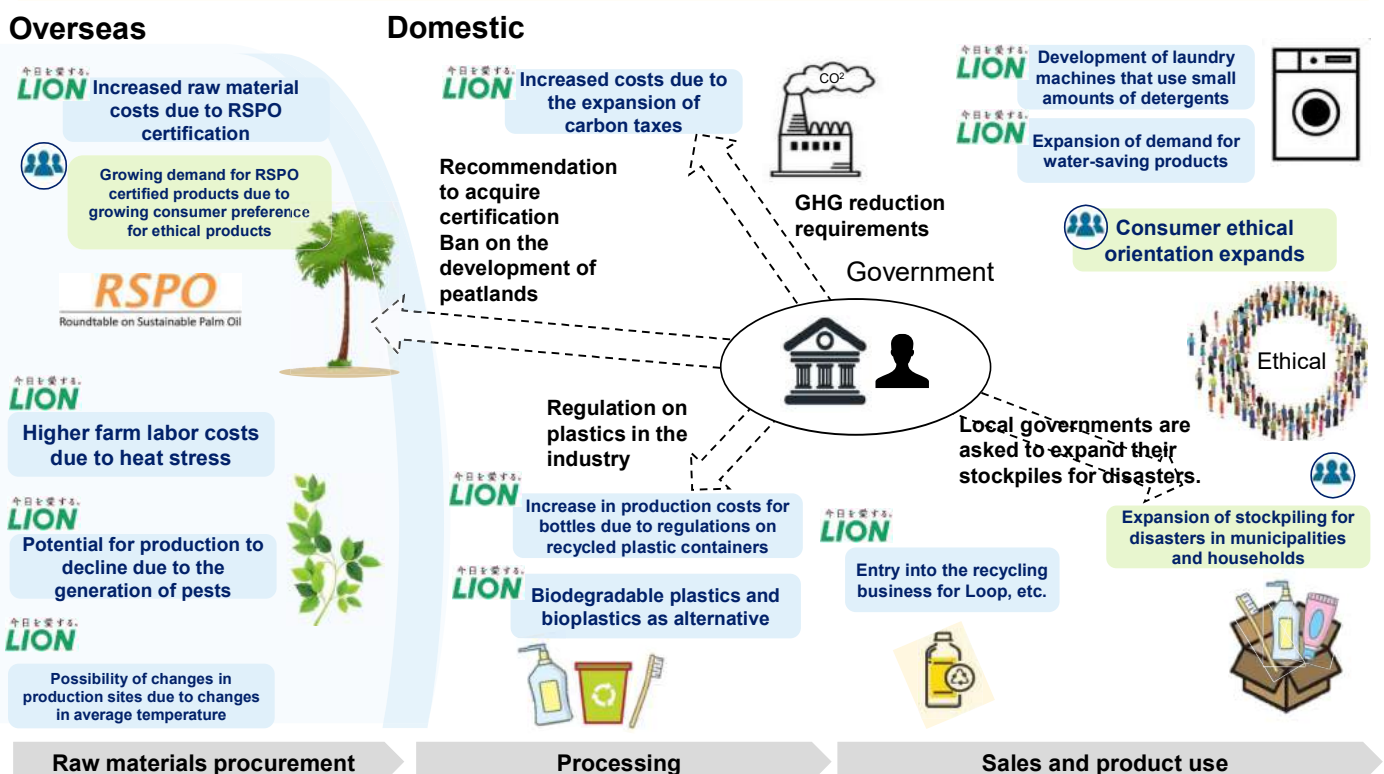
Raw material costs soar due to the introduction of regulations and certification  
Growing environmental awareness and increased demand for "ethical" value-added products



3-204

# Identify and define range of scenarios: Future Social Image under the 2°C Scenario

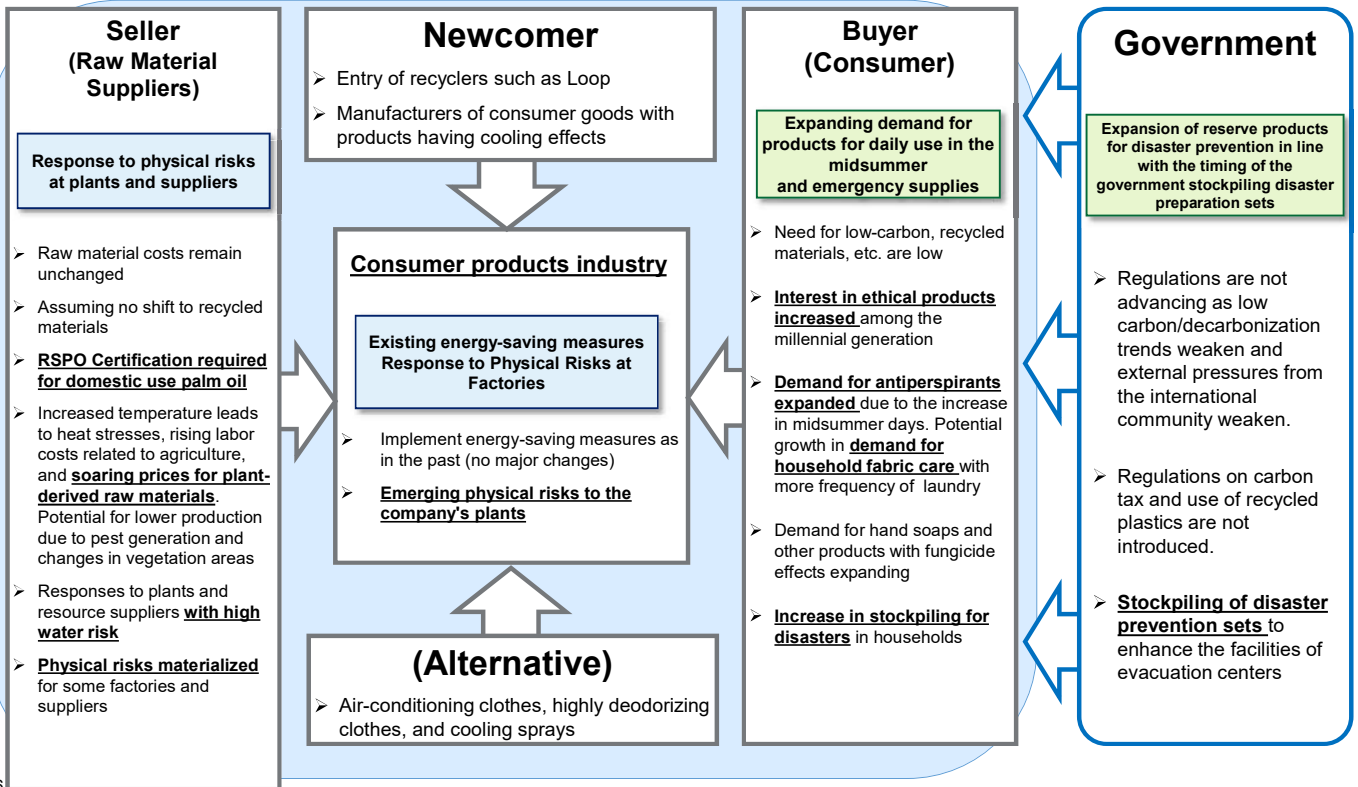
Raw material costs soar due to the introduction of regulations and certification  
Growing environmental awareness and increased demand for "ethical" value-added products



3-205

# Identify and define range of scenarios: 4°C Worldwide @ 2030s

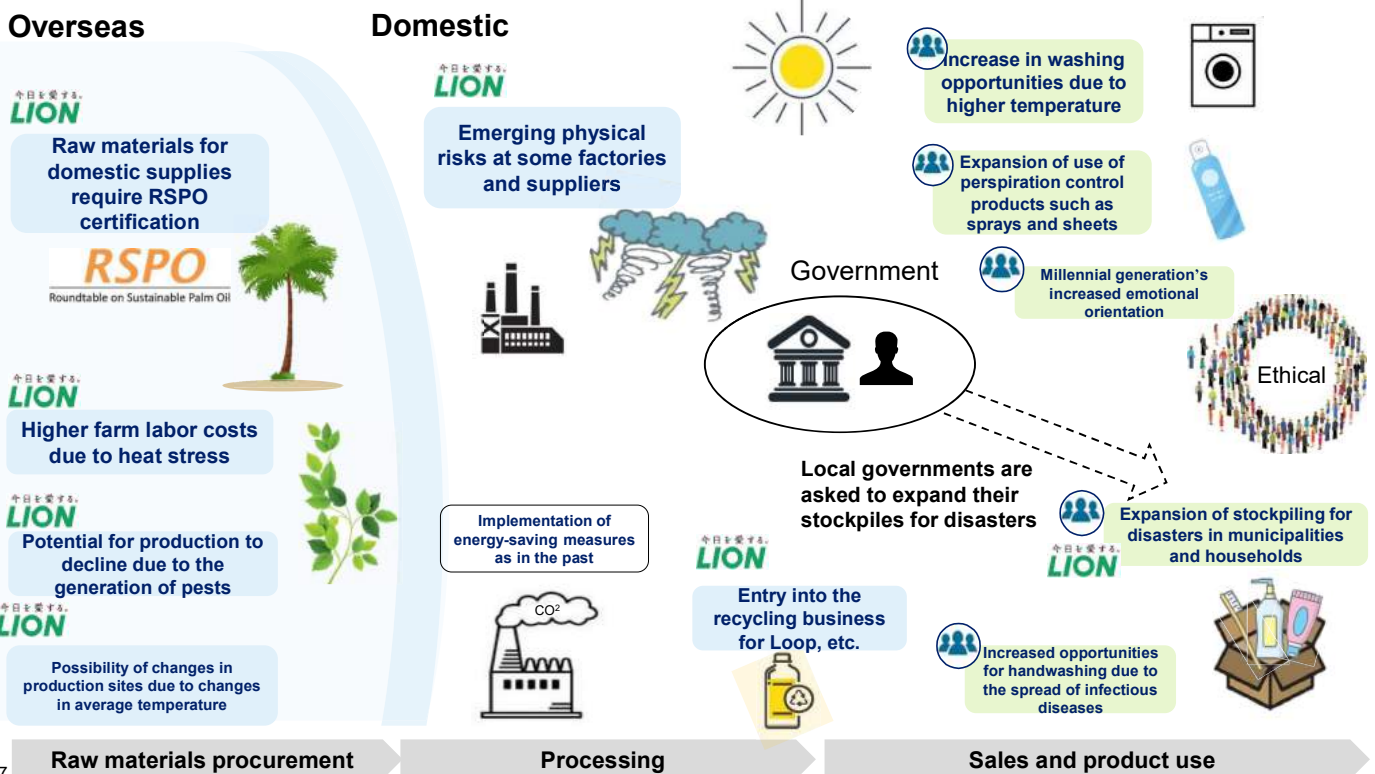
Low carbon/decarbonization trends weaken and physical risks increase  
Increase in demand for certain products due to temperature increase



3-206

# 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

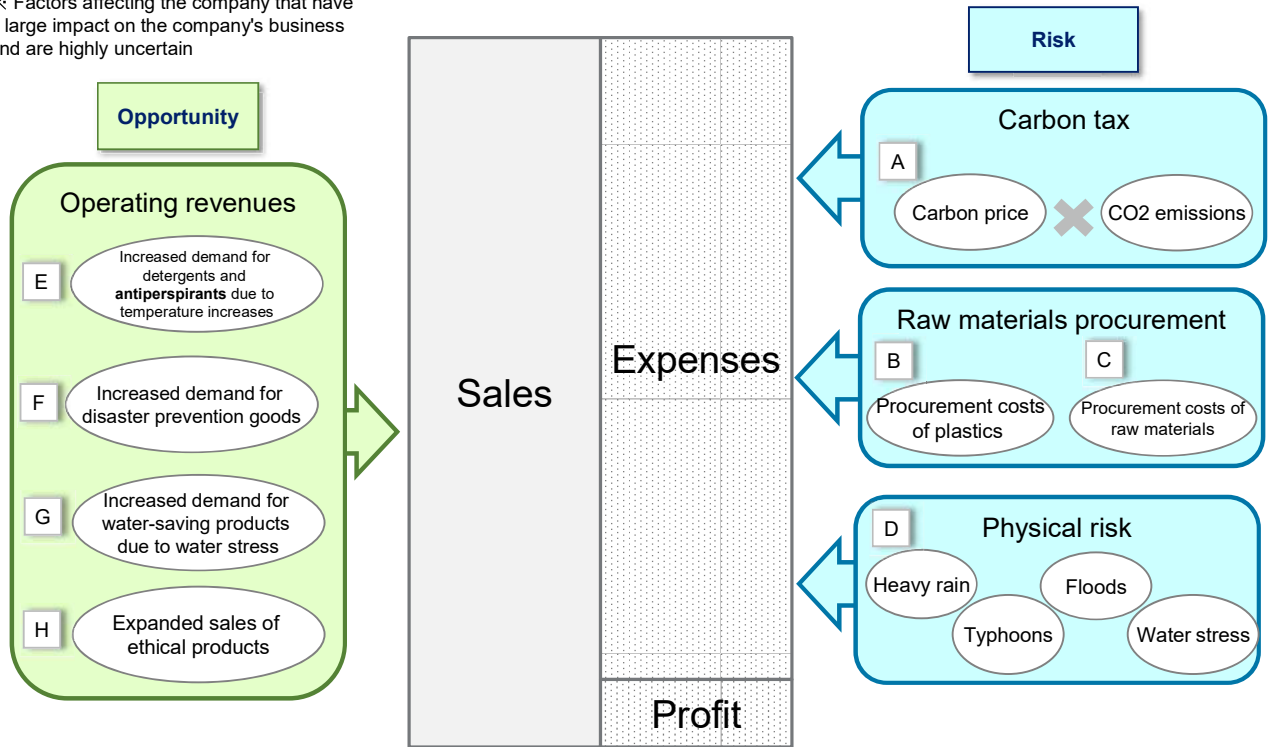


3-207

# 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



3-208

# 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°C	4°C	
Transition risk	Carbon emission targets and policies of each country	Carbon tax	A	<ul style="list-style-type: none"> <li>The effect of carbon tax is significant at 2°C, and operating costs increase</li> <li>In case of 4°C, no carbon tax is included</li> </ul>	X.X billion yen	JPY 0 billion
	Carbon emission targets and policies of each country	Plastics	B	<ul style="list-style-type: none"> <li>Cost increase at 2°C due to introduction of recycled plastic regulations</li> <li>It is assumed that the regulation for recycled plastics will not be implemented at 4°C</li> </ul>	X.X billion yen	JPY 0 billion
	Soaring feedstock costs	Palm oil	C	<ul style="list-style-type: none"> <li>At 2°C, stricter RSPO regulations tighten the supply-demand balance for certified oil and raise palm oil procurement costs (transition risks)</li> <li>At 4°C, harvest volume increases with temperature increase, supply-demand tightness does not progress, and prices remain at the current level (physical risk)</li> </ul>	X.X billion yen	X.X billion yen
Physical risk	Increase in the average temperature	Procurement price of plant-derived raw materials		<ul style="list-style-type: none"> <li>Increase in procurement cost due to decrease in cultivated area due to change in vegetation area of vegetable raw materials</li> </ul>	X.X billion yen	X.X billion yen
	Increase in the average temperature	Procurement price of natural raw materials		<ul style="list-style-type: none"> <li>Decrease in cultivated area of natural crops and increase in procurement costs</li> <li>Besides, the harvest volume of plant-based raw materials in the sub-tropical region is expected to increase (qualitative assessment)</li> </ul>	Qualitative	Qualitative
	Increasing severity of extreme weather conditions	Damage to facilities, impact on infrastructure	D	<ul style="list-style-type: none"> <li>Increasing frequency of typhoons, storm surges, etc., is expected to cause damage to plant facilities and infrastructure and increase costs</li> </ul>	X.X billion yen	X.X billion yen
	Increasing severity of extreme weather conditions	Shutdown and damage to the supply chain		<ul style="list-style-type: none"> <li>Sales are expected to decline due to plant shutdowns or suspension of product transportation (supply chain breakdown) (qualitative assessment)</li> </ul>	Qualitative	Qualitative
	Water stress	Drought damage		<ul style="list-style-type: none"> <li>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)</li> </ul>	Qualitative	Qualitative

3-209

※ Quantitative assessments are difficult, but qualitative assessments are conducted on important matters.

# Evaluate business impact: Opportunity

The 2°C scenario has a greater impact on business profits than the 4°C 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°C	4°C
Opportunity	Increase in the average temperature	Sales of detergents	<ul style="list-style-type: none"> <li>Increase in sales of detergents due to higher temperature</li> </ul>	X.X billion yen	X.X billion yen
	Increase in the average temperature	Sales of perspiration control products	<ul style="list-style-type: none"> <li>Increase in sales of antiperspirants due to higher temperature</li> </ul>	X.X billion yen	X.X billion yen
	Increase in the average temperature	Increase in infections	<ul style="list-style-type: none"> <li>Expansion of infectious diseases increases opportunities for handwashing and profits of hand soap are expected to increase (qualitative assessment)</li> </ul>	Qualitative	Qualitative
	Increasing severity of extreme weather conditions	Sales of disaster prevention goods	<ul style="list-style-type: none"> <li>Increase in demand for stockpiles (disaster prevention goods) at evacuation centers (qualitative assessment)</li> </ul>	Qualitative	Qualitative
	Water stress (drought)	Water-saving products	<ul style="list-style-type: none"> <li>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).</li> </ul>	Qualitative	Qualitative
	Changes in customer behaviours	Ethical products	<ul style="list-style-type: none"> <li>Increased consumer interest in ethical products (qualitative assessment)</li> </ul>	Qualitative	Qualitative
<b>Total (transition risk, physical risk, opportunity)</b>				<b>▲ X.X billion yen</b>	<b>▲ X.X billion yen</b>

3-210

※ 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	<ul style="list-style-type: none"> <li>CO2 emissions generated by each of departments 30% reduction by 2030 (vs. 2017)</li> <li>Set the total amount and the target of zero emissions by 2050.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction of renewable energy</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Recycled plastics	<ul style="list-style-type: none"> <li>Set a target to double the amount of recycled plastics and biomass plastics used by 2030</li> <li>Cooperation with TerraCycle to develop toothbrush recycling program</li> </ul>	<ul style="list-style-type: none"> <li>Set further targets for reduction of virgin plastics from petrochemical</li> <li>Conversion to a sustainable resource circulation program</li> </ul>	<ul style="list-style-type: none"> <li>Promoting cooperation with the recycling industry</li> </ul>
Steep rise in the price of raw materials (palm oil)	<ul style="list-style-type: none"> <li>Replace all palm oil derivatives from non-certified to RSPO certified products by 2020.</li> <li>Formulation of sustainable raw material procurement policy for 2030</li> </ul>	<ul style="list-style-type: none"> <li>Implement measures based on the company's own Sustainable Raw Material Procurement Guidelines</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Steep rise in the price of raw materials (other than palm oil)	<ul style="list-style-type: none"> <li>N/A</li> </ul>	<ul style="list-style-type: none"> <li>Identification and monitoring of risks associated with the procurement of plant raw materials due to climate change</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Changes in customer behavior	<ul style="list-style-type: none"> <li>Establishment of in-house Lion Eco Standards and labeling of Eco-Products</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>	<ul style="list-style-type: none"> <li>Expansion of Eco/Ethical Products</li> <li>Promotion and educational activities concerning eco/ethical consumption</li> </ul>
Increasing severity in extreme weather conditions	<ul style="list-style-type: none"> <li>Carry out awareness-raising activities for hygiene and health care in the event of a disaster</li> <li>Establishment of BCPs at business sites</li> </ul>	<ul style="list-style-type: none"> <li>Understand the impact on supply chain (raw material suppliers, transportation and delivery) and strengthen countermeasures</li> </ul>	<ul style="list-style-type: none"> <li>Expand sales of products for disaster prevention</li> </ul>

3-211

## 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

## Appendix.

Appendix1. Parameter list

Appendix2. Physical risk assessment tools

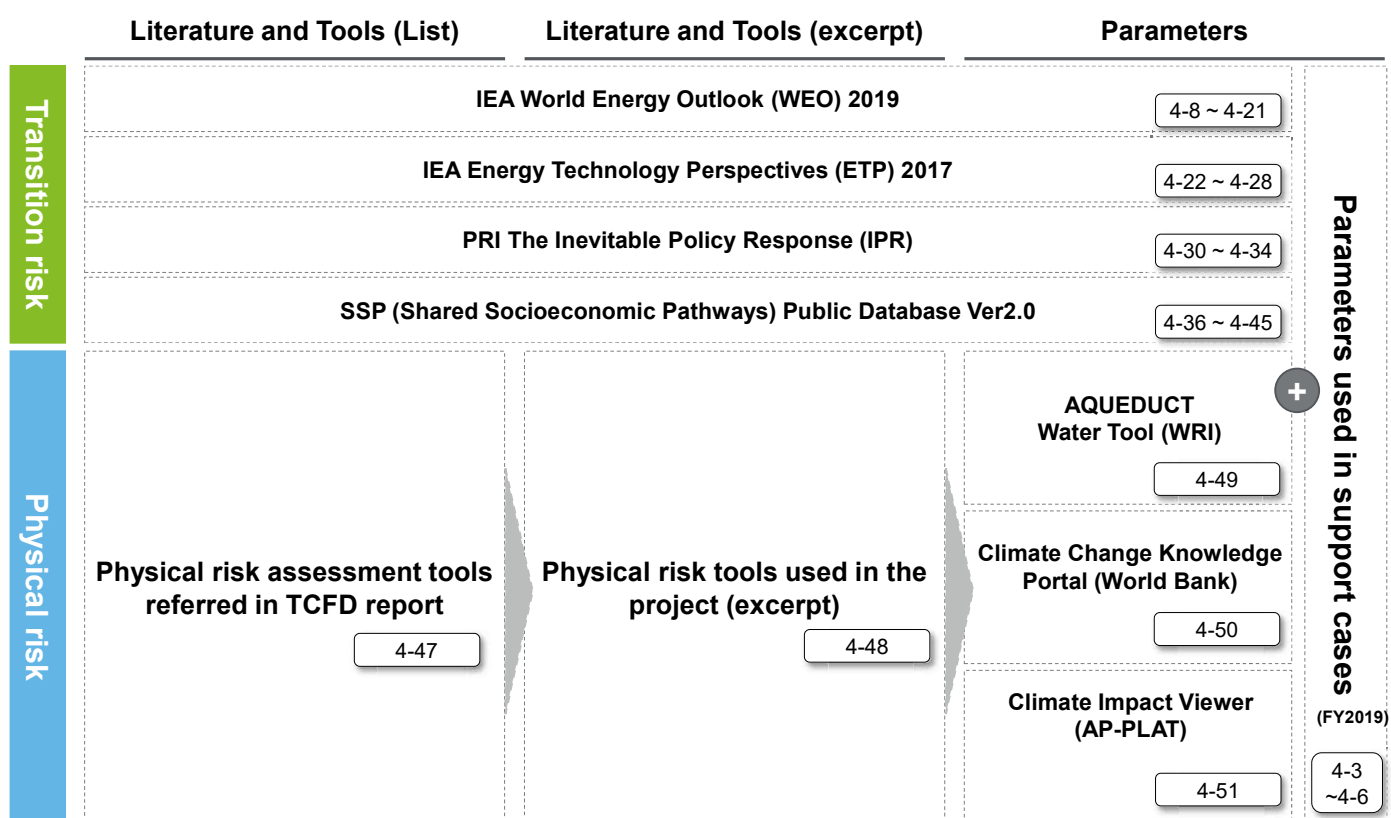
Appendix3. Examples of scenario analysis

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 2020

4-2

# [Parameters referenced in support cases 1/4]

## Transition risk 1/2

	Item	Parameter	Source	Reference: Companies referenced parameters
Transition risk	Carbon price	Carbon tax	<ul style="list-style-type: none"> <li>IEA WEO 2018,2019</li> <li>PRI IPR FPS</li> </ul>	Kagome, Kashima Construction, Calbee, Seven & i HD, Chiyoda Corporation, FUJIFILM HD and Furukawa Electric, Meiji HD, Lion Corporation, and LIXIL
		Electricity price	<ul style="list-style-type: none"> <li>IEA WEO 2018</li> </ul>	Kyocera, Seven & i Holdings, LIXIL
	Carbon emissions targets/policies	Target values for emissions	<ul style="list-style-type: none"> <li>Ministry of the Environment's "Draft Japanese Commitments," "Toward Significant Reductions in Greenhouse Gases by 2050," IEA ETP</li> </ul>	Kajima Corp., Kyocera Corp., Seven & i HD, Chiyoda Corporation, FUJIFILM HD, Furukawa Electric Co., Ltd., LIXIL
			<ul style="list-style-type: none"> <li>IEA WEO2018,2019</li> <li>PRI IPR FPS</li> </ul>	Kajima Corporation, FUJIFILM HD, Furukawa Electric Co., Ltd., Chiyoda Corporation, LIXIL
	Changes in the energy mix	Power Generation Mix (Japan)	<ul style="list-style-type: none"> <li>IEA WEO2019</li> <li>PRI IPR FPS</li> </ul>	Chiyoda Corporation
		Primary energy demand	<ul style="list-style-type: none"> <li>IEA WEO2019</li> <li>PRI IPR FPS</li> </ul>	Chiyoda Corporation
		Final energy demand	<ul style="list-style-type: none"> <li>IEA WEO2019</li> </ul>	Chiyoda Corporation
		LNG: pipeline ratio	<ul style="list-style-type: none"> <li>IEA WEO2019</li> </ul>	Chiyoda Corporation
	Changes in important products	Unit price of renewable energy generation	<ul style="list-style-type: none"> <li>IEA WEO2017</li> </ul>	Kyocera and Furukawa Electric
		Production of newsprint	<ul style="list-style-type: none"> <li>IEA WEO2018</li> </ul>	FUJIFILM HD
		Rate of recycled aluminum Production of aluminum	<ul style="list-style-type: none"> <li>IEA WEO2018</li> <li>IEA ETP2017</li> </ul>	FUJIFILM HD and LIXIL
		Price of aluminum	<ul style="list-style-type: none"> <li>World Bank, "World Bank Commodities Forecast"</li> </ul>	LIXIL
	Dissemination of renewable energy and energy-saving technologies	ZEB target	<ul style="list-style-type: none"> <li>METI's Basic Energy Program</li> </ul>	Kajima Corporation
		ZEH introduction target	<ul style="list-style-type: none"> <li>Ministry of Economy, Trade and Industry, "Policy Trends for Promoting ZEV and Related Budget Draft for FY2018"</li> </ul>	LIXIL
		ZEV ratio	<ul style="list-style-type: none"> <li>IEA ETP2017</li> <li>Shinichiro Fujimori et al. "The marker quantification of the Shared Socioeconomic Pathway 2: A middle-of-the-road scenario for the 21st century"</li> </ul>	Seven & i HD, Chiyoda Corporation, Development Bank of Japan, Furukawa Electric
Increase in the amount of electricity used for air-conditioning		<ul style="list-style-type: none"> <li>IEA "The Future of Cooling"(2018)</li> </ul>	Seven & i HD	
World's storage capacity		<ul style="list-style-type: none"> <li>IRENA "ELECTRICITY STORAGE AND RENEWABLES: COSTS AND MARKETS TO 2030"</li> </ul>	Chiyoda Corporation and 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.

4-3



## [Parameters referenced in support cases 2/4 ] Transition risk 2/2

	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		

※ 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.

4-4

## [Parameters referenced in support cases 3/4 ] Physical risk 1/2

	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 • Climate Change Knowledge Portal	Kajima Corporation and 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
	Changes in rainfall and 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 and Lion
		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
	Impacts of changes in rainfall patterns and increases in average temperature on raw material growth	Changes in potato yield due to the impact of climate change	• "Climate change impact on global potato production" (2018)	Calbee Corp.
		Changes in oat yield due to the impact of climate change	• FAO, "GAEZ(Global Agro-Ecological Zones)"	Calbee Corp.

※ 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.

4-5

# [Parameters referenced in support cases 4/4]

## Physical risk 2/2

	Item	Parameter	Source	Reference: Companies referenced parameters
Physical risk	Sea level rise	Magnitude of sea level rise	<ul style="list-style-type: none"> <li>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"</li> <li>Japan Meteorological Agency Website "Past and Future Sea Level Changes in the World"</li> </ul>	Furukawa Electric and Meiji HD
	Deterioration of labor and construction conditions	Rate of decline in labor productivity due to heat stress	<ul style="list-style-type: none"> <li>ILO, "Working on a warmer planet"</li> </ul>	Kajima Corporation and Lion Corporation
		Extreme heat (Japan)	<ul style="list-style-type: none"> <li>Ministry of the Environment press release (2014)</li> <li>Academic paper "Anthropogenic-contribution-to-global-occurrence-of-heavy-precipitation-and-high-temperature-extremes" (2015)</li> <li>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."</li> </ul>	Calbee, Seven&i HD
	Drought	Water stress	<ul style="list-style-type: none"> <li>WRI, "The Aqueduct"</li> </ul>	Kagome, Furukawa Electric, Lion
	Changes in the marine environment	Changes in fish catches in general	<ul style="list-style-type: none"> <li>"Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems" (2012)</li> </ul>	Calbee, Furukawa Electric
	Increasing extreme weather conditions (typhoons, heavy rains, sediment, storm surges, etc.)	Flood damage in urban areas	<ul style="list-style-type: none"> <li>WRI "The Aqueduct Global Flood analyze"</li> </ul>	Kajima Corporation
Flow rate		<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure, Transport and Tourism, "Proposals for Flood Control Plans Based on Climate Change"</li> </ul>	LIXIL	
Frequency of floods		<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure, Transport and Tourism, "Proposals for Flood Control Plans Based on Climate Change"</li> </ul>	Kyocera, Lion Corporation and LIXIL	

※ 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.

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## 【IEA WEO, ETP】 Report on transition scenarios published by the IEA

IEA World Energy Outlook 2019  
IEA Energy Technology Perspectives 2017

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.
- Presenting more ambitious scenarios, ETP 2017 presents three pathways for the energy sector towards 2060.

Source: IEA website

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# 【Parameters in IEA WEO 2019 1/14】

## CO2 emissions 1/3

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
CO2 emissions	World energy-related CO2 emissions by fuel and scenario	○			○		○						○		
	Cumulative energy-related CO2 emissions (since 1890) and annual emissions by fuel and scenario	○	○		○		○						○		
	Average CO2 emissions intensity of hourly electricity supply in India and the European Union, 2018, and by scenario, 2040	○					○							○	
	Effects of including announced net-zero carbon pledges on CO2 emissions in the Stated Policies Scenario	○			○		○						○		
	Installed power generation capacity by source and CO2 emissions from electricity generation in India in the Stated Policies Scenario and Cheap Battery Case	○			○		○							○	
	Energy-related CO2 emissions and reductions by source in the Sustainable Development Scenario	○								○			○		
	Average annual post-peak CO2 emissions reductions and power sector mix in various WEO scenarios	○											○		
	Energy-related CO2 emissions in the Sustainable Development Scenario to 2050 and extended pathway to 2100	○	○		○		○		○			○	○		
	Electricity generation by source and carbon intensity of electricity in the Sustainable Development Scenario	○			○		○		○				○		
	Energy-related CO2 emissions by region in the Stated Policies Scenario	○	○		○		○		○				○	○	○
	Net-zero carbon or GHG emissions reduction announcements	○								○				○	
	Effects of including announced net-zero carbon pledges on CO2 emissions in the Stated Policies Scenario	○	○		○		○		○				○		
	CO2 emissions reductions by measure in the Sustainable Development Scenario relative to the Stated Policies Scenario	○	○		○		○		○				○		
	Global fossil fuel demand by CO2 content in the Sustainable Development Scenario, 2018 and 2050	○								○			○		
	CO2 emissions in advanced and developing economies in the Sustainable Development Scenario	○	○		○		○		○					○	
Carbon emissions of different car powertrains by region	○			○									○		
Savings in energy-related CO2 emissions in industry by measure and scenario	○	○		○		○		○				○			

Source: IEA World Energy Outlook 2019

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# 【Parameters in IEA WEO 2019 2/14】

## CO2 emissions 2/3

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
CO2 emissions	Emissions trajectories for total CO2 emissions in the Sustainable Development Scenario and to limit warming to 1.5 ° C	○	○				○					○	○		
	Cumulative net-negative CO2 emissions between 2018 and 2100 in 1.5 ° C scenarios assessed by the IPCC	○											○		
	Illustrative trajectory of energy-related CO2 emissions to achieve a 50% chance of 1.5 ° C in advanced and developing economies	○			○		○		○					○	
	Locked-in emissions from international shipping and the maximum potential remaining emissions from LNG		○	○	○	○	○	○	○				○		
	CO2 emissions reductions since 2010	○											○	○	
	Average cost of potential emissions savings from coal-to-gas switching in the power sector, 2025				○									○	
	Potential CO2 savings from coal-to-gas switching at various gas prices using existing power plants	○												○	
	Cumulative effects on electricity generation and emissions in Southeast Asia of spending \$5 billion in the power sector	—												○	
	Growth in global GDP, coal demand and related CO2 emissions by scenario	○	○		○		○						○		
	Indirect CO2 and methane emissions intensity from global coal supply, 2018	○											○		
	Indirect CO2 and methane emissions, and emissions intensities for the ten-largest coal producing countries, 2018	○												○	
	Lifecycle emission intensities of coal and natural gas used for heat and electricity generation, 2018	○											○		
	Annual CO2 emissions from the power sector by scenario	○		○	○	○	○						○		
	CO2 intensity of electricity generation by region and scenario	○			○		○							○	
	Global CO2 emissions from existing coal-fired power plants by technology with a 50-year lifetime in the Stated Policies Scenario	○	○		○		○						○		
Cumulative CO2 emissions from existing coal-fired power plants by assumed lifespan, 2019-2040	○	○	○	○	○	○						○	○		
Measures to reduce CO2 emissions from coal-fired power plants	—											○			

Source: IEA World Energy Outlook 2019

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# 【Parameters in IEA WEO 2019 3/14】

## CO2 emissions 3/3, Energy demand 1/4

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
CO2 emissions	Reducing CO2 emissions from existing coal-fired power capacity by measure	○			○		○						○		
	Installed capacity by source and CO2 emissions from electricity generation in India in the Stated Policies Scenario and Cheap Battery Case	○			○		○							○	
	CO2 emissions reductions resulting from material demand reductions for steel, cement and aluminium	○			○		○						○		
	Impact of energy efficiency on CO2 emissions from electricity supply in the Sustainable Development Scenario, 2040						○							○	
	Installed CCGTs equipped with CCUS and emissions avoided in the Sustainable Development Scenario	○		○	○	○	○						○		
	Avoided CO2 emissions due to the deployment of offshore wind in the Stated Policies and Sustainable Development scenarios	○		○	○	○	○						○	○	
Energy demand	World primary energy demand by fuel and related CO2 emissions by scenario	○					○						○		
	World primary energy demand by fuel and scenario	○			○		○						○		
	Total primary energy demand by region and scenario	○			○		○						○	○	
	Change in energy demand and average annual GDP growth rate by region in the States Policies Scenario, 2018-2040	○					○							○	○
	Final energy consumption by sector, fuel and scenario	○			○		○						○		
	Change in final energy consumption by sector 2000-2018 and by scenario to 2040	○					○						○		
	World electricity generation by fuel, technology and scenario	○			○		○						○		
	Change in fossil fuel production and demand in selected regions in the Stated Policies Scenario, 2018-2040	○					○							○	
	Net oil and gas imports to Asia by scenario	○			○		○							○	○
	Net import (shaded) and export shares by fuel, region and scenario	○					○							○	○
US tight oil production and assumed resources in the announced policies scenarios of the WEO-2018 and WEO-2019	○		○	○	○	○							○		

Source: IEA World Energy Outlook 2019

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# 【Parameters in IEA WEO 2019 4/14】

## Energy demand 2/4

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region				
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Energy demand	Differences in oil supply and power generation in the announced policies scenarios of the WEO-2019 and WEO-2018	○			○	○	○	○						○		
	Tight oil and shale gas output in the United States, 2010-2018, and in the Stated Policies Scenario	○			○	○	○	○							○	
	Total final consumption by sector and fuel in the Sustainable Development Scenario	○									○			○		
	Oil demand in transport by mode (left) and change in transport energy use by scenario in 2050 relative to today	○									○			○		
	Change in energy demand by end-use in the buildings sector in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2050										○				○	
	Change in oil demand, supply and net trade position in the Stated Policies Scenario, 2018-2040	○	○	○	○	○	○	○							○	
	Global oil demand and production by scenario	○			○		○							○		
	Oil demand by region and scenario	○			○	○	○	○						○	○	○
	Change in oil demand by region in the Stated Policies Scenario	○			○		○							○	○	
	Annual average change in global oil demand by sector in the Stated Policies Scenario	○	○	○	○	○	○	○						○		
	Oil production by type in the Stated Policies Scenario	○			○	○	○	○							○	
	Composition of global production in the Stated Policies Scenario	○			○	○	○	○						○		
	World liquids demand by scenario	○			○	○	○	○						○		
	Oil net imports and import dependency in selected developing Asian economies in the Stated Policies Scenario	○			○		○								○	
	Major exporters and importers of crude oil traded via the Strait of Hormuz, 2018	○													○	○
	Oil and gas trade volumes via major chokepoints in the Stated Policies Scenario	○			○		○							○		
	Crude oil quality of selected producers and refiners, 2018	○													○	○
Global gas demand, production and trade by scenario	○			○		○							○			

Source: IEA World Energy Outlook 2019

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# 【Parameters in IEA WEO 2019 5/14】

## Energy demand 3/4

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region				
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Energy demand	Change in gas demand by region and scenario, 2018-2040	○	○	○	○	○	○							○		
	Gas demand by region and scenario	○		○	○	○	○							○	○	○
	Change in gas supply and demand in developing Asian markets in the Stated Policies Scenario, 2018-2040	○	○	○	○	○	○								○	
	Annual average change in gas demand and production in selected regions in the Stated Policies Scenario, 2018-2040	○	○	○	○	○	○							○	○	
	LNG trade volumes by contract type and assumed oil indexation levels in the Stated Policies Scenario	○		○	○		○							○	○	
	Change in gas and coal demand by scenario, 2018-2040	○	○	○	○	○	○								○	
	Global coal demand by scenario	○	○				○							○		
	Global coal demand, production and trade by scenario	○			○		○							○		
	Coal demand by region and scenario	○		○	○	○	○							○	○	○
	Global coal demand by key sector and scenario	○					○							○		
	Share of global coal demand by sector and scenario	○					○							○		
	Global industrial use of energy by fuel and scenario	○					○							○		
	Industrial use of energy by fuel and key sub-sector in China in the Stated Policies Scenario	○					○								○	
	Change in heat demand by temperature in China in the Stated Policies Scenario, 2018-2040	○	○	○	○	○	○								○	
	Global electricity demand and generation by scenario	○			○		○							○		
	Electricity demand by region and scenario	○			○		○							○	○	○
	Per capita electricity demand and share of electricity in total final consumption in advanced and developing economies	○					○								○	○
	Electricity demand by sector and scenario	○			○		○							○		
Electricity demand growth by end-use and scenario in advanced and developing economies, 2018-2040	○	○	○	○	○	○								○		
Growth in electricity demand and flexibility needs by selected region and scenario, 2018-2040	○	○	○	○	○	○								○		

Source: IEA World Energy Outlook 2019

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# 【Parameters in IEA WEO 2019 6/14】

## Energy demand 4/4

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region				
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Energy demand	World renewable energy demand by scenario	○			○		○							○		
	Renewable energy in total primary energy demand by category and region in the Stated Policies Scenario, 2018 and 2040	○					○							○	○	
	Demand for key materials in the Stated Policies Scenario	○	○		○		○							○		
	Average hourly electricity supply and demand in China in the Sustainable Development Scenario, 2040						○								○	
	Global biogas demand in the Sustainable Development Scenario	○		○	○	○	○								○	
	Change in global gas demand in the Sustainable Development Scenario, 2010-2040	○	○	○	○	○	○								○	
	Monthly electricity and natural gas use in Europe and the United States	○													○	
	Global final energy consumption in industry and buildings in the Future is Electric Scenario	○					○							○		
	Change in natural gas demand in selected regions in the Sustainable Development Scenario	○	○	○	○	○	○								○	○
	Historic global annual demand for hydrogen	○												○		
	Estimated tolerance to hydrogen blend shares of selected elements of existing gas distribution networks	○												○		
	Current limits on hydrogen blending in natural gas networks and gas demand per capita in selected locations	○													○	○
	Biomethane production and share of total biogas production that is upgraded in selected regions, 2017	○													○	
	Biomethane consumption by sector and region in the Stated Policies Scenario	○		○	○	○	○							○	○	
	Biomethane consumption by sector and region in the Sustainable Development Scenario	○		○	○	○	○							○	○	
	Low-carbon hydrogen and biomethane injected into gas grids in the Sustainable Development Scenario	○		○	○	○	○							○		

Source: IEA World Energy Outlook 2019

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## 【Parameters in IEA WEO 2019 7/14】 Energy mix 1/2

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Energy mix	Share of renewables in total capacity additions by region and scenario, 2019-2040	○	○	○	○	○	○						○	○	○
	Global installed power generation capacity by scenario	○	○		○		○						○		
	Reducing CO2 emissions from existing coal-fired power capacity by measure	○			○		○						○		
	Average annual capacity factors for various power generation technologies by region/country	○											○	○	○
	Electricity access by sub-Saharan region in the Stated Policies Scenario	○			○		○							○	
	Operational nuclear power capacity in advanced economies absent further investment	○		○	○	○	○							○	○
	Primary energy mix and fuel use by sector in the Sustainable Development Scenario, 2018 and 2050	○								○			○		
	Global industrial energy use by fuel (left) and energy mix for selected sub-sectors (right)	○											○		
	Energy mix in industrial use for selected regions, 2018	○												○	
	Global power capacity by source in the Stated Policies Scenario	○	○		○		○						○		
	Global electricity generation by source and scenario	○		○	○	○	○						○		
	Global electricity generation mix by scenario	○											○		
	Global power generation capacity by source and scenario	○	○		○		○						○		
	Renewables share in capacity additions by region in the Stated Policies and Sustainable Development scenarios, 2019-2040	○	○	○	○	○	○						○	○	○
	Electricity generation by region in the Stated Policies (STEPS) and Sustainable Development (SDS) scenarios	○						○						○	○
	Global coal-fired power capacity by plant age, 2018	○											○	○	
	Germany's existing coal-fired power capacity by age and phase-out plan	○							○					○	
Sources of flexibility by region in the Stated Policies Scenario	○							○					○		
Energy intensity improvement and renewables share of total final consumption by scenario	○							○				○			
Year-on-year changes in the share of global energy consumption covered by mandatory efficiency standards by selected end-uses	○											○			

Source: IEA World Energy Outlook 2019

4-14

## 【Parameters in IEA WEO 2019 8/14】 Energy mix 2/2

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Energy mix	Annual offshore wind capacity additions by region, 2010-2018	○											○	○	
	Offshore wind installed capacity and share of electricity supply by country, 2018	○												○	
	Indicative annual capacity factors by technology and region	○											○	○	○
	Simulated average weekly capacity factors for new offshore wind and solar PV projects by region	○												○	
	Range of simulated hour-to-hour variations in output for new projects by technology, 2018	○												○	
	Projected global offshore wind capacity and share of electricity supply by scenario	○			○		○						○		
	Installed capacity of offshore wind by region and scenario	○			○		○						○	○	○
	Outlook for offshore wind in the European Union, 2018-2040	○			○		○							○	
	Outlook for offshore wind in China, 2018-2040	○			○		○							○	
	Outlook for offshore wind in the United States, 2018-2040	○			○		○							○	
	Regional average annual capacity factors for new projects	○			○		○						○	○	○
	Energy value by technology and region relative to average wholesale electricity price in the Stated Policies Scenario	—												○	
	Average capacity credit by technology and region in the Stated Policies Scenario	○						○						○	
	Average simulated capacity factors for offshore wind worldwide	—											○		
	Offshore wind capacity needed to produce 1 Mt of hydrogen	—											-		
	Share of potential cross-border connection projects developed by case in Europe to 2030	○	○	○	○									○	

Source: IEA World Energy Outlook 2019

4-15

# 【Parameters in IEA WEO 2019 9/14】

## Price of key commodities/products

IEA World Energy Outlook 2019

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Price of key commodities/products	Supply costs of natural gas, biomethane and hydrogen in the Sustainable Development Scenario, 2018 and 2040	○					○						○		
	Evolution of debt risk premiums for solar PV and wind in India and sensitivity of solar PV LCOE 2018 to debt financing	○												○	
	Evolution of capital costs of solar PV in the Stated Policies and Sustainable Development scenarios				○								○		
	Global oil demand and crude oil price by scenario	○	○		○		○						○		
	Domestic natural gas production costs, LNG import prices and industry gas prices in developing Asian import markets, 2018	○												○	
	Capital costs of liquefaction projects	○	○											○	
	Investment cost ranges for liquefaction capacity and long-run marginal costs in the Stated Policies Scenario, 2018-2040	○	○	○	○	○	○							○	
	Fuel cost competitiveness of small-scale LNG versus oil products for stationary uses, 2018	○												○	
	Residential electricity prices in selected regions by scenario	○			○		○							○	○
	Sensitivity analysis of residential electricity prices by scenario, 2040						○							○	○
	Household energy bill by fuel, 2018 and 2040 by scenario	○					○							○	○
	Battery storage capital costs and installed capacity by scenario	○			○		○						○	○	
	Average hourly CO <sub>2</sub> emissions intensity, electricity demand and wholesale electricity prices in India and the European Union	○					○							○	
	Cost curves of potential global biogas supply by feedstock	○					○							○	
	Cost of using the least expensive biomethane to meet 10% of gas demand and natural gas prices in selected regions, 2018	○												○	
	Marginal abatement costs for global biomethane potential with and without credit for avoided methane emissions, 2018	○												○	
Growing markets and falling costs for offshore wind in the Stated Policies Scenario	○		○	○	○	○							○	○	
Offshore wind indicative shares of capital costs by component and levelised cost of electricity for projects completed in 2018	○												○		
Historical LCOE of offshore wind and strike prices in recent auctions in Europe	○	○	○										○		

Source: IEA World Energy Outlook 2019

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# 【Parameters in IEA WEO 2019 10/14】

IEA World Energy Outlook 2019

## Price of key commodities/products, Predictions on production and sales 1/2

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Price of key commodities/products	Cumulative capital spending on offshore wind, gas- and coal-fired capacity worldwide by scenario, 2019-2040	○	○	○	○	○	○						○		
	Capital costs of offshore wind projects excluding transmission, historical and projects in development	○	○		○									○	○
	Indicative upfront capital cost for high-voltage transmission cables by type and distance from shore	○													
	Regional average annual O&M costs for new projects	○			○		○							○	○
	Offshore wind: indicative nominal cost of debt in Europe (left) and LCOE sensitivity analysis to cost component changes (right)	○												○	
	LCOEs for new offshore wind projects in the European Union, China and the United States, 2018-2040	○			○		○							○	
Predictions on production and sales	Leading market players in the offshore wind industry, 2018	○													
	Leading manufacturers of offshore wind turbines, 2018	○													
	Urban population and cement demand growth in China (historical) India (Stated Policies Scenario) and Africa (Africa Case)	○	○		○		○							○	
	Non-OPEC oil production in the Stated Policies Scenario	○		○	○	○	○							○	
	OPEC oil production in the Stated Policies Scenario	○		○	○	○	○							○	
	Refining capacity and runs by region in the Stated Policies Scenario	○			○		○							○	○
	Oil trade by region in the Stated Policies Scenario	○			○		○							○	○
	Cumulative oil and natural gas supply investment by region in the Stated Policies Scenario, 2019-2040	○	○	○	○	○	○							○	○
	Electric car targets of the world's 20 largest car manufacturers	○	○	○	○										
	Share of SUV sales in key car markets	○												○	
	Historical global trends in car sales by size	○												○	
	Passenger car sales in the Stated Policies Scenario	○		○	○		○							○	
	Share of SUVs in total sales and oil demand in the Stated Policies Scenario and two cases examining differences in the SUV market	○			○		○							○	
	US tight crude oil production in the Stated Policies Scenario	○		○	○	○	○							○	
Year-on-year growth from new wells and underlying declines from existing wells in the Stated Policies Scenario	○		○	○	○	○							○		

Source: IEA World Energy Outlook 2019

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## 【Parameters in IEA WEO 2019 11/14】

IEA World Energy Outlook 2019

### Predictions on production and sales 2/2, Efficiency

Category	Datasets	Timeframe										Country/region				
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Predictions on production and sales	Change in global oil production by type, 2008-2018	○												○		
	Net income from oil and gas production in selected producer economies in the Stated Policies Scenario	○												○		
	Change in gas supply balance by region in the Stated Policies Scenario, 2018-2040	○	○	○	○	○	○							○		
	Natural gas production by region in the Stated Policies Scenario	○		○	○	○	○							○	○	
	Natural gas trade by region in the Stated Policies Scenario	○			○		○							○	○	
	Natural gas net trade by region in the Stated Policies Scenario	○					○							○	○	○
	Use of associated gas by region, 2018	○												○	○	
	Associated gas volumes in the total output from oil fields, 2018	○												○	○	
	Associated and non-associated gas production in selected countries in the Middle East in the Stated Policies Scenario	○			○		○							○	○	
	Associated gas production in the United States in the Stated Policies Scenario, 2010-2025	○		○										○	○	
	Natural gas demand and production in Brazil in the Stated Policies Scenario	○			○		○							○	○	
	Change in global gas and oil production in the Sustainable Development Scenario	○	○	○	○	○	○							○		
	Coal production by region in the Stated Policies Scenario	○		○	○	○	○							○	○	
	Share of coal production by key country in the Stated Policies Scenario	○			○		○							○	○	
	Coal trade by region in the Stated Policies Scenario	○			○		○							○	○	○
	Top-ten global coal producing companies	○														
	Global coal production by type in the Stated Policies Scenario	○		○	○	○	○							○	○	
	Material demand worldwide by scenario and end-use	○						○						○	○	
Power sector demand for steel, cement and aluminium by scenario	○						○						○	○		
Biogas production by region and feedstock, 2017	○												○	○		
Efficiency	Changes in the average efficiency and economics of US tight oil production, 2012-2018	○												○		
	Summary of material efficiency strategies in the Sustainable Development Scenario	—											○			
	EV charging patterns and average hourly CO <sub>2</sub> emissions intensity of electricity in the European Union in the Sustainable Development Scenario, 2040							○						○		

Source: IEA World Energy Outlook 2019

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## 【Parameters in IEA WEO 2019 12/14】

IEA World Energy Outlook 2019

### Technology, Policy, Other 1/3

Category	Datasets	Timeframe										Country/region			
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Technology	Examples of technologies that scale from low levels today to over 3% market share in the Sustainable Development Scenario				○								○		
	Low-carbon technologies by unit size and average annual installations in the Sustainable Development Scenario	○	○	○	○	○	○						○		
	Global sustainable technical potential of biomethane	○					○						○		
	Evolution of the largest commercially available wind turbines	○			○								○		
	Ratio of technical potential to domestic electricity demand by region in the Stated Policies Scenario, 2040						○						○		○
	Regional technical potentials for offshore wind	—											○		
	Offshore wind potential supply curves by region	—											○		
Policy	Policies targeting at least 10 GW of offshore wind by 2030				○								○		
	Policy targets for offshore wind in the European Union				○								○		
	Offshore wind targets by province in China's 13th Five-Year Plan	○											○		
	Offshore wind targets and support policies in the United States			○	○	○							○		
Other	Offshore wind: average distance from shore by country	○											○		
	Evolution of offshore wind competitiveness: value-adjusted LCOEs by technology and region in the Stated Policies Scenario		○		○		○						○		
	Rise in the number of hours of cross-border grid congestion with the addition of a 12 GW hub in the North Sea	—											○		
	Global offshore wind capital spending and potential synergies with offshore oil and gas activities	○											○	○	
	Global average annual energy investment by type and scenario	○	○	○	○	○	○						○		
	Global average annual energy supply investment by type and scenario	○	○	○	○	○	○						○		
	Estimated value of subsidies to fossil fuel consumption, renewables and electric vehicles, and carbon pricing, 2010-2018	○											○		
	Energy investment indicators by economy and scenario	○					○						○		
Key energy indicators in the Sustainable Development and Stated Policies scenarios	Key energy indicators in the Sustainable Development and Stated Policies scenarios	○			○					○			○		
	Pathways to universal access in the Sustainable Development Scenario	○	○	○	○	○	○						○		

Source: IEA World Energy Outlook 2019

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## 【Parameters in IEA WEO 2019 13/14】

IEA World Energy Outlook 2019

### Other 2/3

Category	Datasets	Timeframe										Country/region		
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan
Other	Global premature deaths attributable to air pollution	○							○			○		
	Average annual energy investment in the Sustainable Development Scenario, 2014-2018 and 2019-2050	○							○			○		
	Average annual upstream oil and gas investment in the Stated Policies and Sustainable Development scenarios	○	○	○	○	○	○	○	○			○		
	Population without modern energy access and premature deaths due to air pollution in the Stated Policies Scenario, 2018 and 2050	○							○			○		
	Financial flows in energy investment	—										—		
	Key financing issues in the Sustainable Development Scenario	—										—		
	Sensitivity of US tight crude oil production in 2030 to technical and economic uncertainties				○								○	
	Seaborne crude oil trade by route in the Stated Policies Scenario	○		○	○	○	○					○		
	Cumulative coal supply investment by region in the Stated Policies Scenario, 2019-2040 (\$2018 billion)	○	○	○	○	○	○					○	○	
	Coal supply investment	○										○	○	
	Selected financial and investment institutions committed to reduce or end involvement in coal supply and coal-fired power	—											○	○
	Return on invested capital and after-tax weighted average cost of capital for selected coal companies	○												
	Depth of coal production in selected countries, 2018	○											○	
	Global annual average power sector investment, historical and by scenario, 2019-2040	○	○	○	○	○	○					○		
	Average annual power sector investment by region, 2019-2040	○	○	○	○	○	○						○	
	Value-adjusted levelised cost of electricity by technology in selected regions in the Stated Policies Scenario, 2020-2040		○		○		○						○	
	SO <sub>2</sub> , NO <sub>x</sub> and PM <sub>2.5</sub> emissions in the power sector by region and scenario, 2018-2040	○					○						○	
Value-adjusted LCOE for select power technologies in India in the Stated Policies Scenario		○		○		○						○		
Key indicators by scenario	○			○		○					○			
Energy intensity of GDP by scenario	○			○		○					○	○	○	

Source: IEA World Energy Outlook 2019

4-20

## 【Parameters in IEA WEO 2019 14/14】

IEA World Energy Outlook 2019

### Other 3/3

Category	Datasets	Timeframe										Country/region		
		Past	'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan
Other	Annual average investment in energy efficiency in selected regions by scenario	○	○	○	○	○	○					○	○	
	Global annual average investment in renewables by scenario													
	Per capita material consumption and GDP for selected countries, 2000-2017	○	○	○	○	○	○					○		
	Average annual investment in LNG and gas pipeline infrastructure in the Sustainable Development Scenario	○										○	○	○
	Alternative supply routes to produce low-carbon gases												○	
	Global offshore wind capital spending and potential synergies with offshore oil and gas activities	○	○	○	○	○	○							

Source: IEA World Energy Outlook 2019

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# Parameters in IEA ETP 2017 1/7

## Energy demand

	Category	Datasets	Timeframe								Country / region					
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Energy demand	General	Total final industrial energy consumptions by region	○	○										○		
		Final electricity demand by sector and region, 2014-60	○	○	○	○	○	○	○	○	○			○		
	Primary energy	Global primary energy demand (Biomass and waste, Hydro, Other renewables, Nuclear, Natural gas, Oil, Coal)	○	○	○	○	○	○	○	○	○	○				
	Final energy	Final energy demand industry sector (Oil, Coal, Natural gas, Electricity, Heat, Biomass and waste, Hydrogen)		○												
	Renewable energy	Bioenergy in final energy consumption by end use										○				
	Power supply	Fuel input electricity and heat generation		○	○	○	○	○	○	○	○	○				
Specific sector		Final energy demand (Transport, Residential, Services, Agriculture, Fisheries and forestry)		○	○	○	○	○	○	○	○	○		○		
		Cement production energy use, Energy intensity and direct CO2 emissions intensity of global cement production		○												
		Sector-wide energy consumption and CO2 emissions			○									○		
		Energy intensity development under current regulation and 2DS Energy intensity in 2DS, Energy intensity with EEDI	○	○	○											
		Final energy use by fuel and per person		○	○	○	○	○	○	○	○	○	○			
		Global direct CO2 emissions and process energy intensities of primary chemicals			○								○	○		
		Global energy intensity and direct CO2 emissions of crude steel production			○								○	○		
		Bus and rail activity by scenario and passenger transport activity by mode, 2015-60											○	○		
		Energy intensity improvements in global aviation by scenario	○	○	○	○	○	○	○	○	○	○	○			
		Floor area additions to 2060 and share of additions built by 2035 for selected regions (Non-residential, Residential)											○		○	
		Final energy demand (Oil, Coal, Natural gas, Electricity, Heat, Biomass and waste, Hydrogen)			○			○				○	○			
		Cumulative energy savings by end use relative to the RTS	○		○		○		○		○	○	○			
		Passenger/Freight transport final energy consumption		○	○	○	○	○	○	○	○	○	○		○	
		Energy demand (Space heating, Water heating, Space cooling, Lighting/Appliances and miscellaneous equipments, Cooking)		○	○	○	○	○	○	○	○	○	○			
		Residential - Total final energy consumption by end-use		○	○	○	○	○	○	○	○	○	○			
Energy demand (Cement, Chemicals and petrochemicals, Iron and steel, Pulp and paper, Aluminum)		○	○	○	○	○	○	○	○	○	○					

4-22

Source: IEA Energy Technology Perspectives 2017

# Parameters in IEA ETP 2017 2/7

## Energy mix, Price of key commodities/products, Macroeconomic Variables, Demographic variables, Efficiency

	Category	Datasets	Timeframe								Country / region					
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Energy mix	Renewable energy	Final energy demand in the RTS and 2DS, 2014-60 (Biomass and waste, Natural gas, Electricity, Commercial heat, Oil, Coal, Other, Renewable share, Low-carbon share)	○	○	○	○	○	○	○	○	○	○				
		Bioenergy use and CO2 capture in the RTS, 2DS and B2DS (Power, Fuel Transformation, Agriculture, Buildings, Industry, Transport, %BECCS)										○	○			
		Tracking by technology and region (Solar PV, Hydropower, Bioenergy, CSP, Onshore wind, Offshore wind, Geothermal, Ocean)	○	○										○		
	Power supply	Power generation fuel mix by scenario, 2014 and 2060 (Fossil w/o CCS, Fossil with CCS, Nuclear, Bioenergy with CCS, Renewables)										○	○			
	Nuclear power	Nuclear electricity generation, Capacity additions and reactors under construction	○	○									○			
	Power supply	Coal capacity development (Subcritical, Supercritical, Ultra-supercritical)	○	○									○			
	Specific sector	Investment needs in the power sector	○	○	○	○	○	○	○	○	○	○				
		Role of transport biofuels - final energy demand in the 2DS	○	○	○	○	○	○	○	○	○					
Price of key commodities/products	Renewable energy	Solar PV LCOE and contract prices	○													
	Fossil-fuel	Fossil fuel prices by scenario	○		○		○		○		○	○	○	○	○	
Macroeconomic Variables	GDP	Global GDP, primary energy demand and CO2 emissions	○		○		○		○		○					
		Real GDP growth projections in ETP 2017 (assumed identical across scenarios)	○		○		○		○		○					
Demographic variables	General	Population projections used in ETP 2017 (millions)	○		○		○		○		○					
Efficiency	Efficiency	Natural gas-fired power technology intensity	○	○										○		
		Buildings energy use and intensity per m2 since 1990			○							○	○			
		Global fleet average and new-build plants emissions	○	○	○	○	○	○	○	○	○	○	○			
		Global fleet average and new-build plants emissions	○	○	○	○	○	○	○	○	○	○	○			
		Cost components in battery storage in the scenarios			○							○	○			
		Battery scale-up in the 2DS and B2DS			○					○	○					

4-23

Source: IEA Energy Technology Perspectives 2017

# 【Parameters in IEA ETP 2017 3/7】 Technology, CO2 emissions

	Category	Datasets	Timeframe								Country / region				
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Technology	General	Development of storage technologies in the scenarios		○				○				○	○		
		CCS	Globally installed electricity storage (GW)	○	○								○		
	CCS	Global CO2 captured and stored in the chemicals and petrochemicals/ iron and steel/cement subsector by scenario	○	○	○	○	○	○	○	○	○	○	○		
		Share of CCS in power generation and capacity - B2DS	○	○	○	○	○	○	○	○	○	○	○		
		Share of CCS in industrial production	○	○	○	○	○	○	○	○	○	○	○		
		CO2 captured, BECCS			○	○	○	○	○	○	○	○	○	○	
		Global technology penetrations in LDV stock by scenario, 2015-60	○	○	○	○	○	○	○	○	○	○	○		
	Specific sector	Comparative cost of PLDV technologies by country/region in the RTS and B2DS, 2015 and 2060										○		○	○
		Model shift from aviation to HSR, RTS and B2DS	○	○	○	○	○	○	○	○	○	○			
		Deployment rates for renewables-based power technologies in the B2DS	○		○		○		○		○	○			
	Investment	Investment needs by scenario, 2017-60										○	○		
		Buildings investment to 2060 and share of total B2DS investment by key region	○	○	○	○	○	○	○	○	○		○		
CO2 emissions	CCS	Sector-wide energy consumption and CO2 emissions		○								○			
		International well-to-wake shipping CO2-eq emissions trajectories	○	○											
	Specific sector	Global direct CO2 emissions and process energy intensities of primary chemicals by scenario			○							○	○		
		Energy intensity and direct CO2 emissions of crude steel/global cement production			○							○	○		
		WTW GHG emissions reductions by transport mode and scenario, 2015 - 60	○	○	○	○	○	○	○	○	○	○	○		
		Direct CO2 emissions (Mt CO2)	○	○	○	○	○	○	○	○	○	○	○		
		Well-to-wheel emissions by mode	○	○	○	○	○	○	○	○	○	○	○		
		Buildings - Total emissions by end-use	○	○	○	○	○	○	○	○	○	○	○		

Source : IEA Energy Technology Perspectives 2017

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# 【Parameters in IEA ETP 2017 4/7】 Predictions on production and sales, Carbon pricing

	Category	Datasets	Timeframe								Country / region				
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan	
Predictions on production and sales	Specific sector	Vehicle sales and technology shares in 2015 and 2060 in the RTS and B2DS , Light-duty vehicles (Gasoline internal combustion engine, Diesel combustion engine, Compressed natural gas/ Liquefied petroleum gas, Hybrids, Electric & fuel cell vehicles)										○	○		
		Share of 2-wheelers in major Asian regions and the OECD average in the B2DS, 2015-60			○							○		○	
		Passenger kilometers		○	○	○	○	○	○	○	○	○	○	○	
		Freight tonne kilometers		○	○	○	○	○	○	○	○	○	○	○	
		Global material production projections in the RTS and B2DS										○		○	
		Crude steel/HVC production by process route, scenario and region										○	○		
		Production and energy intensity for primary chemicals		○											
		Global HVC/ammonia/methanol production by process technology in the B2DS		○	○	○	○	○	○	○	○	○	○		
		Global hot metal production in the iron and steel subsector by process technology in the B2DS, Hot metal production in the iron and steel subsector by process route and region										○		○	
		Average CO2 intensity of electricity production and primary aluminium production										○	○	○	
		Production of pulp, paper and paperboard			○									○	
		Product mix of pulp production by region and scenario										○		○	
	Energy mix of pulp and paper production and CO2 intensity			○							○				
Renewable energy	Global biofuels production	○	○								○				
Carbon pricing	CO2 price	CO2 price in selected regions by scenario	○		○		○					-	○	-	

Source : IEA Energy Technology Perspectives 2017, IEA World Energy Outlook 2017

4-25

# 【Parameters in IEA ETP 2017 5/7】

## Energy demand

	Category	Datasets	Timeframe								Country / region					
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan		
Energy demand	General	Evolution of electricity demand	○	○	○	○	○						○			
	Coal	Incremental coal demand by key sector and region	○		○		○							○		
	Fossil-fuel	Coal , Oil and liquids, Fossil fuel, Natural gas demand			○	○	○	○						○	○	○
		Oil and total liquids demand and supply, Change in global oil product demand for petrochemical feedstock		○	○	○	○	○						○		
		Difference in oil demand by sector in the Low Oil Price Case relative to the New Policies Scenario		○	○	○	○	○						○		
		Global liquefaction capacity and demand		○	○	○	○	○						○		
	Gas	Key natural gas demand growth centres, additional use in the New Policies Scenario,					○							○		
	Coal, Gas	Share of coal consumption by technology in electricity					○						○	○	○	
	Renewable energy	World renewable energy consumption			○		○							○		
		Renewable energy use by sector from a consumer perspective and by region					○									
	Heat	Growth in global industrial heat demand by temperature level, Change in global industrial heat supply mix by temperature level					○						○	○		
	Electricity	Electricity demand by region		○	○	○	○	○						○	○	○
	Power supply	Energy demand(TPED, Power generation, Other energy sector, TFC, Industry, Transport, Buildings, Other)			○	○	○	○						○	○	○
	Energy access	Electrification rate		○	○	○									○	
		Population without access to electricity		○	○	○	○	○							○	
	Primary energy	World primary energy demand by fuel and scenario			○		○							○		
		Global primary energy demand(Coal, Oil, Gas, Other renewables, Bioenergy, Nuclear)						○						○		
	Final energy	Average annual global energy efficiency and renewables investments		○	○	○	○	○						○	○	
Avoided final energy demand in 2040 due to energy efficiency policies by fuel, sector and region							○							○		
Specific sector	Residential LED stock and lighting electricity demand in the New Policies Scenario					○							○			
	Global road freight fuel demand by vehicle category					○							○			

Source : IEA Energy Technology Perspectives 2017, IEA World Energy Outlook 2017

4-26

# 【Parameters in IEA ETP 2017 6/7】

## Energy mix, Price of key commodities/products, Efficiency, Technology(1/2)

	Category	Datasets	Timeframe								Country / region						
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan			
Energy mix	Power supply	Electricity generation(Total generation, Coal, Oil, Gas, Nuclear, Renewables)			○	○	○	○						○	○	○	
		Offshore electricity generation			○	○	○	○						○	○	○	
	Power plant	Electrical capacity(Total capacity, Coal, Oil, Gas, Nuclear, Renewables)			○	○	○	○						○	○	○	
		Cumulative power plant capacity retirements by region and source in the New Policies Scenario, 2017-2040 (GW)			○	○	○	○						○	○	○	
		Nuclear power	Top-five regions by installed capacity of nuclear power plants			○	○	○	○					○	○	○	
	CCS	Power generation by source and installed capacity					○							○			
	Investment	Cumulative global energy investment by scenario					○							○			
Average annual offshore energy investment				○	○	○	○						○				
Cumulative investment needs by sector in the New Policies and Sustainable Development Scenarios, 2017-2040							○						○				
Price of key commodities/products	Coal	Steam coal prices by key region in the New Policies Scenario		○	○	○	○	○							○		
		Average FOB cash costs for global seaborne steam coal trade and Richard's Bay FOB coal price		○	○	○	○	○							○		
Efficiency	Efficiency	Global energy intensity reduction			○	○	○	○						○			
		Evolution of global average cost for utility-scale solar PV, Evolution of global average cost for EV battery		○	○	○	○	○						○			
		Powertrain cost comparison of conventional and electric cars			○										○		
		Potential additional impact of material efficiency improvements on oil demand for plastics production							○						○		
		Historical and projected levelised costs of electricity improvements on oil demand for plastics production			○	○	○	○							○		
Technology	Coal, Gas	Delivered cost of coal and natural gas to different power systems in the United States			○									○			
	Fossil-fuel	Deepwater and ultra-deepwater production by region in the New Policies Scenario		○	○	○	○	○						○			

Source : IEA Energy Technology Perspectives 2017, IEA World Energy Outlook 2017

4-27

# 【Parameters in IEA ETP 2017 7/7】 Technology(2/2), Policy, CO2 emissions, Predictions on production and sales

	Category	Datasets	Timeframe								Country / region			
			'20	'25	'30	'35	'40	'45	'50	'55	'60	Global	Several areas	Japan
Technology	Gas	Average costs of resources developed in the New Policies Scenario by year and average Henry Hub price	○	○	○	○	○							
		Estimated average time to procure an extra 10% of LNG import volumes by selected importer			○	○	○						○	○
	Renewable energy	Average annual global energy efficiency and renewables investments		○	○	○	○					○		
	Investment	Cumulative oil and gas supply investment by region					○						○	
Policy	Policy	Cross-cutting policy assumptions by scenario for selected regions										○	○	○
		Selected recent initiatives for electric mobility										○		
	Specific sector	Recent developments in regional power sector policies included in the New Policies Scenario										○		
		Subsidy	Estimated value of global fossil-fuel consumption subsidies									○		
	Renewable energy	Share of supported wind and solar PV generation by mechanism type	○	○	○							○		
	Final energy	Share of global final energy consumption covered by mandatory efficiency regulations by sector										○		
	Renewable energy	Selected renewable energy targets proposed or introduced since mid-2016											○	
CO2 emissions	Gas	Average CO2 emissions intensity of electricity generation in selected regions		○			○						○	
Predictions on production and sales	Coal	World coal demand, production and trade		○			○					○		
	Fossil-fuel	Changes in oil production by region										○		
	Power supply	Offshore oil and gas production					○					○		
	Specific sector	Deployment levels of electric cars					○						○	
		Deployment levels of solar PV					○						○	

Source: IEA Energy Technology Perspectives 2017, IEA World Energy Outlook 2017

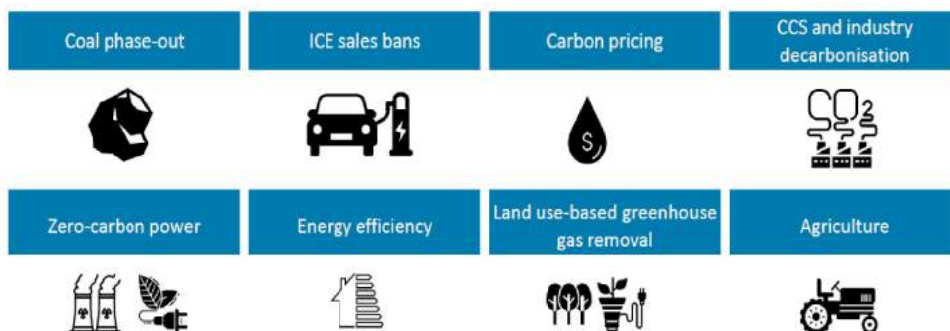
## 【PRI IPR】

# Scenarios for possible short-term climate policies released by the PRI in September 2019



- The International Principles for Responsible Investment (PRI) is an initiative by global investors to “incorporate ESG issues into investment decisions and actions as shareholders, improve long-term investment performance, and better fulfill fiduciary responsibilities.”
- The PRI launched The Inevitable Policy Response (IPR) as a project for investors to prepare for possible short-term climate-related policy risks. As part of the project, Forecast Policy Scenario scenarios have been developed to depict **the impact on 2025-2050 of policies expected to be released between 2023 and 2025.**
- Scenarios include the perspectives of “how will the economy be affected,” “which sectors are most exposed to risk,” and “which asset classes are affected.”

### PRI: The Forecast Policy Scenario (FPS) Hypothetical policy for the 8 items



Sources: 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

#1	Datasets #2	Unit	Timeframe	Country / region			Corresponding page
				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 Sky, 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

#1	Datasets #2	Unit	Timeframe	Country / region			Corresponding page
				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】

PRI The Inevitable Policy Response

### Energy mix 2/2, Price of key commodities/products, Policy 1/2

#1	Datasets #2	Unit	Timeframe	Country / region			Corresponding page
				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		○	○	p.61
	Coal generation by region (China, USA, India, Western Europe, Australia, Japan, Canada, ROW)	TWh per year	'40	○			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	○			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	○			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	○			p.69
	Biomass demand by sector (Industry, Agriculture, Electricity, Transport)	EJ per year	'20 / '30 / '40 / '50	○			p.72
	CCS power generation in the SDS scenario (Coal with CCS, Gas with CCS, Share of CCS)	TWh, %	'20 / '25 / '30 / '35 / '40	○			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		○		p.73
	Zero-carbon power, Nuclear capacity and renewable power generation	TWh			○	○	Policy Forecasts
Price of key commodities /products	Food Price Index (2020=100)	(Index)	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.38, 82
	Share of food in household expenditure	%	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.38, 82
	Bioenergy Price Index (2020=100)	(Index)	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.39, 74, 84
Policy	phase-out of coal in electricity globally	-			○	○	Policy Forecasts
	ICE sales bans	-			○	○	Policy Forecasts
	Carbon Capture and Storage (CCS) and industry decarbonisation	-			○	○	Policy Forecasts
	Energy efficiency	-			○	○	Policy Forecasts
	Afforestation and reforestation	Mha		○			Policy Forecasts
	Restoration of degraded Land	Mha		○	○		Policy Forecasts
	Soil sequestration	-		○			Policy Forecasts

Sources: PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

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## 【Parameters in PRI IPR 4/5】

PRI The Inevitable Policy Response

### Policy 2/2, CO2 emissions

#1	Datasets #2	Unit	Timeframe	Country / region			Corresponding page
				Global	Several areas	Japan	
Policy	Dietary shifts	-		○	○		Policy Forecasts
	Mitigation potential	GtCO2e/yr		○			Policy Forecasts
	Productivity	-		○			Policy Forecasts
	Enabling the Green Economy	-		○	○	○	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	○			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	○			p.18, 88
	Global energy-related CO2 emissions (IPR FPS, IEA NPS, IEA SDS)	GtCO2	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			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)	○			p.20
	Land use GHG emissions (CO2, CH4, N2O, Total Baseline Gt CO2e/year)(IPR FPS)	GtCO2e	2020-2100 (every 5 years)	○			p.21, 79
	Global GHG emissions (IPR SPF, IPCC P1, IPCC P2)	GtCO2e	'20 / '25 / '30 / '35 / '40 / '45 / '50	○			p.22, 89
	CO2 emissions by sector in 2040 (Power) (Low-carbon generation, Total electricity demand)	GtCO2	'40	○			p.26
	CO2 emissions by sector in 2040 (Transport) (Low carbon fuel share, Total fuel demand)	GtCO2	'40	○			p.26
	CO2 emissions by sector in 2040 (Industry) (Low carbon fuel share, Total fuel demand)	GtCO2	'40	○			p.26
	CO2 emissions by sector in 2040 (Buildings) (Low carbon fuel share, Total fuel demand)	GtCO2	'40	○			p.26
	Energy CO2 emissions by fuel (Coal, Oil, Natural Gas, Fossil CCS, Biomass CCS, Net CO2)	GtCO2	2020-2100 (every 5 year)	○			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	○			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		○		p.80

Sources: PRI "The Inevitable Policy Response: Forecast Policy Scenario", "The Inevitable Policy Response: Policy Forecasts"

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**Predictions on production and sales, Other**

#1	Datasets #2	Unit	Timeframe	Country / region			Corresponding page
				Global	Several areas	Japan	
Predictions on production and sales	Passenger vehicles by powertrain (ICE, ULEV)	million 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”

4-34

**[SSP]**

**SSPs are developed as socioeconomic scenarios based on recent policies and socioeconomic conditions**

**Outline of Shared Socioeconomic Pathways**

- National Institute for Environmental Research (Japan), PNNL (United States), PBL (Netherlands), IIASA (Austria), and PIK (Germany) to develop SSPs based on the issues of SRES, an existing socioeconomic scenario for evaluating climate change \*1.
  - SPES had an older base year (1990) and failed to reflect recent policies.
  - SSPs are developed considering recent changes in external environments such as **policies, demographics, GDPs, and the increase in urbanization** \*2, and as scenarios related to existing socioeconomic scenarios such as “SERS” and “RCPs.” To be composed of 5 scenarios.

**5 SSP Scenario Structures**

SSP	Scenario	Scenario-Summary *3
SSP1	Sustainability	Scenarios that envisage both international mitigation and adaptation measures related to climate change
SSP2	Middle of the Road	Scenario based on the assumption that current socioeconomic growth will continue
SSP3	Regional Rivalry	A scenario in which countries are segmented and it is difficult to implement international mitigation and adaptation measures
SSP4	Inequality	Scenario that assumes an expanding disparity in the international economy and society
SSP5	Fossil-fueled Development	Scenario that assumes the development of the international community by relying on fossil fuels



\* 1: <https://www.nies.go.jp/whatsnew/20170221/20170221.html>. \*2: [https://unfccc.int/sites/default/files/part1\\_iiasa\\_rogeij\\_ssp\\_poster.pdf](https://unfccc.int/sites/default/files/part1_iiasa_rogeij_ssp_poster.pdf)  
 \* 3: <https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change>

4-35



# 【Parameters in SSP Public Database Version2.0 1/10】

## IAM Scenarios model: GDP, Population, Primary Energy, Secondary Energy (Electricity)

SSP Public Database Version2.0

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	○	○	○	○	○	
		Biomass(Total / Traditional / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS and Traditional biomass are not available
		Coal (Total / with CCS /without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS is not available
		Oil (Total / with CCS / without CCS)	EJ/yr	○	△	△	○	△	Some data about CCS is not available
		Gas (Total / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS is not available
		Fossil (Total , with CCS, without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS is not available
		Nuclear	EJ/yr	○	○	○	○	○	
		Non-Biomass Renewables	EJ/yr	○	○	○	○	○	
		Hydro	EJ/yr	○	○	○	○	○	
		Geothermal	EJ/yr	○	○		○	○	
		Other	EJ/yr	○	○		○		
		Solar	EJ/yr	○	○	○	○	○	
		Wind	EJ/yr	○	○	○	○	○	
	Secondary Energy Trade	EJ/yr			○				
	Secondary Energy (Electricity)	Total	EJ/yr	○	○	○	○	○	
		Biomass(Total / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS is not available
		Coal (Total / with CCS /without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS is not available
		Oil	EJ/yr	○	○	○	○	○	
		Gas (Total / with CCS/ without CCS)	EJ/yr	○	○	△	○	○	Some data about CCS is not available
		Geothermal	EJ/yr	○	○		○	○	
		Hydro	EJ/yr	○	○	○	○	○	
		Non-Biomass Renewables	EJ/yr	○	○	○	○	○	
		Nuclear	EJ/yr	○	○	○	○	○	
Solar		EJ/yr	○	○	○	○	○		
Wind	EJ/yr	○	○	○	○	○			

Source: SSP Public Database Version 2.0

※Listed parameters that is capable of extracting global data

※Listed parameters from 2005, ever 5 years between 2015~2100

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# 【Parameters in SSP Public Database Version2.0 2/10】

## IAM Scenarios model : Secondary energy, Final energy, Energy service

SSP Public Database Version2.0

Category			Unit	SSP					Remark
Large	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Energy	Secondary Energy (Gases)	Total	EJ/yr	○	○	○	○	○	
		Biomass	EJ/yr			○	○	○	
		Coal	EJ/yr			○	○	○	
	Secondary Energy (Heat)	Natural Gas	EJ/yr	○	○	○	○	○	
		Total	EJ/yr		○		○	○	
	Secondary Energy (Hydrogen)	Geothermal	EJ/yr		○		○	○	
		Total	EJ/yr	○	○		○	○	
		Biomass(Total / with CCS/ without CCS)	EJ/yr	○	○		○	○	
	Secondary Energy (Liquids)	Electricity	EJ/yr	○	○		○	○	
		Total	EJ/yr	○	○	○	○	○	
		Biomass(Total / with CCS/ without CCS)	EJ/yr	△	○	△	○	○	Some data about CCS is not available
		Coal (Total / with CCS /without CCS)	EJ/yr		○			○	
	Secondary Energy (Solids)	Gas (Total / with CCS/ without CCS)	EJ/yr		○				
		Oil	EJ/yr	○	○	○	○	○	
		—	EJ/yr	○	○			○	
	Final Energy	Total	EJ/yr	○	○	○	○	○	
		Electricity	EJ/yr	○	○	○	○	○	
		Gases	EJ/yr	○	○	○	○	○	
		Heat	EJ/yr	○	○	○	○	○	
		Hydrogen	EJ/yr	○	○		○	○	
		Liquids	EJ/yr	○	○	○	○	○	
		Solar	EJ/yr	○	○				
	Final Energy (Solids)	Total	EJ/yr	○	○	○	○	○	
		Biomass (Total, Traditional)	EJ/yr	△	○	△	○	○	Some data about Traditional biomass is not available
		Coal	EJ/yr	○	○	○	○	○	
	Final Energy	Industry	EJ/yr	○	○	○	○		
		Residential and Commercial	EJ/yr	○	○	○	○		
		Transportation	EJ/yr	○	○	○	○	○	
	Energy Service (Transportation)	Freight	bn tkm/yr	○			○	○	
		Passenger	bn pkm/yr	○			○	○	

Source: SSP Public Database Version 2.0

※Listed parameters that is capable of extracting global data

※Listed parameters from 2005, ever 5 years between 2015~2100

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# 【Parameters in SSP Public Database Version2.0 3/10】 IAM Scenarios model: Land Cover, Emissions(unharmonized)

SSP Public Database Version2.0

Large	Category		Unit	SSP					Remark	
	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5		
Land Cover	Built-up Area	—	million ha	○		○	○	○		
	Cropland	—	million ha	○	○	○	○	○		
	Forest	—	million ha	○	○	○	○	○		
	Pasture	—	million ha	○	○	○	○	○		
Emissions (unharmonized)	BC	—	Mt BC/yr	○	○	○	○	○		
	CH4	Total	Mt CH4/yr	○	○	○	○	○		
		Fossil Fuels and Industry	Mt CH4/yr				○	○		
		Land Use	Mt CH4/yr	○	○	○	○	○		
	CO	—	Mt CO/yr	○	○	○	○	○		
	CO2	Total	Mt CO2/yr	○	○	○	○	○		
		CO2 (Carbon Capture and Storage)	Total	Mt CO2/yr	○	○		○	○	
			Biomass	Mt CO2/yr	○	○		○	○	
	CO2	Fossil Fuels and Industry	Mt CO2/yr	○	○	○	○	○		
		Land Use	Mt CO2/yr	○	○	○	○	○		
	F-Gases	—	Mt CO2-equiv/yr	○	○	○	○	○		
	Kyoto Gases	—	Mt CO2-equiv/yr	○	○	○	○	○		
		Total	kt N2O / yr	○	○	○	○	○		
	N2O	Land Use	kt N2O / yr	○	○	○	○	○		
		NH3	—	Mt NH3/yr	○	○	○	○	○	
	NOx	—	Mt NO2/yr	○	○	○	○	○		
	OC	—	Mt OC/yr	○	○	○	○	○		
Sulfur	—	Mt SO2/yr	○	○	○	○	○			
VOC	—	Mt VOC/yr	○	○	○	○	○			

※Listed parameters that is capable of extracting global data  
 ※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-38

# 【Parameters in SSP Public Database Version2.0 4/10】 IAM Scenarios model: Emissions (harmonized), Climate

SSP Public Database Version2.0

Large	Category		Unit	SSP					Remark
	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Emissions (harmonized)	BC	—	Mt BC/yr			○		○	
	CH4	Total	Mt CH4/yr			○		○	
		Fossil Fuels and Industry	Mt CH4/yr			○		○	
		Land Use	Mt CH4/yr			○		○	
	CO	—	Mt CO/yr			○		○	
	CO2	Total	Mt CO2/yr			○		○	
		Fossil Fuels and Industry	Mt CO2/yr			○		○	
			Land Use	Mt CO2/yr			○		○
	F-Gases	—	Mt CO2-equiv/yr			○		○	
	Kyoto Gases	—	Mt CO2-equiv/yr			○		○	
	N2O	—	kt N2O/yr			○		○	
	NH3	—	Mt NH3/yr			○		○	
	NOx	—	Mt NO2/yr			○		○	
	OC	—	Mt OC/yr			○		○	
	Sulfur	—	Mt SO2/yr			○		○	
	VOC	—	Mt VOC/yr			○		○	
	Climate	Concentration	CO2	ppm	○	○	○	○	○
CH4			ppb	○	○	○	○	○	
N2O			ppb	○	○	○	○	○	
Forcing		Total	W/m2	○	○	○	○	○	
		CO2	W/m2	○	○	○	○	○	
		CH4	W/m2	○	○	○	○	○	
		N2O	W/m2	○	○	○	○	○	
		Kyoto Gases	W/m2	○	○	○	○	○	
		F-Gases	W/m2	○	○	○	○	○	
		Aerosol	W/m2	○	○	○	○	○	
Temperature	Global Mean	°C	○	○	○	○	○		

※Listed parameters that is capable of extracting global data  
 ※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-39

## 【Parameters in SSP Public Database Version2.0 5/10】

SSP Public Database Version2.0

### IAM Scenarios model : Agricultural/Economic/Technological Indicators

Large	Category		Unit	SSP					Remark
	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
Agricultural Indicators	Demand	Crops	million t DM/yr	○	○	○			
		Crops (Energy)	million t DM/yr			○		○	
		Livestock	million t DM/yr	○	○	○		○	
	Production	Crops (Energy)	million t DM/yr	○	○	○	○	○	
		Crops (Non-Energy)	million t DM/yr	○	○	○	○	○	
		Livestock	million t DM/yr	○	○	○	○	○	
Economic Indicators	Consumption	—	billion US\$2005/yr	○	○	○		○	
	Price (Carbon)	—	US\$2005/t CO2	○	○		○	○	
Technological Indicators	Capacity (Electricity)	Total	GW	○	○	○	○	○	
		Biomass	GW	○	○	○	○	○	
		Coal	GW	○	○	○	○	○	
		Gas	GW	○	○	○	○	○	
		Geothermal	GW		○	○	○	○	
		Hydro	GW	○	○	○	○	○	
		Nuclear	GW	○	○	○		○	
		Oil	GW	○	○	○	○		
		Other	GW	○					
		Solar (Total, CSP, PV)	GW	○	○	△	△	○	Some data about CSP and PV is not available
Wind (Total, Offshore, Onshore)	GW	○	○	△	△	△	Some data about Offshore and Onshore is not available		

※Listed parameters that is capable of extracting global data

※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-40

## 【Parameters in SSP Public Database Version2.0 6/10】

SSP Public Database Version2.0

### CMIP6 Emissions model: BC, C2F6, CF4, CH4

Large	Category		Unit	SSP					Remark
	Medium	Small		SSP1	SSP2	SSP3	SSP4	SSP5	
BC	Agricultural Waste Burning		Mt BC/yr	○	○	○	○	○	
	Aircraft		Mt BC/yr	○	○	○	○	○	
	Energy Sector		Mt BC/yr	○	○	○	○	○	
	Forest Burning		Mt BC/yr	○	○	○	○	○	
	Grassland Burning		Mt BC/yr	○	○	○	○	○	
	Industrial Sector		Mt BC/yr	○	○	○	○	○	
	International Shipping		Mt BC/yr	○	○	○	○	○	
	Peat Burning		Mt BC/yr	○	○	○	○	○	
	Residential Commercial Other		Mt BC/yr	○	○	○	○	○	
	Transportation Sector		Mt BC/yr	○	○	○	○	○	
	Total		Mt BC/yr	○	○	○	○	○	
	Waste		Mt BC/yr	○	○	○	○	○	
	C2F6	—		kt C2F6/yr	○	○	○	○	○
CF4	—		kt CF4/yr	○	○	○	○	○	
CH4	Agricultural Waste Burning		Mt CH4/yr	○	○	○	○	○	
	Agriculture		Mt CH4/yr	○	○	○	○	○	
	Energy Sector		Mt CH4/yr	○	○	○	○	○	
	Forest Burning		Mt CH4/yr	○	○	○	○	○	
	Grassland Burning		Mt CH4/yr	○	○	○	○	○	
	Industrial Sector		Mt CH4/yr	○	○	○	○	○	
	International Shipping		Mt CH4/yr	○	○	○	○	○	
	Peat Burning		Mt CH4/yr	○	○	○	○	○	
	Residential Commercial Other		Mt CH4/yr	○	○	○	○	○	
	Transportation Sector		Mt CH4/yr	○	○	○	○	○	
	Total		Mt CH4/yr	○	○	○	○	○	
	Waste		Mt CH4/yr	○	○	○	○	○	

※Listed parameters that is capable of extracting global data

※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-41

## 【Parameters in SSP Public Database Version2.0 7/10】 CMIP6 Emissions model: CO2, CO, HFC, N2O

SSP Public Database Version2.0

Large	Category		Unit	SSP					Remark
	Medium			SSP1	SSP2	SSP3	SSP4	SSP5	
CO2		AFOLU	Mt CO2/yr	○	○	○	○	○	
		Aircraft	Mt CO2/yr	○	○	○	○	○	
		Energy Sector	Mt CO2/yr	○	○	○	○	○	
		Industrial Sector	Mt CO2/yr	○	○	○	○	○	
		International Shipping	Mt CO2/yr	○	○	○	○	○	
		Residential Commercial Other	Mt CO2/yr	○	○	○	○	○	
		Solvents Production and Application	Mt CO2/yr	○	○	○	○	○	
		Transportation Sector	Mt CO2/yr	○	○	○	○	○	
		Total	Mt CO2/yr	○	○	○	○	○	
		Waste	Mt CO2/yr	○	○	○	○	○	
CO		Agricultural Waste Burning	Mt CO/yr	○	○	○	○	○	
		Aircraft	Mt CO/yr	○	○	○	○	○	
		Energy Sector	Mt CO/yr	○	○	○	○	○	
		Forest Burning	Mt CO/yr	○	○	○	○	○	
		Grassland Burning	Mt CO/yr	○	○	○	○	○	
		Industrial Sector	Mt CO/yr	○	○	○	○	○	
		International Shipping	Mt CO/yr	○	○	○	○	○	
		Peat Burning	Mt CO/yr	○	○	○	○	○	
		Residential Commercial Other	Mt CO/yr	○	○	○	○	○	
		Transportation Sector	Mt CO/yr	○	○	○	○	○	
		Total	Mt CO/yr	○	○	○	○	○	
		Waste	Mt CO/yr	○	○	○	○	○	
	HFC		—	Mt CO2-equiv/yr	○	○	○	○	○
N2O		—	kt N2O/yr	○	○	○	○	○	

※Listed parameters that is capable of extracting global data  
 ※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-42

## 【Parameters in SSP Public Database Version2.0 8/10】 CMIP6 Emissions model: NH3, NO2

SSP Public Database Version2.0

Large	Category		Unit	SSP					Remark
	Medium			SSP1	SSP2	SSP3	SSP4	SSP5	
NH3		Agricultural Waste Burning	Mt NH3/yr	○	○	○	○	○	
		Agriculture	Mt NH3/yr	○	○	○	○	○	
		Aircraft	Mt NH3/yr	○	○	○	○	○	
		Energy Sector	Mt NH3/yr	○	○	○	○	○	
		Forest Burning	Mt NH3/yr	○	○	○	○	○	
		Grassland Burning	Mt NH3/yr	○	○	○	○	○	
		Industrial Sector	Mt NH3/yr	○	○	○	○	○	
		International Shipping	Mt NH3/yr	○	○	○	○	○	
		Peat Burning	Mt NH3/yr	○	○	○	○	○	
		Residential Commercial Other	Mt NH3/yr	○	○	○	○	○	
		Transportation Sector	Mt NH3/yr	○	○	○	○	○	
		Total	Mt NH3/yr	○	○	○	○	○	
		Waste	Mt NH3/yr	○	○	○	○	○	
NO2		Agricultural Waste Burning	Mt NOx/yr	○	○	○	○	○	
		Agriculture	Mt NOx/yr	○	○	○	○	○	
		Aircraft	Mt NOx/yr	○	○	○	○	○	
		Energy Sector	Mt NOx/yr	○	○	○	○	○	
		Forest Burning	Mt NOx/yr	○	○	○	○	○	
		Grassland Burning	Mt NOx/yr	○	○	○	○	○	
		Industrial Sector	Mt NOx/yr	○	○	○	○	○	
		International Shipping	Mt NOx/yr	○	○	○	○	○	
		Peat Burning	Mt NOx/yr	○	○	○	○	○	
		Residential Commercial Other	Mt NOx/yr	○	○	○	○	○	
		Transportation Sector	Mt NOx/yr	○	○	○	○	○	
		Total	Mt NOx/yr	○	○	○	○	○	
		Waste	Mt NOx/yr	○	○	○	○	○	

※Listed parameters that is capable of extracting global data  
 ※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-43

## 【Parameters in SSP Public Database Version2.0 9/10】 CMIP6 Emissions model: OC, SF6, Sulfur

SSP Public Database Version2.0

Large	Category		Unit	SSP					Remark	
	Medium			SSP1	SSP2	SSP3	SSP4	SSP5		
OC		Agricultural Waste Burning	Mt OC/yr	○	○	○	○	○		
		Aircraft	Mt OC/yr	○	○	○	○	○		
		Energy Sector	Mt OC/yr	○	○	○	○	○		
		Forest Burning	Mt OC/yr	○	○	○	○	○		
		Grassland Burning	Mt OC/yr	○	○	○	○	○		
		Industrial Sector	Mt OC/yr	○	○	○	○	○		
		International Shipping	Mt OC/yr	○	○	○	○	○		
		Peat Burning	Mt OC/yr	○	○	○	○	○		
		Residential Commercial Other	Mt OC/yr	○	○	○	○	○		
		Transportation Sector	Mt OC/yr	○	○	○	○	○		
		Total	Mt OC/yr	○	○	○	○	○		
		Waste	Mt OC/yr	○	○	○	○	○		
	SF6		—	kt SF6/yr	○	○	○	○	○	
	Sulfur		Agricultural Waste Burning	Mt SO2/yr	○	○	○	○	○	
		Aircraft	Mt SO2/yr	○	○	○	○	○		
		Energy Sector	Mt SO2/yr	○	○	○	○	○		
		Forest Burning	Mt SO2/yr	○	○	○	○	○		
		Grassland Burning	Mt SO2/yr	○	○	○	○	○		
		Industrial Sector	Mt SO2/yr	○	○	○	○	○		
		International Shipping	Mt SO2/yr	○	○	○	○	○		
		Peat Burning	Mt SO2/yr	○	○	○	○	○		
		Residential Commercial Other	Mt SO2/yr	○	○	○	○	○		
		Transportation Sector	Mt SO2/yr	○	○	○	○	○		
		Total	Mt SO2/yr	○	○	○	○	○		
		Waste	Mt SO2/yr	○	○	○	○	○		

※Listed parameters that is capable of extracting global data

※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

4-44

## 【Parameters in SSP Public Database Version2.0 10/10】 CMIP6 Emissions model: VOC

SSP Public Database Version2.0

Large	Category		Unit	SSP					Remark
	Medium			SSP1	SSP2	SSP3	SSP4	SSP5	
VOC		Agricultural Waste Burning	Mt VOC/yr	○	○	○	○	○	
		Aircraft	Mt VOC/yr	○	○	○	○	○	
		Energy Sector	Mt VOC/yr	○	○	○	○	○	
		Forest Burning	Mt VOC/yr	○	○	○	○	○	
		Grassland Burning	Mt VOC/yr	○	○	○	○	○	
		Industrial Sector	Mt VOC/yr	○	○	○	○	○	
		International Shipping	Mt VOC/yr	○	○	○	○	○	
		Peat Burning	Mt VOC/yr	○	○	○	○	○	
		Residential Commercial Other	Mt VOC/yr	○	○	○	○	○	
		Solvents Production and Application	Mt VOC/yr	○	○	○	○	○	
		Transportation Sector	Mt VOC/yr	○	○	○	○	○	
		Total	Mt VOC/yr	○	○	○	○	○	
		Waste	Mt VOC/yr	○	○	○	○	○	

※Listed parameters that is capable of extracting global data

※Listed parameters from 2005, ever 5 years between 2015~2100

Source : SSP Public Database Version 2.0

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# 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

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## Physical risk assessment tools referred in TCFD report

Tools at a global level	
WRI Aqueduct Atlas	<ul style="list-style-type: none"> <li>■ Risk mapping tool that helps companies, investors, governments, and other users understand where and how water risks and opportunities are emerging worldwide</li> </ul>
WBCSD Water Tool	<ul style="list-style-type: none"> <li>■ A multifunctional resource for identifying corporate water risks and opportunities, including a workbook, a mapping functionality, and Google earth compatibility</li> <li>■ Organizations can compare sites based on water availability, sanitation, population, and biodiversity</li> </ul>
Global Agro- Ecological Zones	<ul style="list-style-type: none"> <li>■ Based on the Global Agro-Ecological Zones (GAEZ) methodology for assessing agricultural resources and potential</li> <li>■ Users can understand forecast changes in yields, production, and other outputs due to climate change.</li> </ul>
Tools at a local / national level	
UK Climate Impact Programme	<ul style="list-style-type: none"> <li>■ Gathered historical climate records and future climate projections</li> <li>■ Climate projections cover low-, medium- and high- emissions scenarios and can be viewed through an online user interface and associated briefing report</li> </ul>
US Interagency Archive of Downscaled Climate Data and Information	<ul style="list-style-type: none"> <li>■ Provides an archive of simulated historical and future climatology and hydrology</li> <li>■ 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</li> </ul>
Management and Impacts of Climate Change (France)	<ul style="list-style-type: none"> <li>■ Meteo-France is the primary provider of climate projections out to 2100, covering temperature, precipitation, and wind speeds, aligned with the IPCC's RCPs</li> <li>■ Projections are provided for the medium term (2021-2050) and long term (2071-2100)</li> </ul>

※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

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## 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 Tool	<a href="https://www.wri.org/aqueduct">https://www.wri.org/aqueduct</a>	Global	4-49
2	AP-PLAT	Climate Impact Viewer	<a href="https://adaptation-platform.nies.go.jp/en/ap-plat/">https://adaptation-platform.nies.go.jp/en/ap-plat/</a>	Asia	4-51
3	World Bank	Climate Change Knowledge Portal	<a href="http://sdwebx.worldbank.org/climateportal/">http://sdwebx.worldbank.org/climateportal/</a>	Global	4-50
4	European Commission	European Climate Adaptation Platform (Climate-ADAPT)	<a href="http://climate-adapt.eea.europa.eu/">http://climate-adapt.eea.europa.eu/</a>	Europe	— ※ European Adaptation Platform
5	IPCC TGICA	IPCC Data Distribution Centre	<a href="http://www.ipcc-data.org/">http://www.ipcc-data.org/</a>	Global	— ※ Database of the Intergovernmental Panel on Climate Change (IPCC)

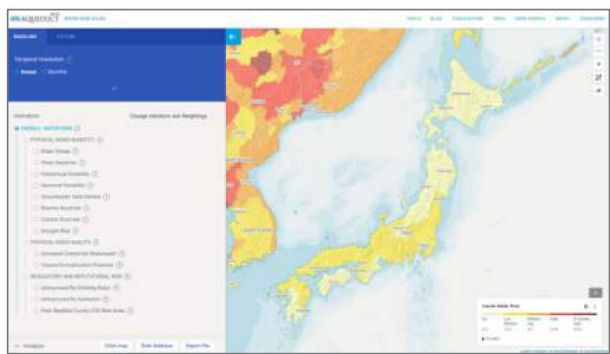
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WRI AQUEDUCT Water Risk Atlas

## AQUEDUCT Water Risk Atlas (WRI)

### AQUEDUCT Water Risk Atlas

<b>Issuing agency</b>	World Resource Institution	<b>Indicators</b>	
<b>Scenario</b>	Pessimistic / Business as usual / Optimistic	<b>Indicators (Baseline)</b>	
<b>Timeframe</b>	Baseline / 2030~2040	Physical risks (quantity)	<ul style="list-style-type: none"> <li>Water stress</li> <li>Water Depletion</li> <li>Interannual Variability</li> <li>Seasonal Variability</li> <li>Groundwater Table Decline</li> <li>Riverine flood risk</li> <li>Coastal flood risk</li> <li>Drought Risk</li> </ul>
		Physical risks (quality)	<ul style="list-style-type: none"> <li>Untreated Connected Wastewater</li> <li>Coastal Eutrophication Potential</li> </ul>
		Regulatory and reputational risk	<ul style="list-style-type: none"> <li>Unimproved / No Drinking Water</li> <li>Unimproved / No Sanitation</li> <li>Peak RepRisk Country ESG Risk Index</li> </ul>
		<b>Indicators (2030-2040)</b>	
		<ul style="list-style-type: none"> <li>Water Stress</li> <li>Seasonal Variability</li> <li>Water Supply</li> <li>Water Demand</li> </ul>	



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](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)

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## 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



Source: World Bank, Climate Change Knowledge Portal  
<https://climateknowledgeportal.worldbank.org/country/japan/climate-data-projections/>

Indicators (excerpt)	
Category	詳細
Essential Climate Variables	<ul style="list-style-type: none"> <li>Monthly Temperature</li> <li>Monthly Maximum Temperature</li> <li>Monthly Minimum Temperature</li> <li>Monthly Precipitation</li> </ul>
Temperature Indicators	<ul style="list-style-type: none"> <li>Maxima of Daily Tmax</li> <li>Minima of Daily Tmin</li> <li>Summer Days (Tmax &gt; 25°C)</li> <li>Tropical Nights (Tmin &gt; 20°C)</li> <li>Frost Days (Tmin &lt; 0°C)</li> <li>Ice Days (Tmax &lt; 0°C)</li> <li>Hot Day (Tmax &gt; 35°C)</li> <li>Hot Day (Tmax &gt; 40°C)</li> <li>Heat Index 35</li> </ul>
Precipitation Indicators	<ul style="list-style-type: none"> <li>Days with Rainfall &gt; 20mm</li> <li>Maximum Monthly Rainfall (10-yr RL)</li> <li>Maximum Monthly Rainfall (25-yr RL)</li> <li>Days with Rainfall &gt; 50mm</li> <li>Rainfall of Very Wet Days</li> <li>Maximum Daily Rainfall</li> <li>Maximum 5-day Rainfall</li> <li>Maximum Daily Rainfall (10-yr RL)</li> <li>Maximum 5-day Rainfall</li> <li>Maximum daily Rainfall (25-yr RL)</li> <li>Maximum 5-day Rainfall (25-yr RL)</li> </ul>
Agriculture Indicators	<ul style="list-style-type: none"> <li>Growing Season Length</li> <li>Days of Consecutive Dry Spell</li> <li>Days of Consecutive Wet Spell</li> <li>Rainfall Seasonality</li> </ul>

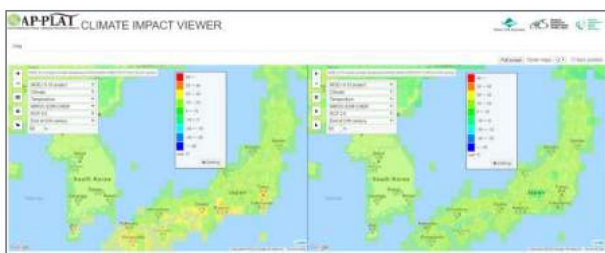
4-50

AP-PLAT Climate Impact Viewer

## 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	
Climate	<ul style="list-style-type: none"> <li>Temperature</li> <li>Precipitation</li> </ul>
Water resources	<ul style="list-style-type: none"> <li>Falkenmark Index</li> </ul>
Vegetation	<ul style="list-style-type: none"> <li>Net Primary Production</li> <li>Vegetation carbon</li> <li>Soil carbon pool</li> <li>Net Biome Production</li> <li>Soil erosion</li> <li>Fire</li> </ul>
健康	<ul style="list-style-type: none"> <li>Heat stress</li> </ul>

Source: [https://a-plat.nies.go.jp/ap-plat/asia\\_pacific/index.html](https://a-plat.nies.go.jp/ap-plat/asia_pacific/index.html)

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# 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

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### Extract examples of the disclosure of scenario analysis that can be used as “reference” for further implementation

Analysis step	Stage	Examples of disclosure
For beginning scenario analysis	<b>Prep ③</b> How the subjects for analysis are chosen	✓ Mitsubishi Corporation (Example ①-1)
<b>2</b> Assess materiality of climate-related risks	<b>Stage2</b> How the risks and opportunities associated with transition / physical risks are described	✓ Mitsubishi Corporation (Example ①-2) ✓ Sekisui Chemical Co., Ltd. (Example ②-1) ✓ JFEHD (Example ③-1)
<b>3</b> Identify and define range of scenarios	<b>Stage1</b> Which scenarios are used	✓ Sekisui Chemical Co., Ltd. (Example ②-2) ✓ BP (Example I) ✓ Downer Group (Example II)
<b>4</b> Evaluate business impacts	<b>Stage2</b> How the business impacts are described	✓ Mitsubishi Corporation (Example ①-3) ✓ Atlantica Yield (Example III) ✓ JFEHD (Example ③-2) ✓ BHP (Example IV) ✓ Kirin HD (Example ④) ✓ South32 (Example V)
<b>5</b> Identify potential responses	<b>Stage2</b> How resilience against climate change is described	✓ Hitachi, Ltd. (Example ⑤)

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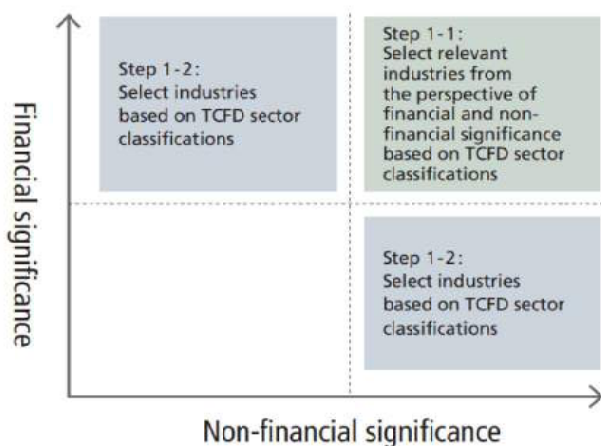
**[Example ①-1: Mitsubishi Corporation]**

**Mitsubishi Corporation selects the subjects of analysis from the sectors of business that has a large financial / non-financial impact and from TCFD recommendations**

<b>Company name and sector</b>	<b>Mitsubishi Corporation</b>	<b>Trading company</b>
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**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 "

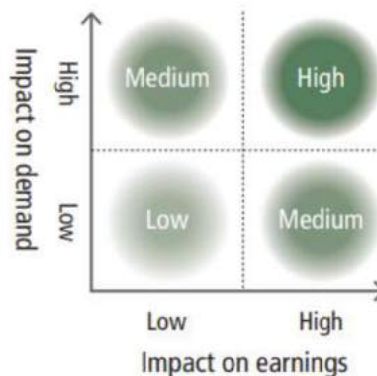
**[Example ①-2: Mitsubishi Corporation]**

**Mitsubishi Corporation assesses the significance of risks on a 3-point scale by multiplying the impact on demand and the impact on earnings. Also conducted risk assessments related to the value chain**

<b>Company name and sector</b>	<b>Mitsubishi Corporation</b>	<b>Trading company</b>
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**Point ② Assess materiality of climate-related risks**

- ✓ Identify businesses with financial and non-financial significance
  - ✓ Extract climate-related opportunities and risks under a 2° C scenario for each element of the industry value chain
  - ✓ In the future, company plan to confirm the impact on each of our businesses, and to consider how to monitor them (including identifying indicators and setting targets), as well as strategies and risk management methods
- ✓ Each risk and opportunity is divided into "impact on demand" and "impact of earnings", and the impact of climate change is plotted and classified into large, medium, and small



**Description about risk analysis in the value chain (Integrated report 2019)**

- Moreover, after identifying businesses of major financial and non-financial importance according to each scenario, MC is performing a climate change opportunity and risk analysis for each element in the value chain.

Raw Materials	Trading	Manufacturing & Processing	Trading	Customers
Risk (small impact) Some infrastructure upgrades	Opportunities (large impact) Increase in transactions	Risk (large impact) Investments in carbon capture technologies and other infrastructure	Risk (small impact) Decrease in transactions	Opportunities (large impact) New business opportunities via market restructuring

Sources: Mitsubishi Corporation "ESG DATA BOOK 2019", "Integrated Report 2019"

# [Example ①-3: Mitsubishi Corporation] Mitsubishi Corporation conducts qualitative business impact evaluation

<b>Company name and sector</b>	<b>Mitsubishi Corporation</b>	<b>Trading company</b>
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Point ③ Evaluate business impacts

**Power Generation (Fossil Fuels)**

	Awareness of the business environment under the NPS/RTS <sup>1)</sup> Scenario	Awareness of the business environment under the 2°C (2DS/SDS) <sup>2)</sup> Scenario
Demand Outlook		
Awareness of the Business Environment	<p>In order to respond to an increase in electricity demand, opportunities are anticipated for businesses such as renewable energy and clean gas-fired power generation.</p> <p>However, given the nature of power generation being produced locally for local consumption, MC feels it is important to continue managing businesses by responding to the policies, etc. of each country and region.</p>	<p>Business opportunities are expected to decline in line with the reduction of fossil fuel power generation amount from the 2020s. In the 2030s, it is anticipated that the strengthening of regulations including carbon taxes could increase the cost of existing thermal power plants, and the profit structure will further change as gas-fired power generation shifts to a dispatchable source of power. Moreover, from the 2040s, thermal power plants used for regulating supply and demand may also be required to reduce their CO<sub>2</sub> emissions, which could necessitate further reductions in operating hours.</p>

- ✓ Demand forecasts obtained from objective data (IEA WEO, ETP) are presented qualitatively
- ✓ Qualitatively describes the company's general perception of business environment based on demand forecasts
- ✓ **Qualitatively describes the impact analyses on the Company's business** based on the business climate perception for **the two scenarios of NPS/RTS scenario (scenario based on the targets set under the current Paris Agreement) and the 2° C scenario (scenario with a 2DS/SDS of 2° C or less)**
- ✓ Based on this, the company's policies and initiatives are described

Policies and Initiatives Based on the Awareness of the Business Environment

In the thermal power generation business, in addition to facilitating collaboration between its gas-fired power generation business, which uses a fuel source with a lower environmental footprint, and its upstream natural gas business, MC is also strengthening its power trading function.

In line with "Transitioning to a Low-carbon Society", MC is taking steps such as converting to alternative fuel sources and raising the percentage of biomass co-combustion at existing coal-fired power plants. Furthermore, MC has adopted a policy not to enter into any new coal-fired power generation businesses, with the exception of projects which MC has already commenced development. Going forward, paying attention to factors including future technology trends for reducing CO<sub>2</sub> emissions (such as CCS), which will become necessary for promoting businesses while considering the environment, as well as progress towards achieving the energy risk of 2030 (including policy trends), MC will aim to reduce its coal-fired power generation capacity on a net equity basis based on 2°C scenario analysis. In the gas-fired power generation business, as well, by conducting a risk analysis based on the impacts of climate change, MC will confirm the future outlook of the business and determine its strategic significance.

Furthermore, for the trading of components, MC has a policy to use best available technology (BAT) to the extent possible.

Source: Mitsubishi Corporation "ESG DATA BOOK 2019"

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# [Example ②-1: Sekisui Chemical] Sekisui Chemical conducted detailed risk analysis and deliberation on countermeasures

<b>Company name and sector</b>	<b>Sekisui Chemical Co., Ltd.</b>	<b>Materials and Buildings (Chemicals)</b>
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Point ① Assess materiality of climate-related risks

Type	Climate change risk item	Rating	Business risk	Business opportunity	SEKISUI response
Physical	Carbon tax hike	Large	<ul style="list-style-type: none"> <li>Medium- to long-term</li> <li>Increase in energy procurement costs</li> <li>Decrease in sales due to shift to product prices</li> </ul>	<ul style="list-style-type: none"> <li>Medium- to long-term</li> <li>Accept business opportunities by differentiating through early response</li> <li>Distribution of energy costs by introducing renewable energy</li> </ul>	<ul style="list-style-type: none"> <li>Increase internal awareness in in-house carbon management through "Environment-Contributing Investments Promotion Measures"</li> <li>Increase efforts towards with commitments to society through ISO certification</li> </ul>
	Energy saving/low carbon response	Large	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase in capital investment to strengthen energy-saving and renewable energy</li> <li>Medium- to long-term</li> <li>Increase in production costs for renewable energy certificates, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase sales from energy conservation/energy-saving business</li> <li>Increase sales from CO<sub>2</sub>-regulator compliant products</li> </ul>	<ul style="list-style-type: none"> <li>Establish Environment-Contributing Investments scale (12 billion yen/3 years)</li> <li>Develop low energy emission technologies (Ex. zero-emission PV)</li> <li>Appropriate selection of green procurement standards</li> <li>Standardization of ZEM housing</li> </ul>
	Policy	Large	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase in renewable energy procurement and waste treatment costs</li> <li>Medium- to long-term</li> <li>Share reduction from loss of differentiation due to marketing of low-carbon products such as ZEM</li> </ul>	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase needs for CO<sub>2</sub> reducing technologies during waste incineration</li> <li>Medium- to long-term</li> <li>Increase in sales of newly built homes due to expansion of ZEM market due to marketing of ZEM</li> </ul>	<ul style="list-style-type: none"> <li>Development of technologies to lower ethanol fuel garbage (Ex. ZEM)</li> <li>Utilization of purchased electricity after FIT (Ex. Smart Heat ZEM)</li> <li>Expansion of Environment-Contributing Products (Net sales ratio 30%→100% (2024))</li> </ul>
	Regulation	Medium	<ul style="list-style-type: none"> <li>Medium- to long-term</li> <li>Leads to expand companies using fossil fuels</li> </ul>	<ul style="list-style-type: none"> <li>Medium-term</li> <li>Increase in business opportunities due to consumer trust derived from commitments to society</li> </ul>	<ul style="list-style-type: none"> <li>Develop long-term vision and long-term (S&amp;P) reduction targets</li> <li>Improve standing in various external rating systems</li> </ul>
Transition	Transition to low-carbon products	Medium	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase in re-evaluation costs due to change of low-carbon materials</li> <li>Medium-term</li> <li>Changeover to lower carbon materials and processes</li> </ul>	<ul style="list-style-type: none"> <li>Short- to medium-term</li> <li>Increase in business opportunities for Environment-Contributing Products that contribute to low-carbon emissions</li> </ul>	<ul style="list-style-type: none"> <li>Use LCA evaluations in planning, development and marketing</li> <li>Use LCA evaluations in marketing</li> <li>Consider product development using bio materials</li> </ul>
	Change in consumer behavior	Medium	<ul style="list-style-type: none"> <li>Long-term</li> <li>Increase in sales of new cars</li> </ul>	<ul style="list-style-type: none"> <li>Long-term</li> <li>Increase in profitability from shift to higher-performance products</li> <li>Expansion of market for ICT-related products</li> </ul>	<ul style="list-style-type: none"> <li>Develop strong heat-resistant, high durability and other high-performance products</li> <li>Develop lightweight PV, heat-insulating products</li> </ul>
	Market uncertainty	Medium	<ul style="list-style-type: none"> <li>Long-term</li> <li>Investments by substitute power supply for disaster-resilient emergency</li> </ul>	<ul style="list-style-type: none"> <li>Long-term</li> <li>Increase in sales of products to support a more disaster-resilient society</li> </ul>	<ul style="list-style-type: none"> <li>Sale of self-sufficient detached housing</li> <li>Development of resilience recycling technologies (Ex. BR)</li> </ul>
Financial	Changes in consumer preferences	Medium	<ul style="list-style-type: none"> <li>Long-term</li> <li>Decrease in sales due to increase preference for sharing over making</li> </ul>	<ul style="list-style-type: none"> <li>Long-term</li> <li>Creation of new businesses to meet the preferences</li> </ul>	<ul style="list-style-type: none"> <li>Begin services utilizing housing-type data (Ex. Smart Heat ZEM)</li> </ul>
	Industry outlook	Large	<ul style="list-style-type: none"> <li>Medium- to long-term</li> <li>Decrease in investor evaluation for non-zero carbon companies</li> </ul>	<ul style="list-style-type: none"> <li>Short- to medium-term</li> <li>Secure stable funding by demonstrating compatibility with measure reporting</li> </ul>	<ul style="list-style-type: none"> <li>Utilization of purchased electricity after FIT</li> </ul>
	Payment difficulty	Large	<ul style="list-style-type: none"> <li>Short-term</li> <li>Damage such as increase in plant stoppages and increase in sales</li> <li>Increase in flooding/flood control costs</li> <li>Decrease in sales due to supply chain disruption</li> <li>Medium- to long-term</li> <li>Increase in insurance costs</li> </ul>	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase in needs for promoting resilient infrastructure</li> <li>Increase in sales of products for high water-related risk areas</li> <li>Increase in needs for equipment/facilities for disaster preparedness</li> </ul>	<ul style="list-style-type: none"> <li>Understand water risks and implement countermeasures</li> <li>Develop highly durable infrastructure</li> <li>Accelerate infrastructure renewal in developed regions (Ex. SPM method)</li> <li>Expand infrastructural business in developing regions</li> <li>Develop disaster response products (Ex. drinking water storage systems)</li> </ul>
	Heavy rain drought	Large	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase in costs for heavy rain restructuring</li> <li>Medium- to long-term</li> <li>Increase in flood protection/warning-related expenses</li> <li>Increase in cooling costs</li> </ul>	<ul style="list-style-type: none"> <li>Short-term</li> <li>Increase in sales of heat-insulating/heat-shielding products</li> <li>Medium- to long-term</li> <li>Increase in needs for pharmaceutical products/medical drugs to contribute to treatments</li> </ul>	<ul style="list-style-type: none"> <li>Encourage changes on the part of raw material suppliers in accordance with the procurement standards</li> <li>Steadily improve production lines</li> <li>Strengthen local manufacturing support in accordance with increase in disease</li> </ul>

- ✓ Risk assessments were conducted in 5 areas, taking into account financial impact and business growth potential. The time horizon, which is expected to be affected, is also mentioned
- ✓ Describes the expected impact of each item in detail, although it is qualitative

Source: S "SEKISUI CHEMICAL Group's Response to Climate Change : Information Disclosure based upon the TCFD Statement of Support"

4-57

**[Example ②-2: Sekisui Chemical]**

**Sekisui Chemical sets specific original scenarios when identify and define a range of scenarios**

<b>Company name and sector</b>	Sekisui Chemical Co., Ltd.	Materials and Buildings (Chemicals)
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**Point ② Identify and define range of scenarios**

- ✓ Assuming four unique scenario-based societies
- ✓ ① Analyses are based on two axes: climate change scenario (2° C scenario: RCP2. 6, 4° C scenario: RCP8. 5), ② social system transition to “centralized” or “dispersed”

Four assumed society scenarios

Scenarios involving various policies to control climate change

Source: Sekisui Chemical Integrated Report 2019

Source: Sekisui Chemical Integrated Report 2019  
4-58

**[Example ③-1: JFE Holdings]**

**JFE Holdings conducts risk assessments incorporating impact and external perspectives**

<b>Company name and sector</b>	JFE Holdings	Materials and Buildings (Iron and steel)
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**Point ① Assess materiality of climate-related risks**

- ✓ Selection of risk and opportunity factors that affect business in two stages
- ✓ After getting a comprehensive overview of the factors in the value chain, consider the degree of impact on the factors and stakeholder expectations and concerns, and identify the factors considered to be important
- ✓ Evaluation of risk and opportunity factors based on the 2° C and 4° C scenarios

	2°C scenario	4°C scenario
Impact on procurement		5. Procurement of raw materials becomes unstable due to increased frequency in climate disasters
Impact on direct business operations	1. Decarbonization in steel production processes 2. Increase in demand for the effective use of steel scraps	6. Damages to business bases due to climate disasters
Impact on demand for products and services	3. Change in demand for steel for automobiles and others 4. Increase in demand for solutions promoting decarbonization	7. National resilience

Impact

×

Expectations and concerns of stakeholders

↑

Identifying important factors

Criteria for identifying important factors: • Impact (possibility of risk opportunities × impact upon occurrence) • Expectations and concerns of stakeholders

Source: JFE GROUP REPORT 2019 - Integrated Report -  
4-59

[Example ③-2:JFE Holdings]

JFE Holdings conducts detailed business impact evaluation (qualitative)

<b>Company name and sector</b>	<b>JFE Holdings</b>	<b>Materials and Buildings (Iron and steel)</b>
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Point ② Evaluate business impacts

- ✓ Qualitatively (with arrows) assess identified risk and opportunity factors
- ✓ Detailed descriptions are provided, and stakeholders' perspectives on the group are also mentioned

	Societal changes and responses to changes	Expectations and concerns of stakeholders towards the JFE Group	Evaluation results
<b>2°C scenario</b> Important factor: Decarbonization in steel production processes	<ul style="list-style-type: none"> <li>Rising societal demands for decarbonization towards steel production processes</li> <li>Implementation of innovative technologies that achieve large-scale decarbonization</li> <li>Implementation of carbon pricing</li> </ul>	<ul style="list-style-type: none"> <li>Significant contribution through innovative technologies</li> <li>Increase in investment in the implementation of innovative technologies</li> <li>Increase in operation costs due to the introduction of carbon pricing</li> </ul>	<ul style="list-style-type: none"> <li>Development and implementation of innovative technologies on top of existing technologies</li> <li>Investment in the implementation of innovative technologies or renewable technologies is possible</li> <li>Cost competitiveness is maintained when introducing a implemented methods</li> </ul>
<b>2°C scenario</b> Important factor: Increase in demand for the effective use of steel scrap	<ul style="list-style-type: none"> <li>Increase in focus on electric furnace method which has lower CO2</li> <li>Rising expectations toward electric furnace steel</li> <li>Increase in scrap generation</li> </ul>	<ul style="list-style-type: none"> <li>Replacement of converter steel with electric furnace steel</li> <li>Increase in JFE Group's production of electric furnace steel</li> </ul>	<ul style="list-style-type: none"> <li>Reduction in the amount of scrap produced, increased production of converter steel</li> <li>Increase in production of electric furnace steel and the need for electric furnace engineering</li> <li>Expansion of the scrap logistic business</li> </ul>
<b>2°C scenario</b> Important factor: Change in demand for steel for automobiles and others	<ul style="list-style-type: none"> <li>Change in automobile needs</li> <li>Increase of EV vehicles</li> <li>Decrease of internal combustion engines</li> <li>Reduction of weight and the increased use of multi-materials</li> <li>Rising demands for non-ferrous raw materials</li> <li>Demand for decarbonization and recyclability</li> </ul>	<ul style="list-style-type: none"> <li>Increase in demand for electrical steel sheets for EV motors</li> <li>Decrease in demand for special steel due to the decrease of internal combustion engines</li> <li>Replacement of automobile steel due to the increased use of multi-materials</li> <li>Demand for future clean-technology and recyclability in steel production</li> </ul>	<ul style="list-style-type: none"> <li>Increase in demand for electrical steel sheets due to more electric vehicles</li> <li>Increase in demand for special steel due to increase in automobile sales</li> <li>Increase in demand for high-tensile steel strength for automobiles</li> <li>Reflex on the recyclability of steel</li> <li>Limited impact of the increased use of multi-materials</li> </ul>
<b>2°C scenario</b> Important factor: Increase in demand for solutions promoting decarbonization	<ul style="list-style-type: none"> <li>Shifting to decarbonization</li> <li>Increase in demand for solutions promoting transition toward decarbonization</li> <li>Decrease development of energy conservation technologies</li> </ul>	<ul style="list-style-type: none"> <li>Renewable energy power generation plants</li> <li>Low-carbon business Eco Solution is developing countries using Best Available Technology (BAT) developed and commercialized in Japan</li> </ul>	<ul style="list-style-type: none"> <li>Integrated construction and operations of renewable energy business, geothermal and solar power plants</li> <li>Integrated construction and operations of waste-to-energy and plastic recycling plants</li> <li>Integrated construction of CCS and EGS facilities</li> <li>Cooperation development of low carbon business</li> </ul>

	Societal changes and responses to changes	Expectations and concerns of stakeholders towards the JFE Group	Evaluation results
<b>4°C scenario</b> Important factor: Procurement of raw materials becomes unstable due to increased frequency in climate disasters	<ul style="list-style-type: none"> <li>Intensifying climate disasters alongside rising temperatures</li> <li>Procurement of raw materials becomes unstable</li> </ul>	<ul style="list-style-type: none"> <li>Procurement of raw materials becomes unstable</li> </ul>	<ul style="list-style-type: none"> <li>Risks</li> <li>Underlying concrete measures "flexible procurement methods and source diversification" "strengthening equipment capabilities"</li> </ul>
<b>4°C scenario</b> Important factor: Damages to business bases due to climate disasters	<ul style="list-style-type: none"> <li>Intensifying climate disasters alongside rising temperatures</li> </ul>	<ul style="list-style-type: none"> <li>Increase in damages due to typhoons and rainstorms</li> <li>Increase in damages due to water shortages</li> <li>Flood damages due to rising sea levels</li> </ul>	<ul style="list-style-type: none"> <li>Risks</li> <li>Flood and water shortage response measures already in motion</li> <li>Flood issues due to rising sea levels can be coped with the current measures</li> </ul>
<b>4°C scenario</b> Important factor: National resilience	<ul style="list-style-type: none"> <li>Intensifying climate disasters alongside rising temperatures</li> <li>Increase in importance of strengthening infrastructure</li> <li>Increase in demand for disaster preventive products</li> </ul>	<ul style="list-style-type: none"> <li>Contribution with steel and related products that help strengthen infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Opportunity</li> <li>Strengthening infrastructure with steel and related products</li> </ul>

Source: JFE GROUP REPORT 2019 - Integrated Report -

[Example ④: Kirin Holdings]

Kirin quantitatively describes the yield of major agricultural products

<b>Company name and sector</b>	<b>Kirin Holdings</b>	<b>Agriculture, food and forestry products (Foods)</b>
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Point ① Impact evaluation on yields of major agricultural products

Impact of climate change on major agricultural product yields/land suitable for cultivation

Legend: Negative/positive impact of less than 10% ▲/▼  
From 10% to less than 50% ▲▲/▼▼  
50% or more ▲▲▲/▼▼▼

Agricultural products	Kirin Group Scenario3: 4°C, unwanted world, 2050			
	United States	Asia	Europe/Africa	Oceania
Barley		<ul style="list-style-type: none"> <li>West Asia Yield▲/+</li> <li>South Korea Yield+</li> </ul>	<ul style="list-style-type: none"> <li>Finland Spring wheat yield▲</li> <li>Mediterranean coast (West) yield▲, (East) yield+</li> <li>France Winter barley and spring barley: Both yields▲</li> <li>Czech Republic Yield▲</li> </ul>	<ul style="list-style-type: none"> <li>Western Australia Yield▲▲</li> </ul>
Hops				
Black tea		<ul style="list-style-type: none"> <li>Sri Lanka Yields down in lowlands. Little impact of temperature rise in highlands.</li> <li>India (Assam region) For each 1°C temperature rise above average temperature of 26°C, yields down 3.8%</li> <li>India (Darjeeling region) Yield▲▲▲▲</li> <li>(Sources from tea industry, not academic papers)</li> </ul>	<ul style="list-style-type: none"> <li>Kenya Rise in altitude of suitable cultivation land. Major contraction of suitable cultivating land in highland region and western Kenya. Kenyan mountain regions will remain suitable for cultivation.</li> <li>Malawi Chitipa district: Suitable land▲▲▲</li> <li>Mhata Bay district: Suitable land▲▲</li> <li>Mulanje district: Suitable land++</li> <li>Thyolo district: Suitable land++</li> </ul>	
Wine grapes	<ul style="list-style-type: none"> <li>United States (California) Suitable land ▲▲▲</li> <li>Northwestern United States Suitable land +++</li> <li>Chile Suitable land ▲▲</li> </ul>	<ul style="list-style-type: none"> <li>Japan (Hokkaido) Expansion of suitable land. Enable cultivation of Pinot Noir</li> <li>Japan (Central Honshu) Suitable land expanded on the one hand, but high-temperature damage also caused</li> </ul>	<ul style="list-style-type: none"> <li>Northern Europe Suitable land: +++</li> <li>Mediterranean coast Suitable land: ▲▲▲</li> <li>Spain Production volumes▲ to▲▲</li> <li>Western Cape, South Africa Suitable land: ▲▲▲</li> </ul>	<ul style="list-style-type: none"> <li>New Zealand Suitable land: +++</li> <li>Southern coastal regions of Australia Suitable land: ▲▲▲</li> <li>Outside southern coastal regions of Australia Suitable land: ▲▲</li> </ul>
Coffee beans	<ul style="list-style-type: none"> <li>Brazil Suitable land for Arabica: ▲▲</li> <li>Suitable land for Robusta: ▲▲</li> </ul>	<ul style="list-style-type: none"> <li>Southeast Asia Suitable land for Arabica: ▲▲</li> <li>Suitable land for Robusta: ▲▲</li> </ul>	<ul style="list-style-type: none"> <li>East Africa Suitable land for Arabica: ▲</li> <li>Suitable land for Robusta: ▲</li> </ul>	
Corn	<ul style="list-style-type: none"> <li>Southwestern United States Yield ▲▲</li> <li>United States (Iowa in midWest) Yield ▲-▲▲</li> </ul>			

- ✓ The quantitative changes in the yields of major agricultural products (barley, hops, tea leaves, wine grapes, coffee beans, and corn) in the major regions (the United States, Asia, Europe, Africa, and Oceania) under the 4° C scenario in 2050 are described

Source: Kirin Group Environmental Report 2019

**[Example ④: Kirin Holdings]**

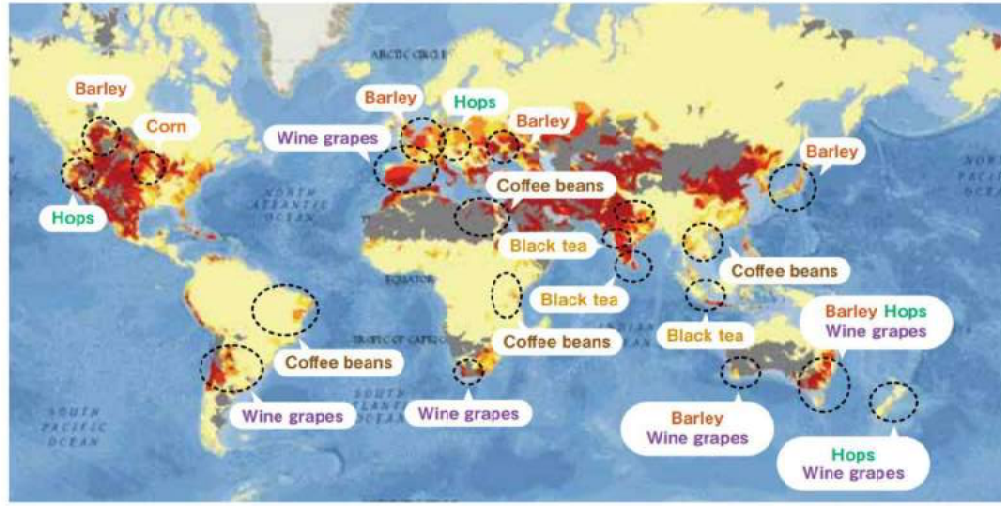
**Kirin qualitatively describes the impact assessment of water stress**

<b>Company name and sector</b>	<b>Kirin Holdings</b>	<b>Agriculture, food and forestry products (Foods)</b>
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**Point ② Impact evaluation of water stress in primary production areas**

- ✓ Water stress in primary agricultural land in 2040 and indication of each agricultural product procured
- ✓ Using the WRI heat map, the areas with high impact of water stress are shown qualitatively

Water stress in major agricultural production regions (2040, equivalent to Kirin Group Scenario 3)



Source: Kirin Group Environmental Report 2019  
4-62

**[Case ④: Kirin Holdings]**

**Kirin quantitatively describes the impact assessment of carbon pricing**

<b>Company name and sector</b>	<b>Kirin Holdings</b>	<b>Agriculture, food and forestry products (Foods)</b>
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**Point ③ Impact evaluation of carbon pricing**

- ✓ Regarding the impact evaluation under the 2° C and 4° C scenarios for carbon pricing in 2030, the impacts in the case of tackling and not tackling GHG reduction targets are quantitatively described

**Assessment of impact of carbon pricing**

In event of inaction on medium-term GHG emission reduction target of 30% by 2030

Kirin Group Scenario1:2°C, sustainable development  
Kirin Group Scenario1:4°C, unwanted world

	Kirin Group Scenario 3		Kirin Group Scenario 1	
	2025	2040	2025	2040
Estimate cost of impact (unit: 1,000 USD)	10,944	14,448	51,268	80,374
Estimate cost of impact (unit: 1 million JPY)	1,215	1,604	5,691	8,921

In event of achievement of medium-term GHG emission reduction target of 30% by 2030

	Kirin Group Scenario 3		Kirin Group Scenario 1	
	2025	2040	2025	2040
Estimate cost of impact (unit: 1,000 USD)	8,956	6,905	41,958	38,411
Estimate cost of impact (unit: 1 million JPY)	994	766	4,657	4,264

\* Calculated by multiplying assumed CO<sub>2</sub> emissions in 2025/2040 by carbon price forecasts

Source: Kirin Group Environmental Report 2019  
4-63

[Example ⑤: Hitachi, Ltd.]

Hitachi, Ltd. summarizes the business environment for each scenario and division, and describes how to respond to future business risks and business opportunities

Company name and sector	Hitachi, Ltd.	Electric and Electronic
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Point ① Identify potential responses

- ✓ Describes the business environment for the five businesses (railway systems, automotive systems, water systems, power generation and power grids, and IT systems) in each scenario (2° C and 4° C), as well as related responses and business opportunities

Target business	Railway systems	Automotive systems	Water systems	Power generation and power grids	IT systems
The business environment under the 2°C scenario	<ul style="list-style-type: none"> <li>Demand for railway systems will increase as electricity and wind power will grow as regulations for CO<sub>2</sub> emissions are strengthened globally</li> <li>Shift to energy saving and reduction of CO<sub>2</sub> emissions, including on existing routes</li> </ul>	<ul style="list-style-type: none"> <li>Electric vehicles will rapidly spread as tighter laws and regulations on fossil fuels push for better prices and encourage ownership of internal combustion engine vehicles. Markets for alternative, non-fossil fuel engines like hydrogen and fuel cells vehicles will expand</li> <li>The number of countries and regions with near-zero emissions of internal combustion engine vehicles will increase</li> </ul>	<ul style="list-style-type: none"> <li>Plans to adopt water treatment systems that reduce CO<sub>2</sub> will expand as tighter regulations on CO<sub>2</sub> emissions in each country and region lead to stringent energy regulations on power users in water treatment</li> </ul>	<ul style="list-style-type: none"> <li>Power generation facilities for CO<sub>2</sub>-free renewable energy, nuclear power, and other non-fossil sources, as well as high-efficiency power generation facilities that contribute to CO<sub>2</sub> reduction will expand with tighter CO<sub>2</sub> emission regulations in each country and region</li> <li>Demand will expand for construction of power networks enabling the mass introduction of renewable energy with large output fluctuations</li> <li>Innovations in energy-saving technologies will further expand demand for energy-saving equipment and services</li> </ul>	<ul style="list-style-type: none"> <li>Climate change will lead to tighter CO<sub>2</sub> emission regulations in each country, and changes in the market environment, bringing shifts in customer behavior, portfolios and IT investments</li> <li>The development of AI and data-driven analysis technologies will further expand demand and increase for high-efficiency IT systems utilizing CO<sub>2</sub>-free non-fossil energy</li> <li>Investments and loans for low-carbon business, green bond issues, and other financial businesses will expand</li> </ul>
The business environment under the 4°C scenario	<ul style="list-style-type: none"> <li>Transport-related energy regulations will remain weak, discouraging a shift to railways, and conventional motorized transportation like automobiles and motorcycles will persist in some areas</li> <li>The risk of flood damage to railways and related facilities will increase due to a rise in extreme weather disasters as typhoons and floods</li> </ul>	<ul style="list-style-type: none"> <li>Fuel efficiency laws and regulations will remain weak globally, and internal combustion engine vehicles will remain a major mode of transport. The need will be slow, as conventional automobiles and motorcycles will remain prevalent</li> <li>The risk of damage to vehicles will increase due to a rise in extreme weather disasters as typhoons and floods in various areas</li> </ul>	<ul style="list-style-type: none"> <li>Demand for clean water will increase due to an increase in abnormal weather phenomena like floods, storms, heat, and drought</li> <li>Rising temperatures will cause a rise in the volume of treated cooling water, the growth of bacteria and algae, and a deterioration in water quality as a result</li> <li>The risk of damage to water-related equipment from increased corrosion as typhoons and floods will increase</li> </ul>	<ul style="list-style-type: none"> <li>The cost competitiveness of non-fossil energy will increase and demand for renewable, nuclear, and other non-fossil energy will increase as the expansion of energy consumption pushes up the price of fossil fuels</li> <li>The risk of damage to power plants and networks will increase due to such natural disasters as typhoons and floods</li> </ul>	<ul style="list-style-type: none"> <li>Demand for low, high-efficiency technology will expand as damage to information equipment from such natural disasters as typhoons and floods increases and as energy demand for multiple (multiple in response to RCP) increases</li> <li>Investment in social and public systems to reduce damage from more frequent natural disasters will increase</li> </ul>
Non-environmental factors (under the 2°C or 4°C scenario) and market conditions	<ul style="list-style-type: none"> <li>Economic growth, urbanization, and population growth will drive increasing demand for public transport for large numbers of passengers, regardless of whether CO<sub>2</sub> regulations are tight. Market size of Japan will remain flat, but other markets in Asia and elsewhere will expand</li> <li>High railway manufacturers will expand their business to meet global demand</li> </ul>	<ul style="list-style-type: none"> <li>Economic growth, urbanization, population growth, and infrastructure development will lead to continued demand for the global market for automobiles as a vehicle and personal means of transport</li> <li>Consumers will have varying degrees of enthusiasm in promoting electrification</li> <li>Non-environmental factors like safety, security, and comfort will drive competitiveness, as demand increases for new functions like autonomous driving and advanced safety features, and new mobility services like car sharing</li> </ul>	<ul style="list-style-type: none"> <li>Economic growth, urbanization, and population growth will push up demand for water in some areas</li> <li>With social, local governments and other entities will accelerate water-use collaboration and participation in building water systems and improving the efficiency of water management</li> <li>Replacement demand for aging water treatment facilities will increase in developed countries</li> </ul>	<ul style="list-style-type: none"> <li>Economic growth, urbanization, and population growth will push up demand for energy, especially electricity, energy in developing countries</li> <li>Energy source will be diversified from the perspective of reducing CO<sub>2</sub> emissions but also environmental factors, economic performance, safety, and energy stability</li> <li>Stability and efficiency of the power supply will increase through the use of digital technology</li> <li>Both companies and individuals will seek to diversify their energy supply and demand</li> </ul>	<ul style="list-style-type: none"> <li>Further digitalization will exponentially increase the volume of data created, accumulated, and analyzed</li> <li>New services and businesses utilizing big data, AI, and other digital technology will expand rapidly</li> </ul>
Response to future business risks and opportunities	<ul style="list-style-type: none"> <li>Continue to strengthen the railway business, as global demand for railways will increase under other scenarios</li> <li>Promote R&amp;D of new products and services that improve efficiency of railway services through digital utilization, such as dynamic railway timetabling operation responses to passenger demand, sharing existing customers' increased value</li> </ul>	<ul style="list-style-type: none"> <li>Response to 2°C scenario</li> <li>Promote R&amp;D of electrification technology and other alternative technologies to enhance response to new markets, such as for electric vehicles</li> <li>Response to 4°C scenario</li> <li>Promote R&amp;D and product development in existing technologies, including internal combustion engines, to not only improve energy efficiency but increase both non-environmental value as safety, security, and comfort</li> </ul>	<ul style="list-style-type: none"> <li>Response to 2°C or 4°C scenario</li> <li>Strengthen provision of water-related facilities and other water generation systems in response to increased water demand from global economic growth, urbanization, and population growth under either scenario</li> </ul>	<ul style="list-style-type: none"> <li>Response to 2°C or 4°C scenario</li> <li>Continue to enhance response to relevant markets in case of expected higher demand for non-fossil energy under either scenario</li> <li>Strengthen the grid services business in response to increased use of renewable energy with large output fluctuations and diversification of energy supplies</li> <li>Promote digital service solutions business for diversifying needs of power customers</li> </ul>	<ul style="list-style-type: none"> <li>Response to 2°C or 4°C scenario</li> <li>Continue to develop innovative digital technologies and enhance digital service solutions that generate new value in view of expected growth in sector's demand and expansion of digital service under either scenario</li> </ul>
Financial information (Scale volume of each target sector)	Impact on part of 119.5 billion yen in Railway Systems Business Unit sales (FY 2018)	Impact on part of 871 billion yen in Automotive System Business Unit sales (FY 2018)	Impact on part of 102.1 billion yen in Water & Environment Business Unit sales (FY 2018)	Impact on part of 406.4 billion yen in Energy Sector sales (FY 2018)	Impact on part of 2,121.1 billion yen in IT Sector sales (FY 2018)

We believe that by paying close attention to market trends and developing our business flexibly and strategically, we have high climate resilience in the medium to long term under either the 2°C or 4°C scenario

Note: The above scenario analysis are not future projections but attempts to examine our resilience. How the future unfolds may be quite different from any of these scenarios.

Source: Hitachi, Ltd. Sustainability Report 2019

[Case I: BP]

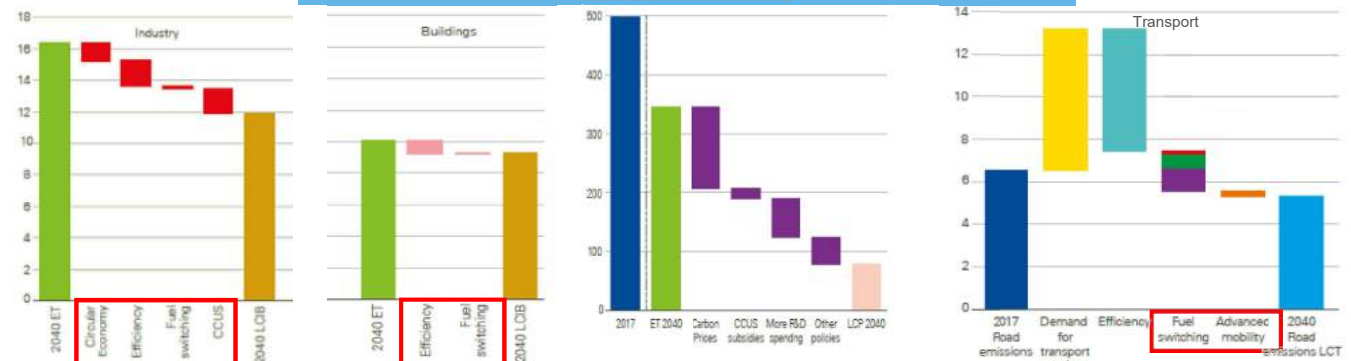
Analyzes global trends in energy supply and demand, and refers to technologies required to achieve the 2°C target by sector

Country Name	United Kingdom	BP	Energy
Company name and sector			

Point ① Identify and define range of scenarios for each sector

- ✓ Analysis of **global energy supply and demand trends (by region and fuel)** by 2040, **based on four scenarios**
- ✓ Evolving transition (ETs): Based on scenarios in which policies, regulations, and technological developments move in the same way as in recent years. In addition, the RT scenario based on the 2° C target, the ME scenario in which energy demand increases, and the LG scenario in which globalization slows down are set
- ✓ Quantitatively describe the technologies and countermeasures required to achieve the 2° C target and the reduction effects **for each sector (industry, construction, transportation, electricity)**

Technologies and measures for each sector and CO2 reductions (emissions) under the ET scenarios



Detailed examples of next-generation technologies that contribute to reducing emissions in each sector

Source: BP "Energy Outlook 2019 edition"

**[Case II: Downer Group]**  
**SSPs are used as scenarios in the Downer Group, a construction/infrastructure-related company**

<b>Country Name</b> Company name and sector	Australia	Downer Group	Construction and infrastructure
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**Point ① Identify and define range of scenarios**

- ✓ In addition to RCPs, range of scenarios including SSPs (Shared Socio-economic Pathways)
- ✓ **Scenario analyses were conducted based on four scenarios: Sustainability (2° C + SSP1 (sustainable scenario)), Follower (2° C + SSP4 (gap scenario)), Fossil Fuel development (4° C + SSP5 (fossil-fuel-dependent development scenario)), and Global decline (4° C + SSP3 (regional segmentation scenario)).**
- ✓ The results of the scenario analysis are as follows
  - ✓ Downer strategies are resilient in all scenarios
  - ✓ Significant opportunities in scenarios below 2° C
  - ✓ To this end, significant decarbonization needs to be advanced by 2030

Definition of 4 Scenarios Using SSPs

Scenarios	
Sustainability	-2 degrees global warming (SSP 1- RCP 2.6)
Follower	-2 degrees global warming (SSP 4- RCP 2.6)
Fossil fuel development	-4 degrees global warming (SSP 5- RCP 8.5)
Global decline	-4 degrees global warming (SSP 3- RCP 8.5)

Source: "Downer Annual Report 2019"  
4-66

**[Case III: Atlantica Yield]**  
**Estimates the quantitative business impact of changes in climate patterns and temperature increases on the company**

<b>Country Name</b> Company name and sector	Spain	Atlantica Yield	Power & Utility
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**Point ①**

**Cost increase due to changes in climate patterns**

- ✓ Changes in climate patterns reduce rainfall and reduce the amount of water stored in the aquifer
- ✓ Need to expand water purification facilities in-house, and consumption of chemicals for water purification will increase by 10% per year

Business impact

**Annual cost increase of USD 800,000**

**Point ②**

**Cost increase due to higher temperature**

- ✓ Estimated annual reduction of 0.04-0.21% in the company's turbine efficiency when temperature rises by 1° C

Business impact

**Annual cost increase of USD 300,000**

**Point ③**

**Increase in costs of solar and wind power generation due to higher temperature**

- ✓ In the case of solar power generation, it is estimated that the module efficiency will decrease by 0.39% due to a temperature increase of 1° C
- ✓ In wind power generation, the air density decreases by 0.34% when the temperature rose by 1° C. Annual power generation is estimated to decrease by 1.2GWh

Business Impact (Solar)

**Annual cost increase of USD 50,000**

Business impact (wind power generation)

**Annual cost increase of USD 100,000**

Source: Atlantica ESG Report 2018 (Atlantica Yield)  
4-67



[Case IV: BHP]

**BHP uses arrows to evaluate the possible impact on each commodity price during the transition to the 2° C scenario**

Country Name Company name and sector	Australia	BHP	Mining
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Point ①

**Business impact evaluation**

Evaluation of the impact of transition to a 2° C scenario for each commodity

- ✓ Analyze four scenarios: New Gear (a scenario in which innovation brings about gradual economic development in developed countries); Closed Doors (a scenario of low-growth economic policies due to nationalism and protectionism, etc.); Global Accord (a scenario in which technological development is proceeding while coordinating toward a 2° C target); and Two Giants (a scenario in which technological growth is centered around the United States and China)
- ✓ To analyze the impact on prices of commodities over the next 10 years (as of 2016) that could occur in transitioning to the baseline Global Accord scenarios
- ✓ 6 types of commodities: thermal coal, gas, metallurgical coal, oil, copper, iron ore

Percentage contribution to EBITDA revenue*	Attractiveness of investment outlook** in Central case	Change in attractiveness of investment outlook** in Global Accord compared to Central case	Impacts under our Global Accord scenario
Thermal Coal 4%	Yellow circle	Down arrow	<ul style="list-style-type: none"> <li>Remains competitive on the cost curve and generates accretion/retention.</li> <li>Careful consideration would be required before pursuing growth opportunities given the current returns and growing regulatory and societal pressures that could impact future asset values.</li> <li>Failure to achieve a breakthrough in commercializing low emissions technologies such as CCS would reinforce this view.</li> </ul>
Gas** 10%	Green circle	Up arrow	<ul style="list-style-type: none"> <li>Key transition fuel as concerted efforts to reduce emissions are expected to increasingly focus on shifting gas for power generation and transportation.</li> <li>This results in high demand for gas, particularly in the short to medium term, providing opportunities to invest in the quality gas resources in our portfolio.</li> </ul>
Metallurgical Coal 11%	Yellow circle	Double-headed arrow	<ul style="list-style-type: none"> <li>Although the sector is slightly less attractive, our higher quality assets remain very attractive compared to peers as permits are applied to lower quality coals.</li> <li>Key consideration is around pace of material substitution (e.g. steel scrap in steelmaking) with the advent of tighter environmental regulations.</li> </ul>
Oil** 11%	Green circle	Down arrow	<ul style="list-style-type: none"> <li>By 2025 real crude oil prices are lower than our Central case primarily due to the higher penetration of EVs.</li> <li>While crude oil will likely remain competitive in its core transportation market, it is the most adversely impacted commodity in our portfolio, lower oil prices in this scenario reduce returns, but our oil remains relatively attractive.</li> <li>Due to the steepness of the oil supply cost curve, our existing oil growth projects remain very competitive with other options in the portfolio.</li> </ul>
Copper** 27%	Green circle	Double-headed arrow	<ul style="list-style-type: none"> <li>Remains attractive due to growing demand driven by the growth in renewables and EVs, which generally require more copper to produce.</li> <li>Price is lower as higher demand is offset by higher recycling.</li> <li>Aluminium substitution is assumed to be so greater.</li> <li>Minimal impact on the copper growth portfolio as returns reduce minimally from the Central case and remain attractive.</li> <li>Increasing regulatory approvals for mines delay the supply of greenfield developments, an advantage for low-cost incumbents.</li> </ul>
Iron Ore 34%	Yellow circle	Double-headed arrow	<ul style="list-style-type: none"> <li>Sector remains attractive and has a minimal impact on our existing portfolio.</li> <li>Key consideration is around pace of material substitution (e.g. steel scrap in steelmaking) with the advent of tighter environmental regulations.</li> </ul>

Source: BHP "Climate Change ; Portfolio Analysis Views after Paris"

4-68

[Example V: South32]

**Assessment of risk significance by value chain and business impact evaluation by site**

Country Name Company name and sector	Australia	South32	Mining
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Point ①

**Impact Assessment by Value Chain**

- ✓ Evaluation of the risk of climate change in the Mozambique aluminum mining business is qualitatively listed by direct operation, supply chain, and employee health impact (see example below)
- ✓ In addition, the company assesses the degree of resilience to risk items on a 5-point scale

Climate stressor	Examples of impacts considered for all South32 operations	Relative assessment of resilience in 2040 Runaway Climate Change scenario – Mozal Aluminium
Changes in extreme weather patterns	Containment failure in dams following intense rainfall	Moderate resilience
	Containment failure in facilities following intense rainfall	Moderate resilience
	River flooding affects mine and processing operations	High resilience
	Cyclones or storms affect port and rail operations	Moderate resilience

**Impact category key**

- Asset integrity and production continuity:** Impacts which could directly affect the operator's capacity to operate safely and maintain planned production levels (e.g. direct damage from severe storms, flooding from intense rainfall events, productivity decline from increasing dust creation).
- Maintaining supply chain and logistics:** Impacts which could materially affect access to critical inputs and delivery of products to key locations (e.g. storms affecting port and rail integrity, drought affecting hydroelectric power supply, heat interrupting flight operations).
- Worker health:** Impacts on the health and safety of our employees (e.g. heat-related illness, increased malaria risk due to regional climate change).

Point ②

**Business Impact Evaluation by Site**

- ✓ Qualitatively analyze the impact of the company's climate change by site (Australia, South Africa, Mozambique, Colombia) (example below)

**Business Impact Assessment in Northern Australia**

**GEMCO (manganese)**  
Adaptation focus indicated under the Runaway Climate Change scenario

- More cyclone events may severely damage port infrastructure. Adaptation options include designing for greater tolerances, or infrastructure that can be installed and reinstated quickly.



**Business Impact Evaluation in South Africa**

**Hillside Aluminium**  
Adaptation focus indicated under the Runaway Climate Change scenario

- Power supply to operations may be interrupted during heatwaves. Adaptation is heavily reliant upon the power provider to enhance reliability and capacity of generation, transmission and distribution facilities.



Source: South32 "Our Approach to Climate Change 2019"

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**Ministry of the Environment, Government of Japan**  
**Climate Change Policy Division**

**Deloitte.**  
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