Practical Guide for Scenario Analysis in Line with the TCFD Recommendations (Banking Sector)

March, 2021

Environmental and Economy Division, Minister’s Secretariat, The Ministry of Environment
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   1-1. Purpose of this practical guide
   1-2. Positioning of scenario analysis in line with TCFD recommendations
1. Introduction

1-1. Purpose of this practical guide

1-2. Positioning of scenario analysis in line with TCFD recommendations
[Challenges faced by financial institutions in implementing scenario analysis]
Climate Change Related Challenges Facing Domestic Financial Institutions

- TCFD has published a status report to show the progress of climate-related information disclosure based on the TCFD recommendations and to promote the sophistication of disclosure. The status report points out the need to clarify potential climate-related financial impacts, disclose strategic resilience assessments using scenario analysis, and involve other sectors to bring climate-related issues mainstream. This issue also applies to the banking sector, which accounts for a large proportion of the financial intermediary function of indirect finance in Japan's financial sector.

- This guide covers the risk of transition to a decarbonized economy in scenario analysis, which is a particular hurdle for TCFD disclosure by financial institutions from October 2020 to March 2021 with the participation of three regional financial institutions. Focusing on quantification and evaluation methods for physical risk due to climate change, we evaluated financial impact through collaboration with multiple departments including risk management of financial institutions using a reliable evaluation method that can withstand information disclosure. We will publish it as a guide based on the results.
1. Introduction

1-1. Purpose of this practical guide

1-2. Positioning of scenario analysis in line with TCFD recommendations
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

Transition Risks
- Policy and Legal
- Technology
- Market
- Reputation

Physical Risks
- Acute
- Chronic

Risks

Opportunities
- Resource Efficiency
- Energy Source
- Products / Services
- Markets
- Resilience

Strategic Planning
Risk Management

Financial Impact

Income Statement
Cash Flow Statement
Balance Sheet

Revenues
Expenditures

Assets & Liabilities
Capital & Financing

### 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.

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

[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

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

**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.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Industry</th>
<th>Recommended disclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Oil and Gas</td>
<td>Assessment and potential impacts of legal compliance, operating costs, changes in risks and opportunities; changes in regulations and shift in consumer and investor preferences; and changes in investment strategy</td>
</tr>
<tr>
<td></td>
<td>Coal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electric Utilities</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>Air Transport, Maritime</td>
<td>Assessment and potential impacts of 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</td>
</tr>
<tr>
<td></td>
<td>Transportation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Transportation (Rail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transportation, Tracking Services)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Automobiles</td>
<td></td>
</tr>
<tr>
<td>Materials and Buildings</td>
<td>Metals and Mining</td>
<td>Assessment and potential impacts of enhanced regulations on GHG emissions and carbon pricing; risk assessment of increased severity of extreme weather events on construction materials and property; and opportunities for products to improve energy efficiency or reduce energy consumption</td>
</tr>
<tr>
<td></td>
<td>Chemicals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Materials, Capital Goods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real Estate Management and Development</td>
<td></td>
</tr>
<tr>
<td>Agriculture, Food, and Forest Products</td>
<td>Beverages, Foods</td>
<td>Assessment and potential impacts of GHG emissions reductions; recycling and waste management; business of food and textile products with lower GHG emissions, and shifts in consumer preferences</td>
</tr>
<tr>
<td></td>
<td>Agriculture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paper and Forest Products</td>
<td></td>
</tr>
</tbody>
</table>

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

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

2. Scenario Analysis - Key Points of Practice

2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks
2-3. Identify and define range of scenarios
2-4. Evaluate Qualitative Business Impact
2-5. Quantitative assessment of transition risk
2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
**Points to consider when implementing scenario analysis in line with the TCFD recommendations were mapped out for 18 companies, forming the basis of the trial.**

<table>
<thead>
<tr>
<th>TCFD</th>
<th></th>
</tr>
</thead>
</table>
| 1 | **Ensure governance is in place**
Integrate scenario analysis into strategic planning and/or enterprise risk management processes. Assign oversight to relevant board committees/subcommittees. Identify which internal (and external) stakeholders to involve and how. |
| 2 | **Assess materiality of climate-related risks**
| Market and Technology Shifts | Reputation |
| Policy and Legal | Physical Risks |
What are the current and anticipated organizational exposures to climate-related risks and opportunities? Do these have the potential to be material in the future? Are stakeholders concerned? |
| 3 | **Identify and define range of scenarios**
Scenarios inclusive of a range of transition and physical risks relevant to the organization |
What scenarios (and narratives) are appropriate, given the exposures? Consider input parameters, assumptions, and analytical choices. What reference scenario(s) should be used? |
| 4 | **Evaluate business impacts**
| Impact on: | • Input costs
• Operating costs
• Revenues
• Supply chain
• Business interruption
• Timing |
Evaluate the potential effects on the organization’s strategic and financial position under each of the defined scenarios. Identify key sensitivities. |
| 5 | **Identify potential responses**
Responses might include • Changes to business model
• Changes to portfolio mix
• Investments in capabilities and technologies
Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities. What adjustments to strategic/financial plans would be needed? |
| 6 | **Documentation and disclose**
Document the process; communicate to relevant parties: Be prepared to disclose key inputs, assumptions, analytical methods, outputs, and potential management responses. |

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2. Scenario Analysis - Key Points of Practice

2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks
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2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
[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**
Gain management’s understanding

Make sure management understands the materiality of TCFD (Recognizes the recommendations and instructions that they must comply with)

**Preparation ②**
Establish execution team

Create an execution team for scenario analysis

**Preparation ③**
Choose target for analysis

Set a target scope for the scenario analysis

**Preparation ④**
Setting the analysis time axis

Choose time horizon to conduct scenario analysis that looks beyond X years in the future

---

How to provide input to management in terms of climate change
Gain management’s understanding

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

In a reasonable foreseeable term…

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

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

- Business management can flexibly respond to future change
- The discussion takes place without any subjective viewpoints on the 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.

• Requests from multi-stakeholders for climate change response accelerated
• There are some cases in which top management is directly informed of climate change solutions, but there are also cases in which there is still a significant gap in understanding.
• In such a case, it is important to compile the status of requests from multi-stakeholders and provide to management through study groups with experts and other means that respond to climate change which can affect corporate value.
• As an input source for support projects by the Ministry of the Environment It is essential to hold briefings on the 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
**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

---

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".
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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Options for Scenario Analysis Scenario (Example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>Domestic</td>
</tr>
<tr>
<td>Scope of Operations</td>
<td>Some businesses</td>
</tr>
<tr>
<td>Corporate scope</td>
<td>Only for the scope of consolidated financial statements</td>
</tr>
</tbody>
</table>

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

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

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

### Proposal for selection ①

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

- Business A: 54.9%
- Business B: 33.3%
- Business C: 11.8%

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**

- Business A: 123,456 tCO2
- Business B: 3,549 tCO2
- Business C: 98,765 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**

- 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 the 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)

![Graph of temperature differences](image)

**Difference in the worldview depending on when is being analyzed**

**2°C scenario**

**4°C scenario**

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Benefits</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>• Abundant data available for reference</td>
<td>• Possibility that the impact of physical risk is small and that the impact on the company will be low</td>
</tr>
<tr>
<td></td>
<td>• Relatively easy to link with business plans</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>• Physical risks are emerging.</td>
<td>• Cooperation may be difficult (cannot involve the company) because the time horizon is significantly longer than the business plan</td>
</tr>
</tbody>
</table>
2. Scenario Analysis - Key Points of Practice
2-1. For starting scenario analysis

2-2. **Assess materiality of climate-related risks**
2-3. Identify and define range of scenarios
2-4. Evaluate Qualitative Business Impact
2-5. Quantitative assessment of transition risk
2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
Assess materiality of climate-related risks: What are the current and anticipated organizational exposures to climate-related risks and opportunities?

<table>
<thead>
<tr>
<th>TCFD</th>
<th>1 Ensure governance is in place</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Integrate scenario analysis into strategic planning and/or enterprise risk management processes. Assign oversight to relevant board committees/subcommittees. Identify which internal (and external) stakeholders to involve and how.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2 Assess materiality of climate-related risks</th>
<th>3 Identify and define range of scenarios</th>
<th>4 Evaluate business impacts</th>
<th>5 Identify potential responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market and Technology Shifts&lt;br&gt;Reputation</td>
<td>Scenarios inclusive of a range of transition and physical risks relevant to the organization</td>
<td>Impact on:&lt;br&gt;- Input costs&lt;br&gt;- Operating costs&lt;br&gt;- Revenues&lt;br&gt;- Supply chain&lt;br&gt;- Business interruption&lt;br&gt;- Timing</td>
<td>Responses might include&lt;br&gt;- Changes to business model&lt;br&gt;- Changes to portfolio mix&lt;br&gt;- Investments in capabilities and technologies</td>
</tr>
<tr>
<td>Policy and Legal&lt;br&gt;Physical Risks</td>
<td>What scenarios (and narratives) are appropriate, given the exposures? Consider input parameters, assumptions, and analytical choices. What reference scenario(s) should be used?</td>
<td>Evaluate the potential effects on the organization’s strategic and financial position under each of the defined scenarios. Identify key sensitivities.</td>
<td>Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities. What adjustments to strategic/financial plans would be needed?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6 Documentation and disclose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document the process; communicate to relevant parties: Be prepared to disclose key inputs, assumptions, analytical methods, outputs, and potential management responses</td>
</tr>
</tbody>
</table>

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.
Collect climate change risks / opportunities in the financial industry and the magnitude of risks by sector (investment and lender) from reliable sources
- Climate Change Initiative (TCFD)
- United Nations (UNEP-FI, etc.)
- Specialized Agencies (SASB, EBRD, etc.)
- think tanks, etc.

Examine your bank’s own climate change impacts
- Extracting Sectors with a Large Credit Balance from your bank’s Portfolio Composition
- Adding high-risk major lending sectors as borrower risks (Closer Look at Next Steps)

Recognition by other banks
- Identify risk and opportunity perceptions of other companies from CDP responses and disclosure information

List risks and opportunities and tentatively assess their importance
- Longer listing of risk and opportunity items in (3)
- After classifying and aggregating, temporarily place the importance in 3 stages ("Large", "Medium", "Small")

By considering the importance of the medium- to long-term transition / physical risk (eg, climate change will progress and countermeasures will be strengthened in 2030 / 2050), the evaluation of "large", "medium", and "small" is assumed.
[Stage 1: List risk items]
List risk and opportunity categories for targeted business areas

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

External reports (Industry-specific reports, etc.)

CDP responses from competitors

Other external information (CDP responses, etc.)

TCFD Recommended Disclosures
High-Level assessment of the impact of climate change on each of GICS’69 industries

Excerpt from the evaluation matrix

<table>
<thead>
<tr>
<th>Sector</th>
<th>Source of information</th>
<th>Sectoral assessment (Up to 34)</th>
<th>Investor</th>
<th>ESG Assessment Bodies</th>
<th>Initiatives, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TCFD Final Report (*)</td>
<td>2 ii (*) EBRD 427 Calvert GPIF</td>
<td>DJSI FTSE SASB Climate Wise GA Institute Finch &amp; Beak</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction materials</td>
<td>30</td>
<td>3 3 3 3 2 3 1 3</td>
<td>3 3</td>
<td>1 3</td>
<td>3 0 3 3</td>
</tr>
<tr>
<td>Metals and mining</td>
<td>28</td>
<td>3 3 3 3 2 3</td>
<td>3 3</td>
<td>0 3</td>
<td>3 3 0 3</td>
</tr>
<tr>
<td>Chemistry</td>
<td>27</td>
<td>3 0 3 3 2 3</td>
<td>3 3</td>
<td>0 3</td>
<td>3 3 0 3</td>
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<tr>
<td>Paper products and forest products</td>
<td>25</td>
<td>3 0 3 3 2 3</td>
<td>3 3</td>
<td>0 3</td>
<td>3 3 0 3</td>
</tr>
<tr>
<td>Electric power</td>
<td>25</td>
<td>3 3 3 3 2 3</td>
<td>3 3</td>
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<td>3 3 0 3</td>
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<tr>
<td>Gas</td>
<td>22</td>
<td>3 0 3 3 2 3</td>
<td>3 3</td>
<td>0 3</td>
<td>3 3 0 3</td>
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<tr>
<td>Oil, gas and consumable fuel</td>
<td>22</td>
<td>3 0 2 2 2 3</td>
<td>3 3</td>
<td>0 3</td>
<td>3 3 0 3</td>
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<tr>
<td>Automotive parts</td>
<td>21</td>
<td>3 3 2 1 1 1</td>
<td>3 3</td>
<td>0 3</td>
<td>3 3 0 3</td>
</tr>
</tbody>
</table>

Sources covering only specific sectors
The source of information for the ‘*’ mark is 3 for those with sector references (Key sources of TCFD information), 0 for those without sector references;
The source of the "**" mark is rated as 1 point (Minor sources of TCFD information) for those with sector references and 0 points for those without sector references.

Sources covering a wide range of sectors
For information sources without a mark such as "*", the top 30% received 3 points, 31 ~ 60% received 2 points, and the rest received 1 point. Roughness points rated on 3 levels (High/Medium/Low, etc.) are evaluated as is.

GICS is used for sector classification.
# Climate-related risks by business segment

## Identifying business segments based on the magnitude of risks to climate change by bank portfolio and business sector

<table>
<thead>
<tr>
<th>Code</th>
<th>Industry</th>
<th>Sectoral evaluation</th>
<th>Investor</th>
<th>ESG rating agency</th>
<th>Initiatives, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TCFD Final Report</td>
<td>Zil</td>
<td>EBIRD</td>
<td>SASB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2ii</td>
<td>427</td>
<td>Calvert</td>
<td>Climate Wise</td>
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<td></td>
<td></td>
<td>GPIF</td>
<td>DJSI</td>
<td>FTSE</td>
<td>GA Institute</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Finch &amp; Beak</td>
</tr>
<tr>
<td>151020</td>
<td>Construction Materials</td>
<td>30</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>151040</td>
<td>Metals &amp; Mining</td>
<td>28</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>151010</td>
<td>Chemicals</td>
<td>27</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>151050</td>
<td>Paper &amp; Forest Products</td>
<td>25</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>551010</td>
<td>Electric Utilities</td>
<td>25</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>551020</td>
<td>Gas Utilities</td>
<td>22</td>
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<td>3</td>
<td>2</td>
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<td>101020</td>
<td>Oil, Gas &amp; Consumable Fuels</td>
<td>22</td>
<td>3</td>
<td>3</td>
<td>2</td>
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<tr>
<td>251010</td>
<td>Auto Components</td>
<td>21</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>251020</td>
<td>Automobiles</td>
<td>21</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>151030</td>
<td>Containers &amp; Packaging</td>
<td>21</td>
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<td>0</td>
<td>2</td>
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<td>302010</td>
<td>Beverages</td>
<td>20</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>101010</td>
<td>Energy Equipment &amp; Services</td>
<td>20</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>302020</td>
<td>Food Products</td>
<td>19</td>
<td>3</td>
<td>3</td>
<td>2</td>
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<tr>
<td>203020</td>
<td>Airlines</td>
<td>19</td>
<td>3</td>
<td>3</td>
<td>2</td>
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<tr>
<td>551040</td>
<td>Water Utilities</td>
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<td>0</td>
<td>0</td>
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<td>201010</td>
<td>Aerospace &amp; Defense</td>
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<td>0</td>
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<td>551030</td>
<td>Multi-Utilities</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>203030</td>
<td>Marine</td>
<td>18</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>601020</td>
<td>Real Estate Management &amp; Development</td>
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<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>551050</td>
<td>Independent Power and Renewable Energy Producers</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>203010</td>
<td>Air Freight &amp; Logistics</td>
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<td>3</td>
<td>2</td>
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<tr>
<td>203040</td>
<td>Road &amp; Rail</td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>201040</td>
<td>Electrical Equipment</td>
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<td>3</td>
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<td>2</td>
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<td>401010</td>
<td>Banks</td>
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<td>3</td>
<td>2</td>
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<td>201060</td>
<td>Machinery</td>
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<td>302030</td>
<td>Tobacco</td>
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<td>1</td>
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<tr>
<td>401020</td>
<td>Thrifts &amp; Mortgage Finance</td>
<td>14</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>201020</td>
<td>Building Products</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>201030</td>
<td>Construction &amp; Engineering</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>301010</td>
<td>Food &amp; Staples Retailing</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>401010</td>
<td>Insurance</td>
<td>13</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Deloitte touche Tohmatsu LLC
[Determination of risk severity]
Determine materiality based on the magnitude of the business impact of a risk or opportunity

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Proposal of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major group</td>
<td>Subclassification</td>
<td>Risk</td>
<td>Opportunity</td>
</tr>
<tr>
<td>Policy/Regulation</td>
<td>Carbon tax and price</td>
<td>In introduction of a carbon tax (rising operating costs)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The introduction of a carbon tax would require the payment of a tax on GHG emissions from corporate activities</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Local fossil energy regulations</td>
<td>Higher energy prices (rising operating costs)</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higher energy prices lead to higher electricity and fuel costs in transport, resulting in higher transport and overhead costs</td>
<td>Medium</td>
</tr>
<tr>
<td>Market</td>
<td>Increase in the price of important products</td>
<td>Rising demand for raw materials (rising operating cost)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the price of materials and parts (batteries, etc.) rises due to the progress of EV shift, the manufacturing cost will rise</td>
<td>Large</td>
</tr>
<tr>
<td>Migration</td>
<td>Dissemination of electric vehicles</td>
<td>Expansion of electric vehicles (increase in capital investment)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conversion cost from internal combustion trucks to EVs is high due to the spread of EVs throughout the market and requests from customers</td>
<td>Large</td>
</tr>
<tr>
<td>Technology</td>
<td>Spread of renewable and energy-saving technologies</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Physical</td>
<td>Acute</td>
<td>Water shortages and drought</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Additional regulations of water usage, equipment at sites is required</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Water and groundwater prices at production sites soar</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Production is stopped due to water shortages, and restrictions on water usage</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Chronic</td>
<td>Temperature variation</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Declining Utilization and Worsening Labor Environment (Decreases in labor)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extremely high or low temperatures will result in loss due to facility closure</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- In average temperature, energy demand would reduce the energy demand for heating</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Higher temperatures will lead to working conditions for outdoor work</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measures against heat stress</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- In order to maintain comfort levels in plants and offices, it is necessary to increase the number of facilities</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Acute</td>
<td>Intensification of extreme weather</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Extreme intensification of wind and rain damages</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Higher premiums and additional costs due to increased natural disasters</td>
<td>Large</td>
</tr>
</tbody>
</table>

For each risk and opportunity category "magnitude of business impact" comparison in terms of
Example: Increase the size of the risks and opportunities with a large scope of impact, or increase the size of the risks and opportunities related to business "Small" for risks and opportunities that have no impact on the borrower's business and "Medium" for others.
[Risk Severity Assessment Flow (1/2)]
Identify potential future climate change risks and opportunities in key investment sectors

**Considerations**

What are the risks and opportunities for climate change organizations are expected to face?
Will they become significant in the future?
Are the organization’s stakeholders actively engaged on these issues?

**Point**

- Build on external views on climate change risks and opportunities, including TCFD
- Based on risk recognition by other companies (Responses to CDP, etc.)
- Supplement with information about critical factors to be analyzed (Major Portfolios, etc.)

### Risk Severity Assessment Process

**Example of TCFD Supplement**

<table>
<thead>
<tr>
<th>Classification</th>
<th>TCFD Risk and Opportunity Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy/ regulation</strong></td>
<td>Carbon price</td>
</tr>
<tr>
<td><strong>Industry/ market</strong></td>
<td>Changes in the energy mix</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Dissemination of low-carbon technologies</td>
</tr>
<tr>
<td><strong>Reputation</strong></td>
<td>Changing customer reputation</td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td>Increase in mean temperature</td>
</tr>
</tbody>
</table>

### External/Other Views

- Governmen t system
- United Nations
- Specialized agency
- Trade association
- Climate Change Initiative
- Competitors
- NGO
- Financial industry

### Examples of Risk Items in the Investment Finance Sector

<table>
<thead>
<tr>
<th>Classification</th>
<th>Your bank’s Risk and Opportunity Items (updated version)</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy/ regulation</td>
<td>Carbon tax and price</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Addressing GHG emission regulations</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Compliance with Disclosure Rules</td>
<td>Small</td>
</tr>
<tr>
<td>Industry/ Market</td>
<td>Investment, Loan and Insurance Policies</td>
<td>*</td>
</tr>
<tr>
<td>Technology</td>
<td>Dissemination of low-carbon technologies</td>
<td>*</td>
</tr>
<tr>
<td>Reputation</td>
<td>Changes in customer behavior</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Reputation from investors</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Litigation risk</td>
<td>*</td>
</tr>
<tr>
<td>Chronic</td>
<td>Water shortages and drought</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Temperature variation</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Sea level rise</td>
<td>*</td>
</tr>
<tr>
<td>Acute</td>
<td>Intensification of extreme weather</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Larger scale forest fires</td>
<td>*</td>
</tr>
</tbody>
</table>
[Risk Severity Assessment Flow (2/2)]
Discuss the major risks and opportunities to be analyzed (High Importance) for each sector

2 Risk Importance Assessment Procedure

Step 1: Target sector decisions
The bank portfolio is narrowed down to the major high-risk loan sectors.

Step 2 - 1: Literature search
Collects climate change risks and opportunities in each sector from reliable sources.

Step 2 - 2: Benchmark survey
Identify risk and opportunity perceptions of leading companies from CDP responses.

Step 2 - 3: Importance assessment (draft)
Classify and aggregate risk and opportunity categories, and assess their importance on a 3-point scale (Large, Medium, and Small).

Step 2 - 4: Validity examination
The importance of risk presented by the bank is adjusted based on its view, and the importance level “Large” is decided for the next.

Identifying risks and opportunities from CDP responses from leading companies in each sector

See TCFD, SASB, EBRD and other external reports by sector

Summarize the risks and opportunities of each sector and prepare a draft of the importance.

<table>
<thead>
<tr>
<th>Major group</th>
<th>Subclassification</th>
<th>Risks and opportunities</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition</td>
<td>policy carbon tax</td>
<td>Due to the introduction of an extreme carbon tax.</td>
<td>Literature A CDP</td>
</tr>
<tr>
<td>Transition</td>
<td>regulation Energy Conservation Law</td>
<td>Due to stricter regulations under the Energy Conservation Law.</td>
<td>CDP</td>
</tr>
<tr>
<td>Transition</td>
<td>technology</td>
<td>Due to the decrease in unit cost of renewable generation,</td>
<td>Bibliography B</td>
</tr>
<tr>
<td>Transition</td>
<td>market Credit Risk</td>
<td>Due to the decrease in production of renewable energy</td>
<td>Literature C</td>
</tr>
<tr>
<td>Transition</td>
<td>reputation from investors</td>
<td>Due to expansion of divestment,</td>
<td>CDP</td>
</tr>
<tr>
<td>Physical</td>
<td>acme</td>
<td>Intensification of extreme weather</td>
<td>Literature C CDP</td>
</tr>
</tbody>
</table>

Due to the introduction of an extreme carbon tax, the importance level “Large” is decided for the next.
2. Scenario Analysis - Key Points of Practice

2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks

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

2-4. Evaluate Qualitative Business Impact
2-5. Quantitative assessment of transition risk
2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
[Overview]
Choose scenarios, obtain forecast information on parameters, and shape the worldview

**Stage 1**
Choose scenarios

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

**Stage 2**
Obtain forecast information on relevant parameters (variables)

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

**Stage 3**
Shape the worldview in consideration of stakeholders

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

---

**Note**

What kind of scenarios should be chosen?

Source: Practical guide for Scenario Analysis in line with the TCFD recommendations 2nd edition (example of ITOCHU Corporation)
31

[How to Define Scenario Groups]
Analyze the business impact of high-risk key lending by sector

How to Define Scenario Groups

1. Real estate
2. Energy
3. Transportation

Risk severity Evaluation
Assess risks and opportunities in high-risk key lending sectors

Parameter collection
Develop a dataset of future projections of sectoral climate change impacts from IEA and other reliable scientific parameters

5 Force Analysis
Consider the risks and opportunities faced by stakeholders in each sector and the actions to be taken

Creating a world view
Based on 5 Force Analysis, create a punch picture that gives a bird’s eye view of the world for each scenario.

Business impact assessment

3-1
3-2
3-3
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.

**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 Transition is achieved.

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

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

<table>
<thead>
<tr>
<th>Climate Change Impact</th>
<th>Important Items (object of analysis)</th>
<th>Confirmed Parameter</th>
<th>Current</th>
<th>2020 and later</th>
<th>2030 and later</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Higher premiums and additional costs due to increased natural disasters</td>
<td>Higher premiums and additional costs due to increased natural disasters</td>
<td>4% increase in risk</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2. Climate extremes</td>
<td>Climate extremes</td>
<td>10% increase in risk per degree</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3. Rising environmental awareness</td>
<td>Rising environmental awareness</td>
<td>20% increase in risk per degree</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>4. Increased demand for non-fossil fuels</td>
<td>Increased demand for non-fossil fuels</td>
<td>30% increase in sales</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5. Increased demand for cooling due to rising temperatures</td>
<td>Increased demand for cooling due to rising temperatures</td>
<td>20% increase in sales</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>6. Rent increase or decrease due to changes in flood risk</td>
<td>Rent increase or decrease due to changes in flood risk</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>7. Changes in flood frequency</td>
<td>Changes in flood frequency</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>8. Changes in rainfall frequency</td>
<td>Changes in rainfall frequency</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>9. Changes in temperature</td>
<td>Changes in temperature</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>10. Changes in solar radiation</td>
<td>Changes in solar radiation</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>11. Changes in wave conditions</td>
<td>Changes in wave conditions</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>12. Changes in wind conditions</td>
<td>Changes in wind conditions</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>13. Changes in sea level rise</td>
<td>Changes in sea level rise</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Parameters List

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Change in sea level rise</td>
<td>Changes in sea level rise</td>
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</tr>
<tr>
<td>Change in wave conditions</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Change in wind conditions</td>
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<td>N/A</td>
<td>N/A</td>
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</tr>
<tr>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Change in temperature</td>
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<td>N/A</td>
<td>N/A</td>
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<td>N/A</td>
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<tr>
<td>Change in rainfall frequency</td>
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<td>N/A</td>
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<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 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.)

Source: Practical guide for Scenario Analysis in line with the TCFD recommendations 2nd edition (example of Chiyoda Corporation)
Based on future information, clarify the world view surrounding the company.

**New entrant**
- Entry of companies involved in renewable energy such as solar and wind power generation

**Industry/Company**
- Higher carbon taxes and carbon prices on operating costs increase sales prices and reduce price competitiveness, resulting in lower sales
- Fossil fuel demand declines and market prices decline as demand for renewable energy increases
- High carbon taxes and high carbon prices make businesses unprofitable, reducing profit margins and stranding assets
- The external pressure of decarbonization is strong, requiring product and technology development and capital investment to reduce environmental impact.

**Buyer (customer)**
- Increasing price competitiveness of energy with low environmental impact and decreasing demand related to fossils
- Fossil fuels and fossil fuel-derived electricity consumption in households decreases as awareness increases
- Lower demand for fuel for passenger cars due to lower demand for engine-powered vehicles

**Strengthening cooperation (Alliances, M & As, etc.)**

**Review of the business entity's portfolio**

**Investment in renewable energy projects**

**Secure suppliers using raw materials and equipment with low environmental impact**

**Secure suppliers using raw materials and equipment with low environmental impact**

**Energy**

**Government**
- Promote the introduction of carbon taxes and emissions trading, and set high carbon taxes and carbon prices
- An ambitious carbon emissions target may be set and fossil fuel projects may not be licensed
- Incentives and subsidies for renewable energy are increased and established
- Stricter emission regulations for gasoline, diesel and other engine-powered vehicles will affect fuel demand.

**Prompt access to policy information**

**Cooperation with the Government**

**In the renewable energy business securing subsidies**

**Lobbying for a new policy**

**Investment in renewable energy projects**

**Review of the business entity's portfolio**

**Strengthening of cooperation (Alliances, M & A)**

**Substitute**
- Increase demand for renewable energy

**Seller (Suppliers)**
- Promote the development of renewable energy
- A carbon tax is imposed on raw materials used in production facilities, resulting in additional costs
- Carbon tax increases the cost of producing fossil fuels and electricity derived from fossil fuels

**Energy**

**2 °C world view @ 2050s (example)**

**Promote the introduction of carbon taxes and emissions trading, and set high carbon taxes and carbon prices**

**An ambitious carbon emissions target may be set and fossil fuel projects may not be licensed**

**Incentives and subsidies for renewable energy are increased and established**

**Stricter emission regulations for gasoline, diesel and other engine-powered vehicles will affect fuel demand.**

**Investment in renewable energy projects**

**Review of the business entity's portfolio**

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**In the renewable energy business securing subsidies**

**Lobbying for a new policy**

**Investment in renewable energy projects**

**Review of the business entity's portfolio**

**Strengthening of cooperation (Alliances, M & A)**
2. Scenario Analysis - Key Points of Practice

2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks
2-3. Identify and define range of scenarios

2-4. Evaluate Qualitative Business Impact

2-5. Quantitative assessment of transition risk
2-6. Quantitative assessment of physical risk

2-7. Documentation and Disclosure
Ensuring consistency with macroeconomic scenarios published by authorities

Analyzing the impact of key segments based on the world view of each parameter

Set up a world view

Qualitatively describe the magnitude of risks and opportunities in key sectors

Note: Specific cases are introduced in scenario analysis practice cases.

NGFS CLIMATE SCENARIOS for central banks and supervisors (June 2020)
The TCFD recommendations present the scope of climate-related risks and opportunities, and the financial impacts to be disclosed.

Climate-Related Risks, Opportunities, and Financial Impacts

- Transition Risks
- Policy and Legal
- Technology
- Market
- Reputation
- Physical Risks
- Acute
- Chronic

Risks

Opportunities

Strategic Planning
Risk Management

Financial Impact

- Income Statement
- Cash Flow Statement
- Balance Sheet

Financial Impact

- Assets & Liabilities
- Capital & Financing

Resource Efficiency
- Energy Source
- Products / Services
- Markets
- Resilience

Consider strategic options for your company based on a scenario view of the world (In some cases, the relative comparison of multiple adaptation strategies in each scenario)

Each of these scenarios represents the strategic and financial position of an organization and evaluation of potential impacts.

<Qualitative assessment of Transition/physical risk>

- Parameter changes in the 2 °C/4 °C scenarios are identified and the associated project impact on the sector from which loans and investments are made.
- Formulate a flow chart of the effects of investments and loans on your bank businesses (qualitative assessment).

Note: Specific cases are introduced in scenario analysis practice cases.

*Industry and the bank impacts are minor compared to 4 °C, but costs of responding to physical risk are assumed to be constant
2. Scenario Analysis - Key Points of Practice
2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks
2-3. Identify and define range of scenarios
2-4. Evaluate Qualitative Business Impact
2-5. Quantitative assessment of transition risk
2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
Analysis of Stranded Asset
[Positioning of stranding trial calculation analysis]
In this analysis, future power supply composition, etc. were quantified using an analytical model. The results of the analysis can be used as interactive material for electric power companies future business models.

Positioning of stranding trial calculation analysis

<table>
<thead>
<tr>
<th>Project Impact Assessment Step for the Power Sector</th>
<th>Analysis Method (Example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the future of the power sector</td>
<td>Analysis of sales loss caused by stranding of existing thermal power plants at target banks</td>
</tr>
<tr>
<td>Dialogue with electric power companies on future business strategies (engagement) and impact prediction</td>
<td>Predicting future power supply configuration</td>
</tr>
<tr>
<td></td>
<td>Projections of future utilization rate of thermal power plants</td>
</tr>
<tr>
<td></td>
<td>In this stranding trial analysis</td>
</tr>
<tr>
<td></td>
<td>Performed using an energy analysis model</td>
</tr>
<tr>
<td></td>
<td>Analyzes and estimates the future business portfolios of the electric power companies to be invested in or financed based on the future business plans prepared by electric power companies or the results of model analysis by banks.</td>
</tr>
</tbody>
</table>
[Method for analysis of stranding calculation]
The transition risk in the power sector includes stranding assets in thermal power generation. Perform a trial run analysis using the future operating rates optimized by the energy analysis model.

Conversion of thermal power generation facilities to stranded assets (TWh)

- Reduction of thermal power generation by standing assets

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petroleum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Current capacity utilization rate is about 80% (coal-fired thermal power)
Future capacity utilization rate will decrease due to an increase in renewable energy.

Method for analyzing stranded assets

- Based on the following concept, we calculated the business impact of reduced operating rates of stranded power generation facilities at each electric power company, and conducted an analysis of stranded power generation facilities.

Δ Power generation for stranding * 1 * Power price * 2

*1: (1) Future energy analysis model
   Estimate the amount of electricity generated
   ② The baseline power generation is based on the operating rate of (1).
   (coal: 80%, LNG: 80%, petroleum: 50%)
*2: Current thermal power generation price (coal: 12.3 yen/kWh, LNG: ¥13.7/kWh, Oil: ¥37.0/kWh)

Source: Agency for Natural Resources and Energy (2015) "Report on verification of power generation costs, etc. to the long-term energy supply-demand outlook subcommittee"
TIMES Overview

A program to analyze the long-term energy situation under development at ETSAP of IEA.

- Used in analysis of long-term energy scenarios of the IEA and governments.
- By inputting future energy demand and technical data on energy supply and transportation facilities, the most economically rational combination of technologies (Power supply configuration, etc.) is output as a solution.

What can you analyze?

- Quantitatively predict and analyze the world view of the future energy structure (From 2030)
  - Power supply composition ratio
  - Demand for system maintenance
  - Power Cost Benefit Orders
  - Demand for storage batteries and hydrogen
  - Penetration rate of ZEV, etc.

What do you input?

- Input of various energy-related information
  - Renewable energy potential information
    - CAPEX/OPEX
    - Sunshine and wind conditions
  - Information on existing thermal and nuclear power plants
  - Cost and technical specifications of systems, storage and hydrogen
  - Demographic trends, passenger and logistics information, etc.

*1: The Integrated MARKAL EFOM System
*2: International Energy Agency (International Energy Agency)
*3: Energy Technology System Analysis Program (Energy Technology Systems Analysis Programme)
### Prerequisites for Analytical Models (Examples)

<table>
<thead>
<tr>
<th>Prerequisites for Analytical Models (Examples)</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric power generation Generation cost</td>
<td>Figures published by the Ministry of Economy, Trade and Industry are used.</td>
</tr>
<tr>
<td>Electric power generation Cost of fuel procurement</td>
<td>Figures published by the IEA, the Ministry of Economy, Trade and Industry, and NEDO are used.</td>
</tr>
<tr>
<td>Electric power generation Equipment capacity</td>
<td>Expansion of optimal power sources in response to increased energy demand, based on a comparison of cost effectiveness up to 2050</td>
</tr>
<tr>
<td>Electric power generation Capacity utilisation rate</td>
<td>Historical figures of the Agency for Natural Resources and Energy &quot;power survey statistics&quot; are used, and seasonal variations are taken into consideration.</td>
</tr>
<tr>
<td>Electric power generation CCS Cost</td>
<td>Use IEA Published Values</td>
</tr>
<tr>
<td>Electric power generation Prerequisites for decommissioning nuclear reactors</td>
<td>Assuming decommissioning after 60 years of operation (No New)</td>
</tr>
<tr>
<td>Transmission line System capacity</td>
<td>Considering the system capacity of the substation to the primary substation</td>
</tr>
<tr>
<td>Transmission line System expansion cost</td>
<td>Use Published Values for OCCTO</td>
</tr>
<tr>
<td>Transmission line Storage battery introduction cost</td>
<td>Figures published by the Ministry of Economy, Trade and Industry are used.</td>
</tr>
<tr>
<td>Electric power demand Electric power demand</td>
<td>Industry: Proposed at 1% per annum; Business, Assumptions, Transport: Calculated by simulation</td>
</tr>
</tbody>
</table>
There are two scenarios for analyzing stranded assets.

### 4 °C

<table>
<thead>
<tr>
<th></th>
<th>80%</th>
<th>90%</th>
<th>95%</th>
<th>26% (2030)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse gas reduction rate *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line expansion</td>
<td>Yes</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle charging pattern **</td>
<td>optimisation</td>
<td>Current situation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2 °C

<table>
<thead>
<tr>
<th></th>
<th>80%</th>
<th>90%</th>
<th>95%</th>
<th>26% (2030)</th>
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<td></td>
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<td>Optimisation</td>
<td>Current situation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*By 2050 compared to 2013*
Current power configuration (Amount of power generated)

Analysis Approach of the Financial Impact of transition risk
Purpose of Financial Statement Analysis of transition risk

- Quantitative analysis of business impacts in advance under certain scenarios, due to climate change and regulatory impacts
- Evaluating the strategies of the borrower based on the results of this analysis, and holding dialogues with the borrower based on this evaluation to mitigate the risk of climate change in the bank’s portfolio and (By expanding opportunities for borrowers) increase the value of the bank’s portfolio
- Assess the impact on the cost of credit (Accounting allowance for loan losses/EL, UL, etc. for risk management) of the bank’s portfolio under different climate change scenarios
- Assess the bank’s financial soundness (Amount of current assets held and capital adequacy) in response to the actualization of climate change risks, and reflect this in risk appetite $\rightarrow$ management plan
### Examples of Quantitative Analysis of transition risk

<table>
<thead>
<tr>
<th>Sector</th>
<th>MUFG (HP October 2020 update)</th>
<th>MIZUHO (TCFD Report May 2020)</th>
<th>SMFG (TCFD Report August 2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Two sectors of energy and utilities defined as carbon-related assets in the TCFD recommendations are analyzed</td>
<td>&quot;Power Utilities&quot; and &quot;Oil, gas and coal&quot; sectors (Domestic operations)</td>
<td>Analyzed carbon-related assets as defined by TCFD (energy utility)</td>
</tr>
</tbody>
</table>
| Scenario | Assuming "Sustainable Development Scenarios (2 °C (Less than) Scenario)" and "New Policy Scenario (4 °C Scenario)" published by the International Energy Agency (International Energy Agency IEA), the scenario is mainly 2 °C (Less than). | • IEA SDS/NPS Scenario  
• Analysis is made in 2 ways: without changing the current business structure (Static Scenario) and with changing the business structure (Dynamic Scenario). | Policy scenario released by IEA (International Energy Agency) (Stated Policies Scenario), 2 °C scenario (Sustainable Development Scenario), etc. |

**Main analytical methods**
- Analyzes the impact of each scenario on credit ratings and the financial impact of the sector's overall credit portfolio
- Reflecting costs such as investment in renewable energy and carbon tax necessary to realize a world below 2 °C

1. Qualitative assessment and analysis of transition risk and physical risk for each sector
2. The analysis target was determined for transition risk and physical risk.
3. Analyze the impact on cost of credit by setting up scenarios according to what is being analyzed

By considering the impact on credit risk for each sector from changes in resource prices and demand, such as crude oil, natural gas, and power generation costs, which are expected under each scenario, and reflecting this in the stress test model, the total credit costs expected to be incurred by 2050 were estimated.

**Quantitative analysis results**
- Transition risk (Total energy and utility sectors): approx. 1 billion yen ~ 9 billion yen per fiscal year
- [Credit costs through 2050] Increase of approximately 120 billion yen (Dynamic Scenario) to 310 billion yen (Static Scenario)
- [Total credit cost] In 2050, it is expected to increase by about 2 billion yen ~ 10 billion yen per fiscal year.
**Steps of quantitative analysis of transition risk**

**Identifying key sectors & Select Scenario**
- Qualitative scenario analysis assesses the importance of each sector and identifies sectors with high transition risks impacts.
- Selected scenarios, such as the IEA Sustainable Development Scenario (Sustainable Development Scenario), related to chosen key sectors.

**Project future financial statement (Estimation of BS and PL)**
- Sample companies from key sectors.
- Estimate the financial statements of the sample company at future time points (2040 ~ 2050) under the scenario.
  ※ Apply the idea of the main analytical elements obtained in the sample company to other companies in the same sector and use it for credit cost measurement (estimate the impact on the credit cost of companies in the sector).

**Estimation of the impact on cost of credit**
- Estimate the effects of climate change on the cost of credit (EL and UL for credit risk management and loan-loss provisions for accounting purposes) of the sample company from estimates of financial statements at future time points.
  (For EL and UL)
  - Estimate financial indicators to be used in scoring models.
  - Estimate the Company's future internal ratings based on the financial indicators.
  - Estimate the EL and UL based on the internal rating and estimate the impact of the cost of credit of the sample company.
**Example of the Financial Impact of transition risk (P/L) Concept (1) EIOPA**

*Net profits = (Production volume * Prices) – Costs of Goods Sold – OPEX – (Taxes + Interests)*

<table>
<thead>
<tr>
<th>#</th>
<th>原文</th>
<th>要約</th>
<th>原文</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increased cost of emitting CO2:</td>
<td>Under a transition scenario, the implementation of a carbon tax will cut the margin of carbon intensive industries proportionally to their emissions. Under a “too late, too sudden” scenario, carbon prices would need to be higher than under a “smooth” transition scenario, in order to foster a quick decrease in emissions.</td>
<td>移行リスクの検討シナリオでは、炭素集約型（炭素を使用する割合が高い）産業の利益は、炭素税の影響により排出量に比例して削減されます。CO2削減を前提としたシナリオのうち &quot;too late, too sudden&quot;のシナリオでは、CO2排出量削減の遅れを取り戻す迅速な回収を促進するために、炭素価格（税）は“smooth”な移行シナリオよりも高くなることが想定されます。</td>
</tr>
<tr>
<td>2</td>
<td>Increased cost of production inputs:</td>
<td>During a low carbon transition, carbon intensive goods will increase in prices due to pass-through of direct emissions costs. Industries using such carbon intensive goods as production inputs will thus be impacted.</td>
<td>低炭素への移行中、炭素集約型の商品は、直接排出コストのパススルーにより価格が上昇します。したがって、このような炭素集約型の商品を生産投入物として使用する産業は影響を受けます。</td>
</tr>
<tr>
<td>3</td>
<td>Additional depreciation costs and R&amp;D expenditures:</td>
<td>Under a transition scenario, significant capital expenditures in low-carbon technologies will increase companies’ annual depreciation costs (included in Operating Expenses). R&amp;D expenditures will also likely increase in the short-term as deployment of new technologies will have to be expedited to meet the unanticipated demand.</td>
<td>移行シナリオでは、低炭素技術への多額の設備投資により、企業の年間減価償却費（営業費用に含まれる）が増加します。予期せぬ需要を満たすために新技術の展開を促進する必要があるため、研究開発費も短期的には増加する可能性があります。</td>
</tr>
<tr>
<td>4</td>
<td>Changes in revenues:</td>
<td>Companies’ revenues will be affected through a change in prices and consumer demand: As they become increasingly costly to produce, prices of carbon intensive goods will likely increase, and consumers will, in turn, decrease their demand for such goods. A delayed transition, as it would increase the costs bared by carbon-intensive industries, would likely deepen this effect.</td>
<td>企業の収益は、価格と消費者の需要の変化によって影響を受けます。生産コストが高くなるにつれて、炭素集約型の商品の価格が上昇し、消費者はそのような商品の需要を減少させる可能性があります。移行が遅れると、炭素集約型産業が負担するコストが増加するため、この影響が深まる可能性があります。</td>
</tr>
</tbody>
</table>

Source: ACRN Journal of Finance and Risk Perspectives "Factoring transition risks into regulatory stress-tests" (2019/12)
[Concept of Financial Impact of transition risk] The Ministry of the Environment guidelines consider the impact of income statements (PL), focusing on changes in the cost of raw materials procurement (fuel cost) due to climate change and changes in carbon taxes.

Example of the concept of financial impact (P/L) of transition risks (2) Ministry of the Environment guidelines

[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

- Change in operating revenues affected by climate change
  - Increased sales due to the expansion of CCUS market
  - Decline in demand for plants due to tightening regulations

- Change in raw material procurement costs due to climate change
  - Price hike of steel

- Fluctuation of carbon tax
  - Burden of collecting carbon tax for Scope 1 and 2 emission

- Damage of physical risk
  - Increased cost of damage due to increased frequency of flood

[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

- Change in raw material procurement costs due to climate change
  - Decline in demand rate for plant due to tightening regulations (%)
  - Increased rate of profit due to the expansion of CCUS market (%)

Source: Ministry of the Environment "Practical guide for Scenario Analysis in line with the TCFD recommendations 3rd edition"
[Estimation step of future financial statement impact]
Although there is no standardized approach at present, a phased analysis of financial statements based on public information, mainly on carbon tax scenarios, is assumed depending on the status of data held.

Estimation step of future financial statement impact

- Reflect only 2 °C scenario carbon tax
- Calculated by multiplying the current CO2 emissions (Scope 1, 2) by the carbon tax scenario
- Assuming that only the burden of the carbon tax will change and that the amount of debt financing and cash outflow will increase accordingly
- PL items (income and expenses) and BS items (Assets and Liabilities) other than carbon tax are assumed to be constant

->Analyzing the financial impact of strengthened regulations under the assumption that the current situation will continue
(Unrealistic assumptions that do not take corporate responses into account)
- Reflects assumptions about changes in corporate responses to each scenario e.g., energy mix in the power industry, EV Ratio in the Automobile Industry etc.

->Analysis of changes in the financial impact of a decrease in the carbon tax
(Assuming no change in the market environment, such as total demand and unit costs of materials and fuel)
- Reflects assumptions for changes in sales (aggregate demand), material costs, etc. according to each scenario
  (Example) Forecast of Electricity Demand and Crude Oil Prices in the Electric Power Industry auto sales forecasts for the auto industry etc.

->Financial impacts of changes in the market environment in response to climate change scenarios

To enable discussions on the actual status of obligors by clarifying issues and interpreting and detailing publicly available information.
[Step 1 Reflection of carbon tax scenario]
First, the impact introducing a carbon tax is calculated assuming that current revenues, costs, assets and CO2 (GHG) emissions remain the same.

Reflection of Impact on Future Financial Statements Image
Step 1 Reflection of Carbon Tax Scenario

Illustrate the net loss situation

Assuming that the carbon tax burden in the event of a net loss is covered by current liabilities
Next, the impact of the carbon tax scenario is adjusted to changes in business structure (Renewable energy ratio in the electric power industry, EV ratio in the automobile industry, and new capital investment, etc.).

- New investments are made to change the product mix, and by changing the product mix, CO2 emissions and carbon taxes are reduced.

- However, depreciation expenses associated with new investments increased and losses related to the retirement of old assets occurred.
[Step 3 Reflect change in market (aggregate demand) and unit price scenario]

Finally, it is assumed that the impact on revenues/expenses will be analyzed based on future projections of market (aggregate demand) and material unit prices.

Reflection of Impact on Future Financial Statements Image
Step 3 Reflection of Change Market (Aggregate Demand) and Material Unit Price Scenario

- Reflect changes in Market (aggregate demand) due to opportunities associated with climate change responses
- Reflect future scenarios for fuel and material costs

Revenue | Expenses
---|---
raw material cost
Depreciation and amortization
Net Profit

Revenue | Expenses
---|---
raw material cost (run-up)
loss on disposal
Depreciation and amortization (Increase in CO2 reduction assets)
carbon tax
Net Profit

Current Assets
- Fixed Assets
- Capital Stock
- Capital Surplus
- Retained Earnings

Current Liabilities
- Fixed Liabilities
- Capital Stock
- Capital Surplus
- Retained Earnings

Old Assets (Before CO2 Reduction Improvement)

CO2 Cutback Assets New Investment

Old Assets
[Factors for Estimating Credit-related Costs, Credit Costs, and Credit Risk]

Although there is no clear definition at this stage, it is necessary to clarify the meaning and calculation method of indicators of credit-related costs $\approx$ allowance for loan losses, credit costs $\approx$ EL, and credit risks $\approx$ UL (Credit VaR).

### 1. Factors for Estimating Credit-related Costs, Credit Costs, and Credit Risk

In accordance with the Manual for Determining Credit Classification, etc., determine the borrower categories that reflect the scenarios by ascertaining the following points to the extent possible, and estimate the changes in the allowance for loan losses applicable to each borrower category (accounting figure) (Obligor Classification Factor)

- Changes in Internal Ratings
- Decrease in working capital
- Long-term debt redemption period

#### Calculation Method

<table>
<thead>
<tr>
<th>Items to be calculated</th>
<th>Cost of Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credit Related Expenses</strong> (Reserve for possible loan losses)</td>
<td>Step 1: Assigning Internal Ratings (Business Corporations) considering scenario impacts</td>
</tr>
<tr>
<td></td>
<td>- Internal ratings are determined by qualitative assessment (Reconcile) after quantitative assessment.</td>
</tr>
<tr>
<td></td>
<td>- Quantitative assessment uses a scoring model that selects financial indicators by industry</td>
</tr>
<tr>
<td></td>
<td>- Estimate and score financial measures after scenario impact</td>
</tr>
<tr>
<td></td>
<td>- The internal rating is established based on the determined score</td>
</tr>
</tbody>
</table>

#### Credit Risk

<table>
<thead>
<tr>
<th><strong>Credit Risk</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2: Estimation of Credit Loss Distribution Based on Internal Ratings considering scenario impacts</strong></td>
</tr>
<tr>
<td>- PD (probability of default) relating to internal ratings will not change, except for deterioration of internal ratings</td>
</tr>
<tr>
<td>- Based on the above assumptions, credit risk is measured using the Merton Model to estimate the loss distribution after the scenario impact is reflected and EL and UL are calculated (*)</td>
</tr>
</tbody>
</table>

In the case of physical risk, the LGD shall be deteriorated by the extent to which the collateral is impaired (taking into consideration only damage to buildings.). The land shall not be damaged.

(*)
As a result of the scenario analysis, if the financial condition of companies in key sectors deteriorates, the impact on cost of credit, etc. is calculated based on a deterioration of internal ratings using the scoring model.


- Add financial indicators after reflecting the financial impact into scoring models and estimate "Internal Ratings after Reflecting Financial Impact" from scoring results.
- Estimate the loss distribution by setting the PD of borrowers based on the "Internal Ratings after Reflecting Financial Impact".
- The difference between EL and 99% VaR at present is considered to have an impact on credit costs, etc. after "Reflecting the financial impact of transition risks" when the scenario becomes apparent.

Based on the magnitude of the above differences, study capital adequacy over the medium to long term.
2. Scenario Analysis - Key Points of Practice

2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks
2-3. Identify and define range of scenarios
2-4. Evaluate Qualitative Business Impact
2-5. Quantitative assessment of transition risk

2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
[How to conduct quantitative assessment of physical risks (flood risk)]

1 Select objects to be analyzed

Select objects to be analyzed from the following viewpoints.
1) customer base
   - Major customers (loans) Balances, etc.
2) regional basis
   - Customers located in flood areas
3) sector based
   - key sector
* Own property (operational risk)
  - Local offices of the company

2 Data Collection

Collateral value analysis buildings owned by the borrower (Books, branches, factories, stores, etc.)
- Address (block number)
- collateral value of the building

Loss on absence from work analysis
Each location of the borrower
- Annual gross profit (Or sales, product purchases, and raw material costs)
- Annual Business Days
- Annual ordinary expenses

3 Data Conversion Parameter Settings

Requires conversion of collected data for analysis

Converting the Latitude-Longitude Information of the Owned Building Address of the Company to Latitude-Longitude Information

Identify parameters for analysis
- Damage ratio by inundation depth
- Average days off by inundation depth

4 PML Analysis

By using Ministry of Land, Infrastructure and Transport GIS data
Plot applicable properties (Layers) on the hazard map

Based on the inundation depth on the hazard map, the loss rate and number of days off derived from the natural disaster model are calculated.

Climate change correction (Assume 4 °C scenario)

5 Credit risk measurement

Understanding LGD
- Estimated LGD from the amount of damage to buildings pledged as collateral

Understanding PD
- Gross profit per day is calculated from sales data, and the amount of loss on absence from work is calculated by multiplying by the number of days of absence from work.
- Estimate PD by reflecting loss profits in PL and assigning ratings, etc., based on each bank’s risk assessment method

Estimate EL

6 Quantitative business impact assessment

- Understand the degree of impact of EL and its financial impact.
- Consider necessary measures such as engagement consultants for borrowers.
Concept of the subject of analysis

Identify the scope of risk to be analyzed, taking into account the impact on the bank’s loans and future disclosures

[Objectives of physical risk quantitative analysis]
• The objective of physical risk analysis for climate change, not just floods, is to consider how risks should be addressed as a result of advanced warming. For general operating companies other than financial institutions, identifying the risks to which they are exposed will enable them to consider and implement countermeasures.
• For financial institutions, the objectives of the analysis are (1) to evaluate the physical risk to which the borrower company is exposed, and to consider how to finance the borrower company as a result of the damage that the borrower company is likely to incur, and (2) to review the credit risk to the financial institution.
• Although financial institutions would usually conduct a credit risk assessment for all borrowers, this would be extremely resource intensive due to e.g. the large quantity of physical risks. Therefore, it is common practice to conduct analysis targeting specific risks and limiting the scope of analysis.

[Concept of the subject of analysis]
(Target Risk)
• As mentioned above, it seems practical to conduct physical risk analysis by setting certain preconditions. The first risk to be considered is the assessment of "acute risk" "natural disaster", which is considered to be physical risk, and "flood risk", to which certain physical laws apply, among others.
• For financial institutions, the damage caused by the flood is the physical damage to the buildings of the borrower, which may be used as collateral against the loan, further there is a risk that the flood will cause an interruption of business, decreasing the borrower’s profits and therefore credit risk profile

(Scope)
① Significant customers
Select and analyze companies that have a large loan balance and whose default is likely to have a significant impact on the financial institution.
② Companies located on the flood zone of the hazard map
• Although floods occur throughout Japan, most of them occur in specified river basins. Because some financial institutions limit loans to specific areas, there is a concept of assessing risks in jurisdictions.
③ Sector unit
• The concept of conducting assessments that are limited to specific sectors, such as those that are judged to have a high physical risk by qualitative analysis.

It is difficult to grasp the flood risk of all borrowers. The scope of the analysis was gradually expanded by starting to limit the subjects in stages under certain conditions.
[Target risks and required data]
What damage could a flood cause, what are the risks to a bank and what data is required to assess the impact.

"Where to look" for loan related risks

- Buildings
- Furniture and fixtures
- Merchandise
- Dwelling
- Household and other property
- Life
- Traffic block
- Restoration work
- Uncollectible if pledged
- Inability to operate
- Decline in earnings
- Uncollectible if pledged
- (Recoverable by insurance)

- Location
- Amount of collateral
- Location
- Decrease in revenue
- Location
- Amount of collateral

- The above risk exists for properties in locations where flooding is likely to occur, but it is necessary to ascertain in advance whether the properties concerned are exposed to flood risk.
- Hazard maps can be identified, but they can be mapped. Need granularity data to
- The amount of collateral for each property is necessary to understand the impairment of collateral value.
- In order to understand the decrease in revenue (lost profit), it is necessary to understand the revenue that would be generated from the relevant property in advance.
### Parameters for flood damage measurement

**Building damage ratio based on inundation depth**

*<Usage Parameters>*

<table>
<thead>
<tr>
<th>Maximum submergence</th>
<th>Loss ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>~0.49 m</td>
<td>21.4%</td>
</tr>
<tr>
<td>0.50 ~ 0.99 m</td>
<td>29.3%</td>
</tr>
<tr>
<td>1 ~ 1.99 m</td>
<td>45.8%</td>
</tr>
<tr>
<td>2 ~ 2.99 m</td>
<td>64.6%</td>
</tr>
<tr>
<td>3 m ~</td>
<td>83.6%</td>
</tr>
</tbody>
</table>

**Table 4.2 浸水深別被害率**

<table>
<thead>
<tr>
<th></th>
<th>地盤勾配</th>
<th>床下</th>
<th>床上</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5cm未満</td>
<td>50〜99</td>
<td>100〜199</td>
<td>200〜299</td>
<td>300cm以上</td>
<td>50cm未満</td>
<td>50cm以上</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aグループ</td>
<td>0.047</td>
<td>0.189</td>
<td>0.253</td>
<td>0.406</td>
<td>0.592</td>
<td>0.800</td>
<td>0.43</td>
<td>0.785</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bグループ</td>
<td>0.058</td>
<td>0.219</td>
<td>0.301</td>
<td>0.468</td>
<td>0.657</td>
<td>0.843</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cグループ</td>
<td>0.064</td>
<td>0.235</td>
<td>0.325</td>
<td>0.499</td>
<td>0.690</td>
<td>0.865</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A：1/1000未満、B：1/1000～1/500、C：1/500以上
注: 1. 平成5年～平成29年災のうち利用可能な「水害被害実態調査」やハウスメーカー等へのヒアリングに基づき設定した被害率。(ただし、土砂堆積は従来の被害率)
2. 家屋の全半壊についても考慮した数値である。

**Note:** Source material is written in Japanese.

Number of business suspension days for buildings based on inundation depth

<table>
<thead>
<tr>
<th>Maximum submergence</th>
<th>Business suspension days</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ 0.49 m</td>
<td>6.4 days</td>
</tr>
<tr>
<td>0.50 ~ 0.99 m</td>
<td>13.5 days</td>
</tr>
<tr>
<td>1 ~ 1.99 m</td>
<td>20.0 days</td>
</tr>
<tr>
<td>2 ~ 2.99 m</td>
<td>41.2 days</td>
</tr>
<tr>
<td>3 m ~</td>
<td>56.1 days</td>
</tr>
</tbody>
</table>

<Usage Parameters>


Note: Source material is written in Japanese.
Increased frequency scenario. Estimated to double in the 2 °C scenario and quadruple in the 4 °C increase scenario

<table>
<thead>
<tr>
<th></th>
<th>Rainfall</th>
<th>Flow rate</th>
<th>Flood occurrence Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4 °C (2040)</strong></td>
<td>1.3 x</td>
<td>About 1.4 times</td>
<td>About 4 times</td>
</tr>
<tr>
<td><strong>2 °C (2040)</strong></td>
<td>1.1 x</td>
<td>About 1.2 times</td>
<td>About twice</td>
</tr>
</tbody>
</table>

Note: Source material is written in Japanese.

Source: Ministry of the Environment and others "Proposal of a flood control plan based on climate change" (p. 15)
[Procedure for analyzing the inundation risk of the property]

Overall flow

1. Prepare a list of properties
2. Match property information with hazard map information
3. Combine property list and hazard map data

1-1. Selection of object property
1-2. Obtain address information
2-1. On the overlapping hazard map
Search maximum inundation depth
2-2. With the GIS geographic information system
Search maximum inundation depth
2-2-1. Download relevant data from the Ministry of Land, Infrastructure, Transport and Tourism
2-2-2. Convert property address information to latitude/longitude information
2-2-3. Search maximum inundation depth with GIS Geographic Information System
3. Maximum inundation depth
Search Results Summary

=>Introduced later

Summary of search results for maximum inundation depth
Method of investigating maximum inundation depth

[Summary] A hazard map portal site published by the Ministry of Land, Infrastructure, Transport and Tourism. It is possible to refer to risk information such as floods, landslide disasters, and tsunamis in the area where the object is located. https://disaportal.gsi.go.jp/

[Procedure] Using the map of "flood", search the maximum possible inundation depth of the subject property based on the address.

[Benefits] By entering the address of the subject property, it is possible to easily investigate.

[Demerit] Since it is not possible to investigate multiple properties at once, it is not suitable for analyzing many properties.

For the number of properties (minority)

Superimpose hazard map

GIS geographic information system

[Summary] A technology that comprehensively manages and processes data (spatial data). It contains information regarding geographical location and displays it visually, enabling advanced analysis and quick judgment. By using the exclusive data provided by the Ministry of Land, Infrastructure, Transport and Tourism, it is possible to superimpose the object and flood inundation assumption area on GIS.

[Procedure]

1. National land map data provided by the Ministry of Land, Infrastructure, Transport and Tourism (base map information);
   - Download inundation risk area data (national land numerical information)
   - Infrastructure Map Information: https://fgd.gsi.go.jp/download/menu.php
   - Geographical Data: https://nlfpt.mlit.go.jp/ksj/index.html

2. Convert object address to latitude/longitude (The following is an example of a conversion tool.)
   - JNS Address Recognition System: https://nlfpt.mlit.go.jp/ksj/jns_download.html
   - The University of Tokyo Address Matching Service: http://newspat.csis.u-tokyo.ac.jp/geocode/

3. The maximum inundation depth of the object is searched by superimposing the object and the inundation assumed area data on GIS

[Benefits] Since multiple properties can be surveyed at once, it is efficient to analyze many properties.

[Demerit] A preparation process for analysis, such as converting addresses to latitude and longitude, is required, so it takes time for a small number of properties. It is also difficult to use without knowledge of GIS software.

[Reference] Key GIS Software

- ArcGIS — paid, supported https://www.esrij.com/products/arcgis/
- QGIS: Free (open source), no support https://qgis.org/ja/site/index.html
Overlapping hazard maps and national land information websites

Note: Source material is written in Japanese.
Convert address information of the object to latitude and longitude

Note: Source material is written in Japanese.
[References]

In the hazard map, the following flow is used to plot properties and extract data on those that suffer flood damage.

Property plot image on hazard map

Layer 1 (Geographical Survey Institute map data)

Layer 2 (Ministry of Land, Infrastructure and Transport "Hazard Map")

Layer 3 (Location latitude and longitude data of property)

Three-layer consolidation

Inundate by the inundation depth to be able to identify objects

Inundated extraction
[References]
Link inundation risk analysis results to property lists

Example of overlapping hazard maps

GIS example (For QGIS)

Display the depth of flooding

<table>
<thead>
<tr>
<th>Property</th>
<th>Inundation Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>w</td>
<td>0.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Inundation Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>3</td>
</tr>
<tr>
<td>u</td>
<td>2</td>
</tr>
<tr>
<td>v</td>
<td>2</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
The amount of collateral for each property is calculated as the amount of damage based on the percentage of damage based on inundation depth.

<table>
<thead>
<tr>
<th>Property</th>
<th>Collateral Value (Thousand Yen)</th>
<th>Inundation Depth (m)</th>
<th>Percentage of Loss (%)</th>
<th>Amount of Loss (Thousand Yen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>50,000</td>
<td>3</td>
<td>83.6</td>
<td>41,800</td>
</tr>
<tr>
<td>u</td>
<td>40,000</td>
<td>2</td>
<td>64.6</td>
<td>25,840</td>
</tr>
<tr>
<td>v</td>
<td>100,000</td>
<td>2</td>
<td>64.6</td>
<td>64,600</td>
</tr>
<tr>
<td>w</td>
<td>90,000</td>
<td>1</td>
<td>45.8</td>
<td>41,220</td>
</tr>
<tr>
<td>x</td>
<td>30,000</td>
<td>2</td>
<td>64.6</td>
<td>19,380</td>
</tr>
<tr>
<td>y</td>
<td>50,000</td>
<td>4</td>
<td>83.6</td>
<td>41,800</td>
</tr>
<tr>
<td>E</td>
<td>20,000</td>
<td>5</td>
<td>83.6</td>
<td>16,720</td>
</tr>
<tr>
<td>F</td>
<td>50,000</td>
<td>3</td>
<td>83.6</td>
<td>41,800</td>
</tr>
<tr>
<td>G</td>
<td>30,000</td>
<td>3</td>
<td>83.6</td>
<td>25,080</td>
</tr>
<tr>
<td>H</td>
<td>60,000</td>
<td>2</td>
<td>64.6</td>
<td>38,760</td>
</tr>
<tr>
<td>I</td>
<td>40,000</td>
<td>2</td>
<td>64.6</td>
<td>25,840</td>
</tr>
<tr>
<td>K</td>
<td>70,000</td>
<td>2</td>
<td>64.6</td>
<td>45,220</td>
</tr>
<tr>
<td>L</td>
<td>150,000</td>
<td>3</td>
<td>83.6</td>
<td>125,400</td>
</tr>
<tr>
<td>M</td>
<td>30,000</td>
<td>5</td>
<td>83.6</td>
<td>25,080</td>
</tr>
</tbody>
</table>

The amount of collateral for each property is calculated as the amount of damage based on inundation depth.

<table>
<thead>
<tr>
<th>Property</th>
<th>Revenue per day (Thousand Yen)</th>
<th>Inundation Depth (m)</th>
<th>No. of days of missed work (Days)</th>
<th>Amount of Loss (Thousand Yen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>5,000</td>
<td>3</td>
<td>56.1</td>
<td>2,805</td>
</tr>
<tr>
<td>u</td>
<td>4,000</td>
<td>2</td>
<td>41.2</td>
<td>1,648</td>
</tr>
<tr>
<td>v</td>
<td>10,000</td>
<td>2</td>
<td>41.2</td>
<td>4,120</td>
</tr>
<tr>
<td>w</td>
<td>9,000</td>
<td>1</td>
<td>20.0</td>
<td>1,800</td>
</tr>
<tr>
<td>x</td>
<td>3,000</td>
<td>2</td>
<td>41.2</td>
<td>1,236</td>
</tr>
<tr>
<td>y</td>
<td>5,000</td>
<td>4</td>
<td>83.6</td>
<td>4,180</td>
</tr>
<tr>
<td>E</td>
<td>2,000</td>
<td>5</td>
<td>56.1</td>
<td>1,122</td>
</tr>
<tr>
<td>F</td>
<td>5,000</td>
<td>3</td>
<td>56.1</td>
<td>2,805</td>
</tr>
<tr>
<td>G</td>
<td>3,000</td>
<td>3</td>
<td>56.1</td>
<td>1,683</td>
</tr>
<tr>
<td>H</td>
<td>6,000</td>
<td>2</td>
<td>41.2</td>
<td>2,472</td>
</tr>
<tr>
<td>I</td>
<td>4,000</td>
<td>2</td>
<td>41.2</td>
<td>1,648</td>
</tr>
<tr>
<td>K</td>
<td>7,000</td>
<td>2</td>
<td>41.2</td>
<td>2,884</td>
</tr>
<tr>
<td>L</td>
<td>15,000</td>
<td>3</td>
<td>56.1</td>
<td>8,415</td>
</tr>
<tr>
<td>M</td>
<td>3,000</td>
<td>5</td>
<td>56.1</td>
<td>1,683</td>
</tr>
</tbody>
</table>
2. Scenario Analysis - Key Points of Practice
2-1. For starting scenario analysis
2-2. Assess materiality of climate-related risks
2-3. Identify and define range of scenarios
2-4. Evaluate Qualitative Business Impact
2-5. Quantitative assessment of transition risk
2-6. Quantitative assessment of physical risk
2-7. Documentation and Disclosure
Scenarios inclusive of a range of transition and physical risks relevant to the organization

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

**Responses might include:**
- Changes to business model
- Changes to portfolio mix
- Investments in capabilities and technologies

---

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

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

[Strategy]
Expanded disclosure of climate-related risks and opportunities and qualitative impact disclosure

In conjunction with the development of our management plan, we identified the following risks and opportunities related to climate change.

---

### Disclosure required by TCFD

a) Describe the short, medium, and long-term climate-related risks and opportunities identified by the organization.

b) Explain the impact of climate related risks and opportunities on the organization's business, strategic, and financial planning.

c) Explain the resilience of an organization's strategy based on a variety of climate-related scenarios, including below 2 °C.

[Guidance for the banking sector] Banks should consider describing the excessive concentration of credit exposure to carbon related assets and discloses about climate related risks (Transition and Physical Risks) in loans and other financial intermediation services.

---

Point of disclosure

1. Disclosing the Scope of Analysis (Reasons for selecting target sectors, basis for judgment, exposure of each sector's credit, etc.)

2. Disclosure of sector risk and opportunity categories (Consideration of importance and qualitative impact on business)

*Depending on the disclosure method, it may be possible to disclose only important items in advance.

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Content reference: (Details of implementation)
[Strategy]
Scenario analysis may include narrowing down the scope of analysis, definition of scenario, financial impact, and countermeasures

Point of disclosure

- In the scenario analysis, the following are described
  ① definition of Scenario Groups (Scenarios used, time horizon, scenario assumptions, etc.)
  ② Financial Impact Assessment (Qualitative and quantitative assessment)
  ③ definition of countermeasures

Disclosure required by TCFD

a) Describe the short, medium, and long-term climate related risks and opportunities identified by the organization.
b) Explain the impact of climate related risks and opportunities on the organization's business, strategic, and financial planning.
c) Explain the resilience of an organization's strategy based on a variety of climate related scenarios, including below 2 °C.
3. Scenario Analysis - Practice Examples

3-1. Shiga Bank, Ltd.
3-2. Hachijuni Bank, Ltd.
3-3. Higo Bank

Note: In this project, "Real Estate" "Energy" and "Transportation and Automobile" were selected as important sectors in each bank. In order to avoid duplication of data, this Practical Guide introduces qualitative analysis such as "Transportation and Automobile" for Shiga Bank, "Real Estate" for Hachijuni Bank, and "Energy" "Transportation and Automobile (Automotive Parts)" for Higo Bank. The results of analysis of the above three sectors are presented to the three banks.
Points to consider when implementing scenario analysis in line with the TCFD recommendations were mapped out for 18 companies, forming the basis of the trial.

Scenarios inclusive of a range of transition and physical risks relevant to the organization:
- Impact on:
  - Input costs
  - Operating costs
  - Revenues
  - Supply chain
  - Business interruption
  - Timing

Responses might include:
- Changes to business model
- Changes to portfolio mix
- Investments in capabilities and technologies

Document the process; communicate to relevant parties: Be prepared to disclose key inputs, assumptions, analytical methods, outputs, and potential management responses.

## Characteristics of Banks in Scenario Analysis

### [Transition Risk Analysis]
- The sectors to be analyzed were set based on the degree of impact of climate change based on literature data and the lending exposure of each sector of each bank. However, the “electric power utility” was included in the analysis for all banks because it seems that the impact of climate change is huge. The sectors analyzed and summary of the analysis by each bank are as follows.

<table>
<thead>
<tr>
<th>Sector to be analyzed</th>
<th>Summary of Analysis Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shiga Bank</strong></td>
<td>Within the scope of the sample enterprise analysis, it was confirmed that if the enterprises’ mitigation measures and regulations for climate change are in line with the scenario, no additional credit costs are required. However, at the same time, under the worst scenario, the impact on credit and the importance of dialogue with creditors were recognized. In practice, in order to reflect the analysis results in credit costs, it is necessary to evaluate individual companies based on the results of quantitative analysis of sample companies. For small and medium-sized enterprises, in particular, the degree of impact of climate change is expected to differ from company to company, so an approach different from the analysis of large companies, including the acquisition of data, is required. In addition, since it was confirmed that the analysis of the automobile sector leads to the analysis of automobile transportation, it is considered possible to expand the analysis to related sectors in the future. Regarding qualitative analysis, it is necessary to further deepen the examination and analysis of sectors that have a high impact on the bank, and to respond to changes in scenarios such as fluctuations in basic parameters.</td>
</tr>
<tr>
<td><strong>Hachijuni Bank</strong></td>
<td>Through the analysis of sample companies, we were able to understand the risk factors and analysis methods that are important for each sector. Based on the scenario in which the sample companies take appropriate measures, the analysis shows that there will be no increase in credit costs. In order to link this analysis result to future disclosure, it is necessary to expand the analysis method of the sample companies to individual lenders. Utilizing the analysis method implemented for the sample companies, it is conceivable to focus on the disclosure data and risk factors of each company (in the case of automobiles, if the EV conversion rate progresses, the impact on sales will be small). In particular, it was understood that the changes in the number of automobiles sold obtained from the analysis of automobile manufacturers can be applied to the risks of automobile sales. The risks and opportunities derived from the analysis can also be used to engage with lenders.</td>
</tr>
<tr>
<td><strong>Higo Bank</strong></td>
<td>Since there are many loans to regional companies, it is necessary to transfer the know-how of sample company analysis to regional companies in order to connect it to the evaluation and disclosure of credit costs in practice. In this analysis, in addition to automobile manufacturing, automobile parts manufacturing was also analyzed, and it was understood that if all sectors respond to EV conversion according to the scenario, it is unlikely that additional credit costs will occur. On the other hand, depending on the climate change efforts (mitigation measures) of each lender, there may be both risks and opportunities. It may be necessary to analyze credit costs after understanding the efforts of individual companies. The risks and opportunities obtained from the scenario analysis, including the results of the qualitative analysis, can be used as a tool to appeal the importance of climate change to the lenders.</td>
</tr>
</tbody>
</table>
Characteristics of Banks in Scenario Analysis

**[Physical Risk Analysis]**

- In the analysis, the occurrence of floods is greatly affected by the geographical factors of the location area of each bank's lender, so after specifying the scope of analysis based on the characteristics of the flood occurrence assumption, the importance of the lender, availability of data, etc. In consideration of the above, the target range for each bank was set, and summary of its analysis as follows.

<table>
<thead>
<tr>
<th>Bank</th>
<th>Geographical Factors</th>
<th>Selection of the Subject of Analysis</th>
<th>Summary of Analysis Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shiga Bank</td>
<td>Floods in the rivers that flow into Lake Biwa are expected. The inundation area will be wide, but it can be assumed that the inundation depth will not be too deep.</td>
<td>It was selected for a wide range of lenders in the prefecture.</td>
<td>As expected geographically, the inundation depth was about 2 m if limited to the properties to be analyzed this time. Therefore, it was assumed that the impact on credit risk would be limited for both collateral damage and loan loss.</td>
</tr>
<tr>
<td>Hachijuni Bank</td>
<td>Floods are expected mainly due to the flooding of the Chikuma River. Due to the mountainous terrain, the inundation area is limited to the Chikuma River basin, but it can be assumed that the inundation depth will be deep.</td>
<td>Refer to the hazard map in advance, and target the loan destinations located in the Chikuma River basin and the locations of branches of important companies in terms of loan balance.</td>
<td>In this analysis, the properties to be analyzed were limited to high-risk areas, so the overall picture of the damage could not be obtained, but an inundation depth of more than 2 m (some 5 m) was observed. In particular, it may be necessary to consider credit risk individually for properties with large assumed damage, but since the building structure is not considered in this analysis, further data collection is required for risk assessment.</td>
</tr>
<tr>
<td>Higo Bank</td>
<td>Since almost the entire area of Kumamoto City is covered with a hazard map, flooding in the river basin centered on Kumamoto City and damage in the center of Kumamoto City were assumed.</td>
<td>In order to estimate the damage in Kumamoto city, the loan recipients located in the downtown area and arcade area where the damage is expected were targeted.</td>
<td>Since the area and target properties were limited, the analysis was originally for properties that are expected to be damaged. The inundation depth is generally within the range of 2m, but some damage was expected to exceed 2m. It is necessary to further expand the target properties to evaluate the impact on credit risk.</td>
</tr>
</tbody>
</table>
3. Scenario Analysis - Practical Examples

3-1. Shiga Bank, Ltd.
3-2. Hachijuni Bank, Ltd.
3-3. Higo Bank
3. Practical examples of scenario analysis

3-1. Shiga Bank
   ① Assess materiality of climate-related risks
   ② Identify and define range of scenarios
   ③ Evaluate Qualitative Business Impact
   ④ Quantitative assessment of transition risk
   ⑤ Quantitative assessment of physical risk

3-2. Hachijuni Bank

3-3. Higo Bank
[Examination of the business sector to be analyzed] From the exposure by industry on the bank (total amount), we can assume that the importance of “Real Estate” “Electricity, Gas, Heat and Water Supply” is high.

**Industry Exposures and Climate Risk Impact**

(Exposure prepared based on “Financial Results for Fiscal 2019”)

(Note 1) Goods Rental and Leasing do not include exposures classified as “Other”, which have different risk ratings depending on commercial products.

Source: Exposure prepared based on “Financial Results for Fiscal 2019”
If fossil fuel subsidies are eliminated, support projects for the development of low-carbon technologies may be terminated, resulting in high R & D costs.

Higher energy prices (rising operating costs)
- If higher energy prices lead to higher electricity and fuel costs in transport, resulting in higher transport and overhead costs.
- The development of transportation technologies will increase the maximum load per vehicle, and the spread of low-carbon technologies will reduce transportation costs.

Increased use due to changes in modes of transport (increase in sales)
- May choose rail or other transportation over trucks during periods of high gasoline prices.

Opportunity

- Shift to alternatives through the introduction of a carbon tax (increase in sales)
- Modal shifts (Shift from automobile to rail transport) may accelerate as a carbon tax is introduced

Lower energy costs (lower operating costs)
- Technological progress reduces capital investment costs for CO2 reduction
- Expanding services through the development of energy-saving technologies and the procurement of renewable energy through self-generation

Expansion of electric vehicles and low-carbon technologies (higher sales and lower operating costs)
- Advances in technology will lower the cost of introducing EVs
- The development of transportation technologies will increase the maximum load per vehicle and the spread of low-carbon technologies will reduce transportation costs.

When abnormal weather occurs frequently and manufacturing bases and warehouses are damaged, operations are suspended or restoration costs are incurred, and existing assets are damaged.

- Damage to operations due to severe disaster (Increase in capital investment and operating costs)
- When abnormal weather occurs frequently and manufacturing bases and warehouses are damaged, operations are suspended or restoration costs are incurred, and existing assets are damaged.

Table: Business Impact Analysis (qualitative information)

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation item</th>
<th>Risk</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Opportunity</th>
<th>Proposal of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy/Regulation</td>
<td>Carbon tax and price</td>
<td>Introduction of a carbon tax (rising operating costs)</td>
<td>Shift to alternatives through the introduction of a carbon tax (increase in sales)</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Addressing GHG emission regulations</td>
<td>Strengthening of GHG emission regulations (rising operating costs)</td>
<td>NA</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Fossil fuel subsidy</td>
<td>Abolition of fossil fuel subsidies (rising R &amp; D costs)</td>
<td>NA</td>
<td>Small</td>
<td>Small</td>
</tr>
<tr>
<td>Market Transition Technology</td>
<td>Increase or decrease in the price of important products</td>
<td>Rising demand for raw materials (rising operating costs)</td>
<td>NA</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Energy price</td>
<td>Higher energy prices (rising operating costs)</td>
<td>Increased use due to changes in modes of transport (increase in sales)</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Dissemination of electric vehicles</td>
<td>Conversion to electric vehicles (increase in capital investment)</td>
<td>Expansion of electric vehicles and low-carbon technologies (higher sales and lower operating costs)</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Spread of renewable and energy-saving technologies</td>
<td>NA</td>
<td>Lower energy costs (lower operating costs)</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Reputational</td>
<td>Changes in customer behavior</td>
<td>Changing customer preferences (decline in sales)</td>
<td>NA</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Changing investor reputation</td>
<td>Poor investor reputation (higher funding costs)</td>
<td>NA</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Chronic physical</td>
<td>Changes in precipitation and weather patterns</td>
<td>Lower demand for existing products (decline in sales)</td>
<td>NA</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Increase in mean temperature</td>
<td>Thermal expansion of lines (Increase in capital investment and operating costs)</td>
<td>NA</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td>Acute</td>
<td>Intensification of extreme weather</td>
<td>Damage to operations due to severe disaster (Increase in capital investment and operating costs)</td>
<td>NA</td>
<td>Large</td>
<td>Large</td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)
3. Practical examples of scenario analysis

3-1. Shiga Bank
   ① Assess materiality of climate-related risks
   ② **Identify and define range of scenarios**
   ③ Evaluate Qualitative Business Impact
   ④ Quantitative assessment of transition risk
   ⑤ Quantitative assessment of physical risk

3-2. Hachijuni Bank

3-3. Higo Bank
## [3] List of automobile sector parameters

Forecast parameter data is collected for critical risks and opportunities, for the 2 °C/4 °C scenario

<table>
<thead>
<tr>
<th>Important Items (object of analysis)</th>
<th>Configured Parameter</th>
<th>Current</th>
<th>4 °C</th>
<th>2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>2040 and later</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon tax and price</td>
<td>(1) Carbon tax</td>
<td>Japan: N/A</td>
<td>(2030) Japan: N/A</td>
<td>(2040) Japan: N/A</td>
</tr>
<tr>
<td>Addressing GHG emission regulations</td>
<td>(2) Carbon emission reduction target</td>
<td>(base year) 4 °C - varies by country 2 °C: 2018 years</td>
<td>(2030) High targets limited to some countries</td>
<td>N/A</td>
</tr>
<tr>
<td>Energy price</td>
<td>(3) Crude oil price</td>
<td>(2019) 63 USD/barrel</td>
<td>(2030) 76 USD/barrel</td>
<td>(2040) 85 USD/barrel</td>
</tr>
<tr>
<td></td>
<td>(4) Vehicle sales with engines</td>
<td>(2015) base year</td>
<td>(2030) +16%</td>
<td>(2060) +49%</td>
</tr>
<tr>
<td>Dissemination of next-generation technologies</td>
<td>(5) Dissemination of electric vehicles</td>
<td>(2016) Japan: 28000 (EV, PHV and FCV)</td>
<td>PHV/ZEV: 5% increase</td>
<td>PHV/ZEV: 7% increase</td>
</tr>
<tr>
<td></td>
<td>(6) Flood damage amount</td>
<td>(2010) base year</td>
<td>(2030) +67%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(7) Typhoon</td>
<td>N/A</td>
<td>N/A</td>
<td>(2100) All typhoons ▲ 5.7% Fierce typhoon + 3.6%</td>
</tr>
</tbody>
</table>
Definition of scenario groups:
Accelerate expansion of environmentally friendly vehicles for decarbonization

2 °C world view @ 2050 (example)

**Motor Vehicle**

**Seller (Suppliers)**
- Increased demand for products to reduce vehicle weight and improve energy efficiency
- Higher production costs due to carbon tax, shifting to sales prices

**Seller (Energy, etc.)**
- Increasing share of renewable energy in energy demand and decreasing demand for oil
- Crude Oil Prices Fall

**Industry/Company**
- Withdrawal of production of gasoline vehicles and shift to production of ZEVs
- Promoting the use of renewable energy and environmentally friendly vehicles
- Increasing need for additional energy-efficient capital investment

**New entrant**
- Companies involved in the use of renewable energy and environmentally friendly vehicles enter the market in China and other countries.

**Buyer (customer)**
- Increasing demand for EVs for a decarbonized society
- On the other hand, demand for vehicles with engines declined due to the expansion of ZEVs, etc.
- In addition to the increased demand for EVs, the cost reduction will be promoted and the barrier to EV purchase will be lowered.

**Government**
- To achieve the 2 °C target, the government is promoting the introduction of carbon taxes and emissions trading, and carbon prices are rising.
- Implementation of preferential policies for domestic EV manufacturers
- Stricter regulations on internal combustion vehicles
- Expanding charging infrastructure to promote EVs

**Introduction and sales expansion of environmentally-friendly vehicles such as ZEV**
*ZEV .... zero-emission vehicles (Electric and hydrogen vehicles)*

**Strengthening cooperation (Alliances, M&As, etc.)**

**Promoting investment in low-carbon technologies**

**Improving Production Plans for Low-Carbon Production**

**Crude Oil Prices Fall**: What you need to do to address risk
- Prompt access to policy information; and securing subsidies
- Promoting renewable energy and next-generation vehicles in cooperation with the government

**Definition of scenario groups:**
Accelerate expansion of environmentally friendly vehicles for decarbonization

88
Definition of scenario groups: Maintains the traditional market environment and increases physical risks such as severe disasters

4 °C world view @ 2050 (example)

Motor Vehicle

**Seller (Suppliers)**
- Slow pace of development for low carbon technologies and products
- Increasing need for countermeasures due to intensification of natural disasters

**Seller (Energy, etc.)**
- Crude Oil Prices Rise as Decarbonization Fails and Oil Demand Grows
- Promoting renewable energy procurement and private power generation

**Industry/Company**
- Increased energy costs for cooling vehicle production sites
- Production of ICE in manufacturing has continued and business portfolio is maintained
- Low Carbon Vehicle Sales Slow

**New entrant**
- As ICE cars continue to dominate, the presence of new EV manufacturers is limited.

**Buyer (customer)**
- The lack of a product lineup for infrastructure and next-generation vehicles remains an issue.
- In addition, the subsidy policy has not progressed, and the product cost is high, so the customer’s desire to purchase the next generation car has not increased, and as a result, the market centering on ICE cars * has continued.

**Government**
- The low carbon/decarbonization trend weakens and external pressure from the international community weakens
- Slow or stop the spread of ZEVs and renewable energy policies
- No regulations on carbon taxes will be introduced
- Subsidies (Breakwater, etc.) for increased physical risks such as floods

*ICE cars ••• internal combustion engines (gasoline and diesel vehicles)*
[Vision of Future Society under the 2 °C Scenario]

Strong promotion of decarbonization, the introduction of a carbon tax and increased use of renewable energy and EVs

- Crude Oil Prices Fall
- Renewable energy Diffusion
- Introduction of Carbon taxes and emissions trading
  - Addressing GHG regulations
- Strengthening of regulations
  - For internal combustion vehicles
- Implementation of EV preferential policy
- Promotion of environmentally friendly vehicles
- Emerging manufacturers such as EV enter the market.
- Promotion of renewable energy use
- Expanded investment in energy-efficient facilities and energy-saving technologies to reduce CO2 emissions
- Decrease in demand and production
- Expansion of charging infrastructure to promote EV
- Increase in demand for EVs
- Real estate
- Energy
- Automobiles and transportation

For internal combustion vehicles:
- Promotion of renewable energy use
- Emerging manufacturers such as EV enter the market.
- Crude Oil Prices Fall
- Renewable energy Diffusion
- Introduction of Carbon taxes and emissions trading
  - Addressing GHG regulations
- Strengthening of regulations
  - For internal combustion vehicles
- Implementation of EV preferential policy
- Promotion of environmentally friendly vehicles
- Increased use of renewable energy and EVs

CO2
[Vision of Future Society under the 4 °C Scenario]
Lack of progress regarding own carbon/decarbonization levels, increasing physical risk

- Crude Oil Prices Rise
- ICE Centric Market Continues
- ICE Production Shifts
- Slow down or stop the growth in ZEVs and renewable energy policies
- Shutdown of a factory due to a disaster
- Disasters disrupt the procurement network
- Depend on fossil fuels
- Increase in energy and capital investment costs for cooling
- Subsidies for breakwaters and other facilities
- No regulations on carbon taxes will be introduced
- Real estate
- Energy
- Automobiles and transportation
3. Practical examples of scenario analysis

3-1. Shiga Bank
1. Assess materiality of climate-related risks
2. Identify and define range of scenarios
3. Evaluate Qualitative Business Impact
4. Quantitative assessment of transition risk
5. Quantitative assessment of physical risk

3-2. Hachijuni Bank

3-3. Higo Bank
Flow of climate change impacts to materialize

**Legend:**
- **Bold:** have a particularly large impact on
- **Gray:** have a relatively small impact on
- **Orange arrow:** direction of change

### Important risk and opportunity

<table>
<thead>
<tr>
<th>In the 2 °C scenario</th>
<th>Future assumptions and background</th>
<th>influencing factor (Parameter)</th>
<th>Impact on the automotive sector</th>
<th>Impact on your bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon tax, carbon price</td>
<td><a href="#">Strengthening government decarbonization policies</a></td>
<td>carbon-tax Introduction and expansion</td>
<td>carbon tax</td>
<td>Taxation based on operation-related emissions</td>
</tr>
<tr>
<td>Compliance with GHG emission regulations</td>
<td><a href="#">Decarbonized formulation of international commitments</a></td>
<td>carbon emission reduction target</td>
<td>oil price</td>
<td>decline in sales of engine-powered vehicles</td>
</tr>
<tr>
<td>Energy Price</td>
<td><a href="#">Energy Price</a></td>
<td>engine vehicle sales volume</td>
<td>decline in sales of ZEVs, etc.</td>
<td>increase in sales of ZEVs, etc.</td>
</tr>
<tr>
<td>Dissemination of next-generation technologies</td>
<td><a href="#">Diffusion of electric vehicles</a></td>
<td>Implementation of favorable policies for EV manufacturers</td>
<td>increased opportunities to recover development investment due to increased demand for ZEV</td>
<td>increased investment</td>
</tr>
<tr>
<td>extreme weather intensification</td>
<td></td>
<td></td>
<td>Reduction/withdrawal of low-carbon technology investment</td>
<td></td>
</tr>
</tbody>
</table>

*Although the impact on industry and your bank is minimal compared to 4 °C, the cost of coping with physical risk is assumed to be constant.*
(3) Business impact of automobile × 4 °C
While the current regulatory and market environment continues, the cost of extreme weather will increase.

Flow of climate change impacts to materialize

Legend:

- **Bold**: have a particularly large impact on
- **Gray**: have a relatively small impact on
- **Risk**: direction of change

<table>
<thead>
<tr>
<th>Important risk and opportunity</th>
<th>In the 4 °C scenario</th>
<th>Influencing factor (Parameter)</th>
<th>Impact on the automotive sector</th>
<th>Impact on your bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon tax, carbon price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance with GHG emission regulations</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Energy Price</td>
<td></td>
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<tr>
<td>Dissemination of next-generation technologies</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Extreme weather intensification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Government’s low-carbon policies are limited**
- **Auto market is going well**
- **Increase in demand for crude oil**
- **Increase in oil price**
- **Operational-cost increase**
- **Increase in sales of engine-powered vehicles**
- **Increased risk of recovery of development investment in EVs, etc. due to continuation of ICE market**
- **In sales of EVs stagnant**
- **Diffusion of electric vehicles is limited**
- **In product inventories and factories**
- **Increase in property damage**
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- **Increase in property damage**
- **In order to avoid the impact of Increased number of transportation days**
- **Incurred repair costs**
- **Increase in cost**

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- **Increase in cost**

**Incurred repair costs**
- **Increase in cost**

**Increase in cost**
- **Increase in cost**
- **Possibility of a downward revision in creditworthiness**
- **Possibility of an upward revision in creditworthiness**
- **Increase in revenue**
- **Possibility of an upward revision in creditworthiness**
- **Improvement in ROE**
- **Decline in debtors’ ability to pay**
- **Possibility of a downward revision in creditworthiness**
- **Increase in cost**
- **Increase in cost**

**Incurred repair costs**
- **Increase in cost**
- **Possibility of a downward revision in creditworthiness**
- **Possibility of an upward revision in creditworthiness**
- **Increase in revenue**
- **Possibility of an upward revision in creditworthiness**
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- **Decline in debtors’ ability to pay**
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- **Increase in cost**
- **Increase in cost**
3. Practical examples of scenario analysis

3-1. Shiga Bank
① Assess materiality of climate-related risks
② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
④ Quantitative assessment of transition risk
⑤ Quantitative assessment of physical risk

3-2. Hachijuni Bank

3-3. Higo Bank
Approach to Analysis of the Impact of Transition Risk on Financial Statements
Example of analysis(1):
Energy sector (Electric Power Company (1))

Note: The value set as XXX in the numerical value in the graph is not shown as a real number because it was analyzed by a sample company (the same applies hereinafter).
If the carbon tax scenario is built on the assumption that the CO2 emissions will remain constant in the near future, there will be an excess of liabilities.

**STEP 1: Carbon Tax Considerations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 emission volume</td>
<td>approximately XX, X00,000 [t-CO2]</td>
<td>Last ESG Report</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>105 yen/$</td>
<td>Level at the end of January 2020</td>
</tr>
</tbody>
</table>

**2 °C Scenario**

A carbon tax is introduced regardless of country or region.

**Developed country**

<table>
<thead>
<tr>
<th>Current situation</th>
<th>Developed country</th>
<th>Developing country</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Reference) Average successful bid price in EU-ETS in Europe: approximately US $/t &quot;Implementation and Review of Emissions Trading in Other Countries&quot; From (Ministry of the Environment Report 2016)</td>
<td>100 US $/tCO2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td></td>
<td>75 US $/tCO2</td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td></td>
<td>140 US $/tCO2</td>
<td></td>
</tr>
</tbody>
</table>

**Consideration**

- (whole) As global carbon prices rise to achieve the 2 °C target, the government is promoting the introduction of carbon taxes and emissions trading. On the other hand, companies with high GHG emissions are more likely to be asked to do so by governments and business partners, and more likely to be engaged by investors.
- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings utilizing new low-carbon materials have become popular.
- (Tenants/Residents) Tenants will see an increase in decarbonization and demand for energy-efficient facilities

*Data source:*

- Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario numbers

---

**Step 1 Estimation of Balance Sheet**

Because CO2 emissions are assumed to be constant, the transition is linked to the 2 °C carbon tax scenario (but assuming linear interpolation for periods without values and constant after 2040)

**Step 1 Carbon Tax**

Because CO2 emissions are assumed to be constant, the transition is linked to the 2 °C carbon tax scenario (but assuming linear interpolation for periods without values and constant after 2040)
A decrease in the use of fossil fuels in favor of renewable energy is expected to lead to a reduction in the carbon tax burden and therefore an increase in net income.

**STEP 2: Estimating Financial Impact Based on Changes in Power Supply Composition**

The reduction in carbon tax due to conversion to renewable energy is expected to increase net income and avoid excess liabilities.

Although this estimate assumes that the conversion will take place in stages, it is inferred that if the conversion is delayed, the deficit will widen as shown in Step 1, and there is a possibility that liabilities will exceed assets.

If the composition of power sources is taken into consideration, liabilities will not exceed assets until 2050.
Based on the power supply composition transition scenario, a decrease in carbon tax burden and fossil fuel expenses caused by a decrease in thermal power generation is expected to increase net income.

**STEP 3: Reflection of transition scenario of power supply composition ratio**

Reduction in carbon tax and fuel costs through conversion to renewable energy is expected to increase net income and avoid excess liabilities.

Although this estimate assumes that the conversion will take place in stages, it is inferred that if the conversion is delayed, the deficit will widen as shown in Step 1 and 2, or the liabilities may exceed assets.
Example of analysis (2): 
Motor vehicle manufactures
Assuming the changes in profit and loss and the size of assets and liabilities are as they were in the most recent financial statements, the impact of the carbon tax is insignificant and net income is expected to continue.

**STEP 1: Carbon Tax Considerations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 emissions</td>
<td>About X, XXX, 000 [t-CO2]</td>
<td>Most recent environmental report *</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>105 yen/$</td>
<td>Level at the end of January 2020</td>
</tr>
</tbody>
</table>

**2 ° C Scenario**

A carbon tax is introduced regardless of country or region.

<table>
<thead>
<tr>
<th>Current situation</th>
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<tr>
<td>2030</td>
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**Consideration**

- (whole) As global carbon prices rise to achieve the 2 ° C target, the government is promoting the introduction of carbon taxes and emissions trading. On the other hand, companies with high GHG emissions are more likely to be asked to do so by governments and business partners, and more likely to be engaged by investors.
- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings utilizing new low-carbon materials have become popular.
- (Tenants/Residents) Tenants will see an increase in decarbonization and demand for energy-efficient facilities

*Data source:

- Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario numbers

Because CO2 emissions are assumed to be constant, the transition is linked to the 2 ° C carbon tax scenario (but assuming linear interpolation for periods without values are constant after 2040).

In this case, even if the carbon tax is taken into account, the current net income will continue, so the current liabilities will be repaid and retained earnings will be retained after repayment. 

Set a simple assumption that Debt can be repaid and retained.

(*) Only CO2 emissions for Scope 1 and 2 are counted.
In order to take into account future changes in unit sales, calculations have been made from estimates of the "Percentage and number of units sold" and "Proportion of use and number of units" for next-generation vehicles, using scenarios developed by external think tanks and the IEA WEO.

**STEP 2: Forecasting the Future of Next-Generation Vehicles (≡ PHV or ZEV) in the Overall Automotive Market**

**Proportion of PHV/ZEV Sales**

- Equation: \( y = 0.0005x^2 + 0.0057x + 0.0356 \)
- \( R^2 = 0.9987 \)

**Proportion of PHV/ZEV Spread**

- Equation: \( y = 2E-05x^3 - 0.0011x^2 + 0.045x + 0.005 \)
- \( R^2 = 1 \)

**Number of PHV/ZEV Sales**

- Equation: \( y = 24.671x^2 + 4372.1x + 1163.5 \)
- \( R^2 = 0.9997 \)

**Number of PHV/ZEV Spread**

- Equation: \( y = 8.7864x^2 + 47.442x + 349.89 \)
- \( R^2 = 0.9986 \)
Based on the assumption that it will be linked to the market for next-generation vehicles as described in the previous page, we calculated the number of units sold by automobile manufacturers based on the actual and projected figures shown in our environmental and annual reports.

**STEP 2: Automotive Manufacturers’ Forecasts for Future Sales of Next-Generation Vehicles (≒ PHV or ZEV)**

Number of Sales of Next-Generation Vehicles estimated by Automotive Manufacturers

- Forecasting future sales of a company using current data and the target set by a company itself
- Target set by a Auto Manufacture in its publication
- Current data disclosed by a Auto Manufacture

Sales of Vehicles estimated by Automotive Manufacturers

- ① Sales of next-generation car (estimated the left slide)
- ② Sales of ICE car (estimated on previous page)

Duration (Years from 2019)

Number of Sales

Sales of Vehicles

Duration (Years from 2019)
If we assume a change in the number of units sold (Sales and R & D expenses are simply linked to the aforementioned sales volume scenario.), we expect net income to increase, although the burden of carbon tax will increase.

**STEP 2: Projections for future changes in sales**

*Step1* Estimation of Balance Sheet

Here, even taking into account the carbon tax, current net income will continue, so the assumption that current liabilities will be repaid and retained after repayment can be easily established.

*Step2* Estimation of Balance Sheet

(\(^*\) Only CO2 emissions for Scope 1 and 2 are counted.)
Based on data disclosed by component manufacturers affiliated with automobile manufacturers, we estimated changes in parameters relating to automobile manufacturers R&D expenditure and capital investment.

**STEP 3: Future Forecast of Next-Generation Vehicle Development Costs by Automobile Manufacturers**

(Estimation based on data disclosed by affiliated component manufacturers)

**Estimates from the prior year’s data**

- **Sales: R&D Expense (2008-2019)**
  - \( y = 0.0478x + 7467.3 \)
  - \( R^2 = 0.9483 \)
  - About 5% of the sales of this affiliated parts manufacturer is allocated to R&D at present.
  - It is assumed that there is a proportional relationship even in the main body of the automobile manufacturer, and the value of about 4% is adopted at present.

  - \( y = 2.2869x - 120041 \)
  - \( R^2 = 0.8306 \)
  - There is a proportional relationship between R&D expenditures and capital expenditures among affiliated component manufacturers.
  - Assumption that the ratio of R&D expenditures to capital expenditures (Double) is constant even for the main body of automobile manufacturers.

**Future projections from disclosed targets**

- **R&D Expense/Sales**
  - Our goal is to raise R & D expenditure from the current level of approximately 5% to the level of 6% in 2020. Considering the increase in the ratio of R&D expenditure for advanced technologies, we assume that R&D expenditure will increase over the medium to long term.
  - For affiliated parts manufacturers, from about 5% in 2020 to about 7% in 2050 but maker has the same rate of increase.
  - Assumed to increase from about 4% to about 5%
  - \( y = 2.2869x - 120041 \)
  - \( R^2 = 0.8306 \)

- **CO2 Emission from Plants in Global**
  - Estimated by quadratic polynomials from planned global CO2 emissions at “Environmental Report” plants of automobile manufacturers.
  - Assuming a target of zero global CO2 emissions at plants by 2050.
  - \( y = -0.0002x^2 - 0.0186x + 0.0047 \)
  - \( R^2 = 0.9938 \)
Even if certain assumptions are made in R&D cost projections as shown in the previous page, internal reserves will increase, but if assumptions such as sales volume and capital investment slightly change, the results will change, such as incurring an excess of liabilities.

**STEP 3: Study incorporating the forecast of R&D costs**

[Assumptions Summary]

- Vehicle sales (Next-generation vehicles and gasoline-powered vehicles) are also sold according to the scenario, regardless of region or regulation.
- Assumes that the unit selling price of automobiles does not change on average
- Capital investment and R&D expenses are within the estimated range on the previous page.
- Reduction in global CO2 emissions at plants is expected to zero by 2050
Example of analysis (3): Real estate company
The negative impact of carbon tax on income is expected to be negligible. Even so, any reduction in income is expected to be attributable to an estimated accumulation within retained earnings rather than a result of increasing credit costs.

**STEP 1: Carbon Tax Considerations**

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<td>N/A</td>
<td>&quot;Implementation and Review of Emissions Trading in Other Countries&quot; From (Ministry of the Environment Report 2016)</td>
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<td>2030</td>
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<td>2040</td>
<td>140 US $/ tCO2</td>
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**Consideration**

- (whole) As global carbon prices rise to achieve the 2 °C target, the government is promoting the introduction of carbon taxes and emissions trading. On the other hand, companies with high GHG emissions are more likely to be asked to do so by governments and business partners, and more likely to be engaged by investors.
- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings utilizing new low-carbon materials have become popular.
- (Tenants/Residents) Tenants will see an increase in decarbonization and demand for energy-efficient facilities

*Data source: Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario numbers

Because CO2 emissions are assumed to be constant, the transition is linked to the 2 °C carbon tax scenario (but assuming linear interpolation for periods without values and constant after 2040)

Since the direct effect of the decrease in income from the carbon tax is minor, it is estimated that retained earnings are accumulated even in the course of events.
ZEB and ZEH are set on the basis of IEA scenarios and national targets, simplified assumptions are made regarding initial cost increases and carbon tax reduction

**STEP 2: Sample Company Response (Compatible with ZEB/ZEH)**

[**Prerequisites for ZEB**]

- As the total floor area increased by XXX 1000 m$^2$ per year, the percentage cost increase of ZEB is shown in the graph on the left.
- In addition, the renovation cost will be added, based on the assumption that the current total floor area plus the increase is all ZEB by 2060.
- Reduction of carbon tax for ZEB

[**Assumptions regarding ZEH compliance**]

- The cost of ZEH is added to X, X00 new houses for several years by the ratio shown in the graph on the left.
- Reduction of carbon tax for ZEH
As ZEB and ZEH are implemented, the carbon tax will decrease, but the estimated result is that net income will decrease by the increase in costs.

**STEP 2: Estimating the Financial Impact Based on the Response of the Sample Company**

- **Net Profit**
  - Initial cost of ZEB and ZEH (Include the cost of repairs)
  - Net income decreased

- **Step2 Carbon Tax**
  - Reduction of CO2 emissions due to progress in ZEB/ZEH

- **Step1 Estimation of Balance Sheet**
  - Liabilities/Net Assets

- **Step2 Estimation of Balance Sheet**
  - Liabilities/Net Assets
Taking into consideration the long-term growth rate (CAGR 1.12% by 2050) of the real estate business based on the long-term estimation of GDP, the profit level rises and the retained earnings rise slightly.

**STEP 3: Reflect Market Variables (Forecast)**

**Net Profit**

Net income increased by the business growth rate

**Step3 Carbon Tax**

Reduction of CO2 emissions due to progress in ZEB/ZEH

**Step1 Estimation of Balance Sheet**

**Step2 Estimation of Balance Sheet**
3. Practical examples of scenario analysis

3-1. Shiga Bank
  ① Assess materiality of climate-related risks
  ② Identify and define range of scenarios
  ③ Evaluate Qualitative Business Impact
  ④ Quantitative assessment of transition risk
  ⑤ Quantitative assessment of physical risk

3-2. Hachijuni Bank

3-3. Higo Bank
① collateral valuation

[Properties in scope]
• Extract properties located near the hazard map

[Prerequisites for the Property]
• Number of building floors: Since data on the number of floors of each property was unavailable, it was calculated uniformly.
• The variable used for the damage ratio is the one after the rank correction (Leveling of mixed floors).
• Building structure: The analysis was made by combining wooden and non-wooden construction. As above, the variable used for the damage ratio is not structure-specific.

[Damage ratio variable]
• Adjustment due to inundation depth zones that do not match the inundation depth classification and damage ratio classification on the hazard map

<table>
<thead>
<tr>
<th>Hazard map inundation depth section</th>
<th>Flood control economic research manual</th>
<th>After adjustment loss ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inundation depth section</td>
<td>loss ratio</td>
</tr>
<tr>
<td>Less than 0 ~ 0.5 m</td>
<td>Less than 0 ~ 0.5 m</td>
<td>21.40%</td>
</tr>
<tr>
<td>Less than 0.5 ~ 1.0 m</td>
<td>0.5 ~ 0.99 m</td>
<td>29.30%</td>
</tr>
<tr>
<td>Less than 1.0 ~ 2.0 m</td>
<td>1.0 ~ 1.99 m</td>
<td>45.80%</td>
</tr>
<tr>
<td>Less than 2.0 ~ 5.0 m</td>
<td>2.0 ~ 2.99 m</td>
<td>64.60%</td>
</tr>
<tr>
<td></td>
<td>3.0 m or more</td>
<td>—</td>
</tr>
<tr>
<td>5.0 m or more</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*According to the flood control economic survey manual, inundation depth of 3 m or more is assumed.

In order to reduce the loss ratio to a uniform 83.6%, it is necessary to reduce assumptions regarding the damage caused.

The expected damage of an inundation depth of ≥5 m cannot be estimated. Inundation of ≥ 5 m is assumed to be a total loss (100%)

For a distance between 2 m and less than 5 m captured in the hazard map, it is assumed that the midpoint is 3.5 m

The Economic Survey Manual includes a ratio of loss caused by damage of 83.6% for 3m or more

[Calculation logic]
① Property identification: All collateral properties - land properties = buildings
② Understanding of inundation depth: building property address (latitude-longitude transformation) → inundation depth on hazard map
③ Damage Calculation: Collateral amount by inundation depth and building × Damage ratio by inundation depth = Loss on collateral due to flooding (Assumptions)
② valuation of the company's decline in sales

[Properties in scope]
- Targeted at companies with a certain level of outstanding loans in Shiga Prefecture
- Identifying the locations of head offices and sales

[Prerequisites for the Property]
- Number of building floors: Since data on the number of floors of each property was unavailable, it was calculated uniformly.
- The variable used for the damage ratio is the one after the rank correction (Leveling of mixed floors).
- Building structure: The analysis was made by combining wooden and non-wooden construction. As above, the variable used for the damage ratio is not structure-specific

[Number of days off work]
- Adjustment due to inundation depth zones that do not match the inundation depth classification and damage ratio classification on the hazard map

<table>
<thead>
<tr>
<th>Hazard map inundation depth section</th>
<th>Flood control economic research manual</th>
<th>After adjustment number of days off work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inundation depth section</td>
<td>number of days off work</td>
</tr>
<tr>
<td>Less than 0 ~ 0.5 m</td>
<td>Less than 0 ~ 0.5 m</td>
<td>6.4 days</td>
</tr>
<tr>
<td>Less than 0.5 ~ 1.0 m</td>
<td>0.5 ~ 0.99 m</td>
<td>13.5 days</td>
</tr>
<tr>
<td>Less than 1.0 ~ 2.0 m</td>
<td>1.0 ~ 1.99 m</td>
<td>20.0 days</td>
</tr>
<tr>
<td>Less than 2.0 ~ 5.0 m</td>
<td>2.0 ~ 2.99 m</td>
<td>41.2 days</td>
</tr>
<tr>
<td></td>
<td>3.0 m or more</td>
<td>56.1 days</td>
</tr>
<tr>
<td>5.0 m or more</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*According to the flood control economic survey manual, inundation depth of 3 m or more results in 56.1 days off work.

The number of business downtime days for inundation of 5m or more is based on the Dmap and interpolated linearly over the period (73 days).

For distances between 2 m and 5 m captured in the hazard map, it is assumed that the midpoint is 3.5 m.

Number of business suspension days by inundation depth = sales decrease due to flooding (Assumptions)

[Calculation logic]
① Understanding of inundation depth: building property address (latitude-longitude transformation) → inundation depth on hazard map
② Net Sales Decrease Calculation: Net Sales by Flood Depth and Property/Number of Business Days (Calculated for 242 days excluding holidays and national holidays)
3. Practical examples of scenario analysis

3-1. Shiga Bank

3-2. Hachijuni Bank
- Assess materiality of climate-related risks
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3-3. Higo Bank
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3-3. Higo Bank
[Examination of the business sector to be analyzed]
From the exposure by industry in the bank (total amount), we can assume that the importance of "real estate" "Electricity, Gas, Heat Supply and Water" is high.

Industry Exposures and Climate Risk Impact

(Note 1) Goods Rental and Leasing do not include exposures classified as "Other", which have different risk ratings depending on commercial products.
(Note 2:) "Other", which have different risk ratings depending on commercial products.

Source: Prepared based on your bank "Summary of Financial Results for the Year Ended March 2020 [JGAAP] (Consolidated)"
### Transition Assessment of Climate Change Risks and Opportunities in the Real Estate Sector (1/3)

Transition risks are assumed to be significant, driven by the impact of higher building material prices and GHG emissions regulations.

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation Item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Draft Severity (real estate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>Major group Subclassification</td>
<td>Risk</td>
<td>Opportunity</td>
</tr>
<tr>
<td>Carbon tax and price</td>
<td>Increase in the petroleum and coal tax rate (Increased construction and operation costs)</td>
<td>* Higher oil and coal taxes are expected to raise the cost of procuring construction materials and fuel for operating facilities.</td>
<td>Introduction of high-efficiency buildings and low-carbon building materials (Avoidance of increased construction and operation costs)</td>
</tr>
<tr>
<td></td>
<td>Energy report for operating facilities based on the Energy Conservation Law (increased operating costs)</td>
<td>* Compulsory energy conservation performance stipulated in the Building Energy Conservation Law will be further strengthened, and if energy conservation measures are insufficient in operating facilities, an announcement and improvement order will be issued.</td>
<td>Ensuring superiority through environmental performance (Improving competitiveness)</td>
</tr>
<tr>
<td></td>
<td>Stricter energy efficiency regulations for new buildings (increased construction costs)</td>
<td>* If policies such as the fiscal 2030 target of the &quot;Global Warming Countermeasures Plan&quot; formulated by the Japanese government in response to the Paris Agreement, and regulations on the introduction of ZEB to achieve a 40% reduction in CO2 emissions from the commercial and household sectors are implemented, it will become essential to enhance the environmental performance of buildings in the construction of subdivision and rental housing as well as new buildings, and energy conservation measures will be required in the operation of facilities.</td>
<td>Ensuring superiority through environmental performance (Improving competitiveness)</td>
</tr>
<tr>
<td></td>
<td>Strengthening of energy conservation based on Tokyo Cap and Trade System (Increased construction and operation costs)</td>
<td>* Under the reduction obligation for large business establishments in Tokyo, if GHG emission reductions of 7% on average in the 3rd plan period (2020 ~ 2024) and 17% on average in the 4th plan period (2025 ~ 2029) cannot be achieved, credits must be purchased for the properties held. In order to avoid this, it is necessary to invest in equipment to enhance environmental performance.</td>
<td>Ensuring superiority through environmental performance (Improving competitiveness)</td>
</tr>
<tr>
<td></td>
<td>Renewable energy business utilizing FIT system (decrease in operating income)</td>
<td>* At present, many real estate companies are expanding their renewable energy business by utilizing the FIT system. The end of FIT purchases will affect the profitability of new renewable energy businesses. It is highly likely that the hurdle for new investment will be raised as the situation of new investment utilizing existing permits will change.</td>
<td>Acquiring public incentives (cost reduction)</td>
</tr>
<tr>
<td>Industry / Marketer</td>
<td>Changes in the energy mix (Nothing in particular.)</td>
<td>* Revenues from existing renewable energy businesses will decrease after the purchase period ends.</td>
<td>Lower grid power emission factor (Reduced construction and operating costs)</td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)*
Increasing customer demand for buildings with high environmental performance is considered to have a relatively large impact.

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Opportunity</th>
<th>Draft Severity (real estate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major group</td>
<td>Subclassification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higher energy prices (Increased construction and operation costs)</td>
<td>Ensuring superiority through environmental performance (Improving competitiveness)</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shifting customer needs to buildings with high environmental performance (Increase in construction costs and decrease in rent)</td>
<td>Meeting Customer Needs with Environmental Performance (Improving competitiveness)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of EV charging stations in buildings (higher construction costs and lower sales)</td>
<td>(Nothing in particular,)</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building innovations (higher construction costs and lower sales)</td>
<td>Lower prices for energy-saving equipment and renewable energy materials (lower construction and operating costs)</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rising grid electricity prices due to the spread of CCS (Increased construction and operating costs)</td>
<td>(Nothing in particular,)</td>
<td>Small</td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)
The impact of physical risk on assets due to abnormal weather disasters is assumed to be large.

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Draft Severity (real estate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition</td>
<td>Changes in customer behavior</td>
<td>Corporate evaluation by customers and the general public (decline in reputation)</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* As environmental awareness increases, insufficient disclosure of non-financial information and efforts to address climate change will result in a decline in corporate reputation among customers and the general public.</td>
<td></td>
</tr>
<tr>
<td>Reputations</td>
<td>Reputation from investors</td>
<td>Investor valuations (decline in reputation)</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* As the momentum for ESG investment increases, insufficient disclosure of non-financial information and climate change efforts will result in lower investor valuations.</td>
<td></td>
</tr>
<tr>
<td>Chronic</td>
<td>Increase in mean temperature</td>
<td>Global Warming Countermeasures at Operating Facilities and Construction Sites (Increased construction and operating costs)</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* The increasing number of extremely hot days requires measures to ensure summer comfort at operating facilities and construction sites.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* The cost of measures for employee health and safety management will increase, and construction delays may occur.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Construction costs will increase due to the need to reinforce thermal insulation and air conditioning equipment in operating facilities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Higher cooling loads in operating facilities due to higher temperatures will increase operating costs.</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>Changes in precipitation and weather patterns</td>
<td>Building durability improvements and adverse weather effects in operating facilities (Increase in repair and R&amp;D costs and decrease in sales)</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* As the deterioration rate of building materials due to ultraviolet rays and storms increases, it is necessary to develop technologies for materials with lower cost and higher durability.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* An increase in the number of rainy days at resort facilities such as golf courses leads to a decrease in the number of visitors.</td>
<td></td>
</tr>
<tr>
<td>Sea level rise</td>
<td>Impact of sea level rise on existing assets (higher construction costs and lower sales)</td>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Costs of sea-level rise countermeasures in operating facilities located in coastal areas will increase.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* The number of visitors to coastal resort facilities is expected to decrease as the risk of high tides rises.</td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>Intensification of extreme weather</td>
<td>Water and sediment disasters in existing assets (Increase in construction, operation, and R&amp;D costs, decrease in asset value, and decrease in sales)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Torrential rains, typhoons and floods cause inundation, power outages, and landslides inside and outside the facilities, requiring restoration costs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* The number of business days will decrease due to damage to operating facilities and the number of users will decrease due to harmful rumors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* In order to respond to extreme weather events, which are more severe than conventional assumptions, it is necessary to conduct R&amp;D to improve the durability of houses and operating facilities against extreme weather events and to reduce the cost.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Property value decreases in areas at high risk of flooding/storm surges.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Insurance premium payments to compensate for wind and flood damage will increase.</td>
<td></td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)
3. Practical examples of scenario analysis

3-1. Shiga Bank

3-2. Hachijuni Bank
   ① Assess materiality of climate-related risks
   ② Identify and define range of scenarios
   ③ Evaluate Qualitative Business Impact
   ④ Quantitative assessment of transition risk
   ⑤ Quantitative assessment of physical risk

3-3. Higo Bank
Once risks and opportunities were narrowed down to those deemed most significant (‘large impact’). Predicted data for 2 °C/4 °C scenarios were collected as parameters.

<table>
<thead>
<tr>
<th>Important Items (object of analysis)</th>
<th>Configured Parameter</th>
<th>Current</th>
<th>4 °C</th>
<th>2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>2040 and later</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2030)</td>
<td>(2040)</td>
</tr>
<tr>
<td>Carbon tax and price</td>
<td>(1) Carbon tax</td>
<td>Japan: None</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overseas: Some</td>
<td>EU: 33 USD/t</td>
<td>EU: 43 USD/t</td>
</tr>
<tr>
<td>Addressing GHG emission regulations</td>
<td>(2) Energy consumption per unit of building</td>
<td>(base year) Global 2014</td>
<td>Improvement rate of 6%</td>
<td>Improvement rate of 21%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2030)</td>
<td>(2040)</td>
<td>(2030)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan: 0.48 kg CO2/kWh</td>
<td>0.31 kg CO2/kWh</td>
<td>0.29 kg CO2/kWh</td>
</tr>
<tr>
<td></td>
<td>(3) Grid power emission factor</td>
<td>(base year) 2018</td>
<td>(2030)</td>
<td>(2040)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan: 0.48 kg CO2/kWh</td>
<td>0.31 kg CO2/kWh</td>
<td>0.29 kg CO2/kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total floor area of ZEB 0 Billion m2</td>
<td>Total floor area of ZEB 0.25 Billion m2</td>
<td>Total floor area of ZEB 0.1 Billion m2</td>
</tr>
<tr>
<td></td>
<td>(4) Mandatory implementation of ZEB/ZEH (government target)</td>
<td>(base year) 2014</td>
<td>(2020)</td>
<td>(2040)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total floor area of ZEB 0 Billion m2</td>
<td>Total floor area of ZEB 0.25 Billion m2</td>
<td>Total floor area of ZEB 0.1 Billion m2</td>
</tr>
<tr>
<td>Changes in customer behavior</td>
<td>(5) Rent increase or decrease due to environmental performance</td>
<td>4.4% increase in rent</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Intensification of extreme weather</td>
<td>(6) Flood damage amount</td>
<td>(base year) Japan: 2010</td>
<td>2030) +121%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan: 2015</td>
<td>0.18 m</td>
<td>0.25 m</td>
</tr>
<tr>
<td></td>
<td>(7) Changes in flood frequency</td>
<td>(base year) 2019</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(8) Occurrence of typhoons and cyclones</td>
<td>(base year) Japan: 2016</td>
<td>N/A</td>
<td>(2100) Observations are highly uncertain and the number of typhoons per year is uncertain</td>
</tr>
<tr>
<td></td>
<td>(9) Sea level rise</td>
<td>(base year) 2015</td>
<td>0.18 m</td>
<td>0.25 m</td>
</tr>
</tbody>
</table>
Definition of scenario groups: Accelerate construction of facilities with a view to reducing environmental impact

Real estate

Seller (Suppliers)
➢ A carbon tax is imposed during the manufacturing and production of construction materials, which incurs additional costs that are passed on to sales prices.
➢ Introduction and use of low-carbon building materials
➢ Development of new technology (Building materials and related equipment) to realize ZEB

Industry/Company
➢ High carbon taxes and high carbon prices on procured materials such as steel and cement raise construction costs.
➢ Expanded and widespread use of new low carbon materials (Example: Low carbon concrete, etc.)
➢ The presence or absence of technology related to ZEB is a source of competitiveness
➢ In order to meet the energy conservation standards for existing buildings subject to the Energy Conservation Law, continuous invest in equipment renovation is needed, resulting in an increase in operating costs.

New entrant
➢ New market entry by low-carbon construction materials suppliers and others with low environmental impact
➢ Companies that are ahead of ZEB in advanced technology

Buyer (customer)
➢ Interest in ZEB and the introduction of renewable energy has increased, and energy-saving buildings, LED lighting, BEMS, etc. have become important items for investment/purchase decision making.
➢ Growing demand for energy-efficient buildings and construction methods due to soaring carbon taxes
➢ Expanding customer needs for properties that meet LEED, GRESB and other green building certification requirements

Substitute
➢ Low-Carbon construction materials to replace iron and cement

2 °C world view @ 2050 (example)

Government
➢ Promote the introduction of carbon taxes and emissions trading, and set high carbon taxes and carbon prices.
➢ ZEB/ZEH mandatory to achieve zero primary energy consumption in buildings 100% by 2030.
➢ Compulsory energy conservation performance stipulated in the Law Concerning the Rational Use of Energy in Buildings is further strengthened, and targets for improvement of energy consumption rate of buildings are set.
➢ Stricter energy efficiency regulations for new buildings

Providing high-efficiency buildings

Promising access to policy information Cooperation with the Government

Lobbying for a new policy

Secure suppliers using raw materials and equipment with low environmental impact

Energy

Automobiles and transportation

Real estate

Substitute

Providing high-efficiency buildings

Development and use of technologies related to ZEB

What You Need to Do to Get the Opportunity

What You Need to Do to Address Risk
Industry/Company

- High carbon taxes and high carbon prices on procured materials such as steel and cement raise construction costs.
- Expanded and widespread use of new low carbon materials (Example: Low carbon concrete, etc.)
- The presence or absence of technology related to ZEB is a source of competitiveness
- In order to meet the energy conservation standards for existing buildings subject to the Energy Conservation Law, continuous invest in equipment renovation is needed, resulting in an increase in operating costs.

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- Development of new technology (Building materials and related equipment) to realize ZEB

Secure suppliers using raw materials and equipment with low environmental impact

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Development and use of technologies related to ZEB

Providing high-efficiency buildings

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- Stricter energy efficiency regulations for new buildings

Prompt access to policy information

Cooperation with the Government

Lobbying for a new policy

Definition of scenario groups:
Accelerate construction of facilities with a view to reducing environmental impact

2 °C world view @ 2050 (example)
[Vision of Future Society under the 2 °C Scenario]
Decarbonization will be strongly promoted and a carbon tax will be introduced. Use of low-carbon building materials and introduction of renewable energy in buildings will be promoted.
[Vision of Future Society under the 4 °C Scenario]

Increase in physical risks and higher demand for highly disaster-resistant buildings

- Produce a water-resistant material
- Possibility of procurement delays due to disasters
- Demand increases in flood-prone areas
- Discontinuation of construction due to disaster and delay of construction schedule
- Conventional energy such as electricity used in buildings
- Limited support for low-carbon technologies
- Review of disaster prevention plan
- Increased operational costs due to additional disaster prevention costs
- Increased construction costs due to additional disaster prevention costs
- No regulations on carbon taxes will be introduced

CO₂
3. Practical examples of scenario analysis

3-1. Shiga Bank

3-2. Hachijuni Bank

① Assess materiality of climate-related risks
② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
④ Quantitative assessment of transition risk
⑤ Quantitative assessment of physical risk

3-3. Higo Bank
Decarbonization policies will be promoted and low-carbon buildings will increase

**Climate Change Impacts flow chart**

**Important risks and opportunities**

- **Carbon tax**
  - Carbon price
- **Addressing GHG emission regulations**
  - Strengthening government decarbonization policies
  - Introduction of energy conservation standards for leasing of existing buildings
  - Mandatory implementation of ZEB/ZEH (government target)
- **Customer behavioural change**
  - Low carbon consciousness
  - Improvements
- **Climatic intensification**
  - Frequent occurrence of torrential rains
  - Increased frequency and intensity of typhoon landings

**2 °C scenario**

**Future assumptions and background**

- Introduction of a carbon tax and expansion of carbon trading
- Grid-power emission coefficient
- Energy consumption per unit of building
- Energy conservation per unit of building

**Influencing factor (Parameter)**

- Procurement of building materials
- Higher costs
- Increase in cost of capital investment
- Increase in sales due to increased rents and competitiveness
- Reduction in utility costs

**Impact on the real estate sector**

- For low carbon building materials increased investment
- Increase in rent
- Differentiation through high-efficiency technologies
- Improvement in ROE

**Impact on the bank**

- Increase in expenses
- Decline in earnings
- Possibility of an upward revision of credit quality
- Increase in revenue
- Deterioration in ROE
- Improvement in ROE

**Legend:**
- **Bold:** Be particularly influential
- **Gray:** Impact considered relatively small
- **Direction of change:**
  - **↑:** Risk
  - **↓:** Opportunity

*Industry and the bank impacts are minor compared to 4 °C, but costs of responding to physical risk are assumed to be constant*
While the cost increase due to abnormal weather increases, the number of buildings with high disaster prevention performance increases.

Climate Change Impacts flow chart

- **Important risks and opportunities**
  - 4 °C scenario
  - Future assumptions and background
  - Influencing factor
  - (Parameter)
  - Impact on the real estate sector
  - Impact on the bank

- **Addressing GHG emission regulations**
  - Carbon tax carbon price
  - Government’s Low-Carbon Policy is Limited
  - Energy consumption per unit of building
  - For energy saving equipment
  - Increased investment
  - Higher operating costs
  - Increase in expenses
  - Possibility of an upward revision of credit quality

- **Customer behavioural change**
  - Status quo low-carbon maintenance f
  - No change in selection criteria
  - Environmental performance does not affect rent
  - Review of disaster prevention plan
  - Energy saving as before
  - For energy saving equipment
  - Increased investment
  - Higher operating costs
  - Increase in expenses
  - Possibility of an upward revision of credit quality

- **Climatic intensification**
  - Frequent occurrence of torrential rains
  - River flooding
  - Surge in coastal occurrence of storms
  - Storm
  - Cyclonic occurrence
  - Sea level rise
  - Coastal property damage occurred.
  - Decline in sales
  - Decline in earnings
  - Increase in investments and loans
  - Collateral value damage

Legend: **Bold** Be particularly influential, **Gray** Impact considered relatively small, **Direction of change** Risk, Opportunity
3. Practical examples of scenario analysis

3-1. Shiga Bank

3-2. Hachijuni Bank

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3-3. Higo Bank
Approach to Analyzing the Impact of Transition Risk on Financial Statements
Example of analysis (1):
Energy sector (Electric Power Company (2))
If CO2 emissions are kept constant under the assumption of maintaining the status quo, and only the carbon tax scenario is reflected simply, the country would become insolvent.

**STEP 1: Carbon Tax Considerations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 emissions</td>
<td>approximately XX, X00,000 [t-CO2]</td>
<td>ESG Reports</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>105 yen/$</td>
<td>Level at the end of January 2020</td>
</tr>
</tbody>
</table>

**2 ° C Scenario**

A carbon tax is introduced regardless of country or region.

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed country</td>
<td>(Reference) Average successful bid price in EU-ETS in Europe: approximately US $/t</td>
<td><em>Implementation and Review of Emissions Trading in Other Countries</em> From (Ministry of the Environment Report 2016)</td>
</tr>
<tr>
<td>Developing country</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current situation</th>
<th>2030</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 US $/ tCO2</td>
<td>140 US $/ tCO2</td>
</tr>
<tr>
<td></td>
<td>75 US $/ tCO2</td>
<td>125 US $/ tCO2</td>
</tr>
</tbody>
</table>

- (whole) As global carbon prices rise to achieve the 2 ° C target, the government is promoting the introduction of carbon taxes and emissions trading. On the other hand, companies with high GHG emissions are more likely to be asked to do so by governments and business partners, and more likely to be engaged by investors.
- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings utilizing new low-carbon materials have become popular.
- (Tenants/Residents) Tenants will see an increase in decarbonization and demand for energy-efficient facilities

*Data source: Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario numbers
A decrease in the use of fossil fuels in favor of renewable energy is expected to lead to a reduction in the carbon tax burden and therefore an increase in net income.

**STEP 2: Estimating the Financial Impact Based on the Sample Company’s Response**

The reduction in carbon tax due to the conversion to renewable energy is expected to increase net income and avoid excess liabilities.

Although this estimate assumes that the conversion will take place in stages, it is inferred that if the conversion is delayed, the deficit will widen as shown in Step 1, and there is a possibility that liabilities will exceed assets.

**Carbon Tax (Change in energy mix reflected)**

Reduction of carbon tax by conversion to renewable energy sources

**Net Profit (Change in energy mix reflected)**

Conversion to renewable energy carbon tax relief effect

Although there will be a reduction from Step 1, it is estimated that the electric power company (2) has a period of excess liabilities because the ratio of nuclear power is low and steam power generation is high at present.
Considering the forecast of fuel costs, an increase in the unit price of fossil fuels is expected, but an increase in net income is expected due to a decrease in thermal power generation.

**STEP 3: Reflect Market Variables (Demand and Fuel Cost Forecasts)**

Compared with Step 2, the carbon tax (LNG content) will decrease in Step 3 due to a slight decrease in electricity demand.

Step 1: Estimation of Balance Sheet

Up to Step 2, it was assumed that the fuel cost was constant, but in Step 3, the estimated fuel cost was reflected, and the profit and loss increased by the decrease in the unit fuel cost and the decrease in the share of thermal power generation.

Step 2: Estimation of Balance Sheet

Net assets increased as a result of an increase in net income.

Step 2 Carbon Tax

Domestic Power Demand Forecast

Slight decrease in electricity demand
Example of analysis (2):
Real estate (major player)
(Omitted)
Example of analysis (3):
Motor vehicle manufactures (Omitted)
3. Practical examples of scenario analysis

3-1. Shiga Bank

3-2. Hachijuni Bank
  ① Assess materiality of climate-related risks
  ② Identify and define range of scenarios
  ③ Evaluate Qualitative Business Impact
  ④ Quantitative assessment of transition risk
  ⑤ Quantitative assessment of physical risk

3-3. Higo Bank
① Collateral valuation

[Properties in scope]
• Buildings and structures in real estate collateral held in the Chikuma River basin, Nagano City

[Prerequisites for the Property]
• Number of building floors: Since data on the number of floors of each property was unavailable, it was calculated uniformly.
• The variable used for the damage ratio is the one after the rank correction (Leveling of mixed floors).
• Building structure: The analysis was made by combining wooden and non-wooden construction. As above, the variable used for the damage ratio is not structure-specific.

[Damage ratio variable]
• Adjustment due to inundation depth zones that do not match the inundation depth classification and damage ratio classification on the hazard map

<table>
<thead>
<tr>
<th>Hazard map inundation depth section</th>
<th>Flood control economic research manual</th>
<th>After adjustment loss ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>inundation depth section</td>
<td>loss ratio</td>
<td></td>
</tr>
<tr>
<td>Less than 0 ~ 0.5 m</td>
<td>Less than 0 ~ 0.5 m 21.40%</td>
<td>21.40%</td>
</tr>
<tr>
<td>Less than 0.5 ~ 1.0 m</td>
<td>0.5 ~ 0.99 m 29.30%</td>
<td>29.30%</td>
</tr>
<tr>
<td>Less than 1.0 ~ 2.0 m</td>
<td>1.0 ~ 1.99 m 45.80%</td>
<td>45.80%</td>
</tr>
<tr>
<td>Less than 2.0 ~ 5.0 m</td>
<td>2.0 ~ 2.99 m 64.60%</td>
<td>83.6%</td>
</tr>
<tr>
<td></td>
<td>3.0 m or more 83.60%</td>
<td></td>
</tr>
<tr>
<td>5.0 m or more</td>
<td>—</td>
<td>100%</td>
</tr>
</tbody>
</table>

*According to the flood control economic survey manual, inundation depth of 3 m or more is assumed

In order to reduce the loss ratio to a uniform 83.6%, it is necessary to reduce assumptions regarding the damage caused.

The expected damage of an inundation depth of ≥5 m cannot be estimated. Inundation of ≥ 5 m is assumed to be a total loss (100%)

For a distance between 2 m and less than 5 m captured in the hazard map, it is assumed that the midpoint is 3.5 m

The Economic Survey Manual includes a ratio of loss caused by damage of 83.6% for 3m or more

[Calculation logic]
① Property identification: All collateral properties - land properties = buildings
② Understanding of inundation depth: building property address (latitude-longitude transformation) → inundation depth on hazard map
③ Damage Calculation: Collateral amount by inundation depth and building x Damage ratio by inundation depth = Loss on collateral due to flooding (Assumptions)
② Valuation of the company's decline in sales

[Properties in scope]
- Identifying locations and sales volumes of business offices (e.g. Branches) of companies selected from major borrowers in Nagano Prefecture

[Prerequisites for the Property]
- Number of building floors: Since data on the number of floors of each property was unavailable, it was calculated uniformly.
- The variable used for the damage ratio is the one after the rank correction (Leveling of mixed floors).
- Building structure: The analysis was made by combining wooden and non-wooden construction. As above, the variable used for the damage ratio is not structure-specific

[Number of days off work]
- Adjustment due to inundation depth zones that do not match the inundation depth classification and damage ratio classification on the hazard map

<table>
<thead>
<tr>
<th>Hazard map inundation depth section</th>
<th>Flood control economic research manual</th>
<th>After adjustment number of days off work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inundation depth section</td>
<td>number of days off work</td>
</tr>
<tr>
<td>Less than 0 ~ 0.5 m</td>
<td>Less than 0 ~ 0.5 m</td>
<td>6.4 days</td>
</tr>
<tr>
<td>Less than 0.5 ~ 1.0 m</td>
<td>0.5 ~ 0.99 m</td>
<td>13.5 days</td>
</tr>
<tr>
<td>Less than 1.0 ~ 2.0 m</td>
<td>1.0 ~ 1.99 m</td>
<td>20.0 days</td>
</tr>
<tr>
<td>Less than 2.0 ~ 5.0 m</td>
<td>2.0 ~ 2.99 m</td>
<td>56.1 days</td>
</tr>
<tr>
<td></td>
<td>3.0 m or more</td>
<td>56.1 days</td>
</tr>
<tr>
<td>5.0 m or more</td>
<td>—</td>
<td>73 days</td>
</tr>
</tbody>
</table>

*According to the flood control economic survey manual, inundation depth of 3 m or more results in 56.1 days off work.

The number of business downtime days for inundation of 5m or more is based on the Dmap and interpolated linearly over the period (73 days).

For distances between 2 m and 5 m captured in the hazard map, it is assumed that the midpoint is 3.5 m.

Number of business suspension days by inundation depth = sales decrease due to flooding (Assumptions)

[Calculation logic]
1. Understanding of inundation depth: building property address (latitude-longitude transformation) → inundation depth on hazard map
2. Net Sales Decrease Calculation: Net Sales by Flood Depth and Property/Number of Business Days (Calculated for 242 days excluding holidays and national holidays)
3. Practical examples of scenario analysis

3-1. Shiga Bank
3-2. Hachijuni Bank
3-3. Higo Bank

① Assess materiality of climate-related risks
② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
④ Quantitative assessment of transition risk
⑤ Quantitative assessment of physical risk
3. Practical examples of scenario analysis

3-1. Shiga Bank
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② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
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⑤ Quantitative assessment of physical risk
From the exposure by industry on the bank (total amount), we can assume that the importance of “real estate” “Gas, Heat Supply and water” is high.

(Note 1) Goods Rental and Leasing do not include exposures classified as (Note 2:) “Other”, which have different risk ratings depending on commercial products.

Source: Prepared based on "Financial Results for Fiscal 2019"
[Draft Assessment of Climate Change Risks and Opportunities in the Energy Sector (1/2)]

The impact of carbon taxes, GHG emissions regulations and energy mix are considered high

<table>
<thead>
<tr>
<th>Major group</th>
<th>Subclassification</th>
<th>Evaluation item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Proposal of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy / Regulation</td>
<td>Carbon tax and price</td>
<td>Raising the petroleum and coal tax rate (higher construction and operating costs, lower asset values, and lower sales)</td>
<td>• As carbon taxes are introduced, operating costs increase due to higher prices of construction materials, taxes on fossil fuel and other products, and taxes on emissions from operations. • Extreme carbon taxation undermines the profitability of business operations and causes oil and gas fields, power plants and other assets to run aground • Carbon taxes reduce sales of high-GHG-emitting products such as coal and oil, while increasing the price competitiveness of low-carbon products.</td>
<td>Dissemination of renewable energy (increase in sales) (electric power) • Rising price competitiveness of low-carbon products and increased sales of renewable energy such as solar power generation</td>
</tr>
<tr>
<td>Industry / Market</td>
<td>Addressing GHG emission regulations</td>
<td>Strengthening of GHG emission regulations (higher operating costs and lower asset values)</td>
<td>• Regulations on total emissions will be introduced and strengthened, resulting in the cost of purchasing credits through asset impairment, early retirement, installation of equipment to reduce emissions, and emissions trading. • If the proposed power supply structure is revised without progress in the restart of nuclear power plants, capital investment and the cost ratio will be adversely affected. • Difficulty in recovery of investment due to a lack of approval for a planned coal-fired power plant</td>
<td>Increase in electrification ratio (increase in sales) • Electricity consumption increases as household sector demand increases</td>
</tr>
<tr>
<td>Technology</td>
<td>Dissemination of low-carbon technologies</td>
<td>Dissemination of renewable energy (Decrease in revenue and increase in operating costs)</td>
<td>• The market for fossil fuels shrinks due to the transition to a low-carbon society, and sales prices decline along with a decrease in sales of oil, coal, and gas. • If the energy mix plan, such as oil and coal-fired power generation, focuses on sources whose share is declining, the operating rate of the company's high-GHG-emitting power generation facilities will decline. • As incentives and subsidies for low-carbon power sources increase and subsidies for conventional energy are abolished, business continuity becomes difficult. • With the shift to renewable energy, the number of vehicles equipped with engines will decrease and demand for gasoline and diesel oil will decrease.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Dissemination of low-carbon technologies</td>
<td>Transition to low-carbon technologies (Decrease in sales, increase in R &amp; D expenses, and increase in operating costs)</td>
<td>• Lower demand for conventional energy as new low-cost, high-efficiency technologies (Hydrogen technology and microgrids) become more prevalent. • Increased funding for technology development that contributes to reducing GHG emissions in the area of products using fossil fuels and petrochemicals. • Costs are incurred for the development and introduction of low-carbon technologies such as CCS and the use of patents for next-generation technologies. • If the power generation method is not adjusted to reflect peak power consumption due to the spread of storage, power generation losses will occur, resulting in inefficient production and increased power generation costs.</td>
<td>Promotion of low-carbon technologies (increase in sales) • Increase share of project finance for renewable energy projects and green bond market • Demand for electricity and hydrogen will increase due to the spread of EVs and FCVs • The shift from using city gas to electrification is expanding due to the improvement of energy saving efficiency.</td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)
### Draft Assessment of Climate Change Risks and Opportunities in the Energy Sector (2/2)

The impact of customer behavior changes and extreme weather are considered high.

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Proposal of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transition</strong></td>
<td>Changes in customer behavior</td>
<td>Raising environmental awareness (Decrease in sales and increase in operating costs) - Increased demand for non-fossil fuels reduces sales of conventional energy to individuals - Sales volume decreases due to energy conversion and re-enervation shift (RE 100, etc.) by corporate customers - There is a growing trend to avoid procuring energy from utilities with high grid power emission factors - It is difficult to secure land for new development projects from the viewpoint of adverse effects on the ecosystem</td>
<td>Large</td>
</tr>
<tr>
<td>Reputati on</td>
<td>Reputation from investors</td>
<td>Investor Diversification (Decline in asset value and increase in procurement costs) - Accelerated divestment from oil and coal, reduce the value assets held, and rising interest rates make it difficult to raise new funds - Divestment undermines company valuations and undermines share prices</td>
<td>Medium</td>
</tr>
<tr>
<td>诉讼 risk</td>
<td></td>
<td>Increased operating costs - Lack of information disclosure on climate change and investment in high GHG emissions projects are met with opposition and litigation by investors and surrounding communities, resulting in response costs</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Chronic</strong></td>
<td>Water shortages and drought</td>
<td>Tight water supply and demand (increased operating costs) - Additional installation of water-saving equipment at sites is required - Water and groundwater prices at production sites soar - Production is stopped due to water shortages and restrictions on water intake</td>
<td>Small</td>
</tr>
<tr>
<td>Temperature variation</td>
<td></td>
<td>Declining Utilization and Worsening Labor Environment (Decrease in sales and increase in operating costs) - Extremely high or low temperatures will result in loss due to facility closures and a reduction in production utilisation. - A rise in average temperature would reduce the energy demand for heating - Higher temperatures will worsen working conditions for outdoor workers, resulting in shorter working hours and costs for measures against heat stroke - In order to maintain comfort levels in plants and offices, it is necessary to strengthen the operation of air conditioners and increase the number of facilities</td>
<td>Small</td>
</tr>
<tr>
<td>Sea level rise</td>
<td></td>
<td>Disaster prevention measures (increased operating costs) - Costs will be added for equipment investment in response to storm surges and sea-level rises at storage facilities</td>
<td>Medium</td>
</tr>
<tr>
<td>Intensification of extreme weather</td>
<td></td>
<td>Strengthening disaster prevention measures (increased operating costs) - Requires capital investment to improve disaster prevention performance - It is necessary to double-track the supply chain in order to improve the resilience against the interruption of physical distribution. Occurrence of property damage (increased operating costs) - Receiving bases and power plants in coastal areas are damaged by storm surges and floods, and operations are suspended - Rising raw material procurement costs due to adverse weather conditions - Higher premiums and additional costs due to increased natural disasters</td>
<td>Large</td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)*
The impact of Carbon taxes, energy prices, electric vehicles, and catastrophic disasters are expected to be high.

<table>
<thead>
<tr>
<th>Type</th>
<th>Evaluation item</th>
<th>Business Impact Analysis (qualitative information)</th>
<th>Proposal of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy / Regulation</td>
<td>Carbon tax and price</td>
<td>Introduction of a carbon tax (risings operating costs) <em>The introduction of a carbon tax would require the payment of a tax on GHG emissions from corpoate activities.</em></td>
<td>Shift to alternatives through the introduction of a carbon tax (increase in sales) <em>Modal shifts (Shift from automobile to rail transport) may accelerate as a carbon tax is introduced</em></td>
</tr>
<tr>
<td>Policy / Regulation</td>
<td>Addressing GHG emission regulations</td>
<td>Strengthening of GHG emission regulations (rising operating costs) <em>Fuel efficiency regulations will become stricter, requiring the payment of fines for unmet emissions.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Policy / Regulation</td>
<td>Fossil fuel subsidy</td>
<td>Abolition of fossil fuel subsidies (rising R &amp; D costs) <em>If fossil fuel subsidies are eliminated, support projects for the development of low-carbon technologies may be terminated, resulting in high R &amp; D costs.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Market</td>
<td>Increase or decrease in the price of important products/products</td>
<td>Rising demand for raw materials (rising operating costs) <em>If the price of materials and parts (Batteries, etc.) rises due to the progress of EV shift, the manufacturing cost will rise.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Market</td>
<td>Energy price</td>
<td>Higher energy prices (rising operating costs) <em>Higher energy prices lead to higher electricity and fuel costs in transport, resulting in higher transport and overhead costs</em></td>
<td>Increased use due to changes in modes of transport (increase in sales) <em>may choose rail or other transportation over trucks during periods of high gasoline prices</em></td>
</tr>
<tr>
<td>Technology</td>
<td>Dissemination of electric vehicles (Dissemination of next-generation technologies)</td>
<td>Conversion to electric vehicles (increase in capital investment) <em>Conversion cost from internal combustion trucks to EV trucks is high due to the spread of EVs throughout the market and requests from customers.</em></td>
<td>Expansion of electric vehicles and low-carbon technologies (higher sales and lower operating costs) <em>Advances in technology will lower the cost of introducing EVs</em></td>
</tr>
<tr>
<td>Market</td>
<td>Spread of renewable and energy-saving technologies</td>
<td>NA</td>
<td>Lower energy costs (lower operating costs)</td>
</tr>
<tr>
<td>Reputatio n</td>
<td>Changes in customer behavior</td>
<td>Changing customer preferences (decline in sales) <em>Increased customer awareness of environmental considerations (CO2 reduction, etc.) may result in less companies being chosen for their environmental efforts.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Reputatio n</td>
<td>Changing investor reputation</td>
<td>Lower investor reputation (higher funding costs) <em>The trend of divestment accelerates, and the tide turns for enterprises that do not practice environmental management. As a result, the cost of financing increases.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Chronic</td>
<td>Changes in precipitation and weather patterns</td>
<td>Lower demand for existing products (decline in sales) <em>Changes in weather patterns and increased frequency of flooding will result in sales of amphibious vehicles in some areas, which will impact sales.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Chronic</td>
<td>Increase in mean temperature</td>
<td>Thermal expansion of the line (Increase in capital investment and operating costs) <em>Thermal waves cause thermal expansion and breakage of lines, leading to delays in rail transport and higher response costs.</em></td>
<td>NA</td>
</tr>
<tr>
<td>Acute</td>
<td>Intensification of extreme weather</td>
<td>Damage to operations due to severe disaster (Increase in capital investment and operating costs) <em>When abnormal weather occurs frequently and manufacturing bases and warehouses are damaged, operations are suspended or restoration costs are incurred, and existing assets are damaged.</em></td>
<td>NA</td>
</tr>
</tbody>
</table>

*Considering the importance in the image of medium- to long-term Transition risk/physical risk (Example: Climate change in 2030/2050)
3. Practical examples of scenario analysis
   3-1. Shiga Bank
   3-2. Hachijuni Bank
   3-3. Higo Bank
   ① Assess materiality of climate-related risks
   ② Identify and define range of scenarios
   ③ Evaluate Qualitative Business Impact
   ④ Quantitative assessment of transition risk
   ⑤ Quantitative assessment of physical risk
Regarding the risks and opportunities narrowed down in the importance evaluation (something of great importance), Predicted data for 2 °C/4 °C scenarios were collected as parameters.

<table>
<thead>
<tr>
<th>Important Items (object of analysis)</th>
<th>Configured Parameter</th>
<th>Current</th>
<th>4 °C</th>
<th>2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>2040 and later</td>
</tr>
<tr>
<td>Carbon tax and price</td>
<td>(1) Carbon tax</td>
<td>Japan: None Overseas: Some</td>
<td>(2030)</td>
<td>(2040)</td>
</tr>
<tr>
<td>Addressing GHG emission regulations</td>
<td>(2) Carbon emission reduction target</td>
<td>(base year) 4 °C - Varies by country 2 °C: 2018 years</td>
<td>(2030) High targets limited to some countries</td>
<td>N/A</td>
</tr>
<tr>
<td>Energy mix, etc.</td>
<td>(3) Energy mix</td>
<td>Primary energy (base year) 2018</td>
<td>N/A</td>
<td>(2040) dependent on fossil fuels</td>
</tr>
<tr>
<td></td>
<td>(4) Crude oil price</td>
<td>(base year) 2018</td>
<td>(2025) + 10%</td>
<td>(2040) + 35%</td>
</tr>
<tr>
<td></td>
<td>(5) Power Configuration</td>
<td>(base year) Japan: 2018</td>
<td>(2030) Fossil fuels Down 32%</td>
<td>(2040) Fossil fuels Down 44%</td>
</tr>
<tr>
<td></td>
<td>(6) Vehicle sales with engines</td>
<td>(base year) 2015</td>
<td>(2030) + 16%</td>
<td>(2060) + 49%</td>
</tr>
<tr>
<td>Changes in customer behavior</td>
<td>(3) Energy mix</td>
<td>Same as item (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7) Household energy consumption</td>
<td>(base year) 2017</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Intensification of extreme weather</td>
<td>(8) Flood damage amount</td>
<td>(base year) Japan: 2010</td>
<td>(2030) + 121%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(9) Typhoon</td>
<td>(base year) Japan: 2016</td>
<td>N/A</td>
<td>(2100) Observations are highly uncertain and typhoon numbers are uncertain</td>
</tr>
</tbody>
</table>
Definition of scenario groups: Expanded use of renewable energy for decarbonization

2°C world view @ 2050s (example)

Energy

New entrant
- Entry of companies involved in renewable energy such as solar and wind power generation

Industry/Company
- Higher carbon taxes and carbon prices on operating costs increase sales prices and reduce price competitiveness, resulting in lower sales
- Fossil fuel demand declines and market prices decline as demand for renewable energy increases
- High carbon taxes and high carbon prices make businesses unprofitable, reducing profit margins and stranding assets
- The external pressure of decarbonization is strong, requiring product and technology development and capital investment to reduce environmental impact.

Buyer (customer)
- Increasing price competitiveness of energy with low environmental impact and decreasing demand related to fossils
- Fossil fuels and fossil fuel-derived electricity consumption in households decreases as awareness increases
- Lower demand for fuel for passenger cars due to lower demand for engine-powered vehicles

Substitute
- Increase demand for renewable energy

Seller (Suppliers)
- Promote the development of renewable energy
- A carbon tax is imposed on raw materials used in production facilities, resulting in additional costs
- Carbon tax increases the cost of producing fossil fuels and electricity derived from fossil fuels

Secure suppliers using raw materials and equipment with low environmental impact

Review of the business entity’s portfolio

Investment in renewable energy projects

Strengthening cooperation (Alliances, M & As, etc.)

Government
- Promote the introduction of carbon taxes and emissions trading, and set high carbon taxes and carbon prices
- An ambitious carbon emissions target may be set and fossil fuel projects may not be licensed
- Incentives and subsidies for renewable energy are increased and established
- Stricter emission regulations for gasoline, diesel and other engine-powered vehicles will affect fuel demand.

Prompt access to policy information
 Cooperation with the Government
 Lobbying for a new policy
 In the renewable energy business securing subsidies
Definition of scenario groups:
Demand for fossil fuels increases steadily, increasing physical risks such as severe disasters

4 °C world view @ 2050s (example)

**Energy**

- **Seller (Suppliers)**
  - Crude Oil Prices Rise as Decarbonization Fails and Oil Demand Grows
  - Increasing need for disaster prevention measures due to intensification of natural disasters

- **Industry/Company**
  - Increased demand for fossil fuel-based energy will increase demand for fossil fuels
  - Although there is a movement toward decarbonization, there is little progress in the development and utilization of technologies to reduce environmental impact.
    - Additional capital investment is required to cope with storm surges and sea level rise.
    - Because of the flood damage, the supply relay facilities will be flooded, disrupting the supply of energy and incurring restoration costs.

- **New entrant**

- **Buyer (customer)**
  - Without a carbon tax and price (at a low price even if), traditional fuel and electricity demand remains largely unchanged
  - Demand for passenger car fuel increases as the number of vehicles equipped with gasoline engines increases

- **substitute**
  - Growth in demand for renewable energy is limited

**Government**

- Low-Cost carbon taxes and prices are introduced in some countries
- Most countries remain passive in setting carbon targets
- Incentives and subsidies for renewable energy remain largely unchanged
- Fossil fuel subsidies continue or are phased out

---

Promoting renewable energy procurement and private power generation

Reinforcing the Supply Chain for Abnormal Weather

Additional investment in disaster prevention equipment

Study of weather derivatives (insurance)
Vision of Future Society under the 2 °C Scenario

Decarbonization will be strongly promoted and a carbon tax will be introduced. Introduction and use of renewable energy will be widespread.

- By renewable energy companies: new entry
- For the use of renewable energy: Promotion
- Reducing energy consumption due to increased capital investment and energy-saving technologies
- Expansion of renewable energy in households
- For vehicles equipped with engines: Decline in demand for fossil fuels due to declining demand
- Widespread use of renewable energy infrastructure such as hydrogen production and electricity derived from renewable energy
- Setting ambitious carbon emission reduction targets
- Carbon taxes and emissions trading: Deploying
- Renewable energy: Incentives for the business
- To vehicles equipped with engines: In accordance with emission regulations, Reduced use of fossil fuels
- Crude Oil Prices Fall
- Carbon taxes and emissions trading
- Renewable energy
- Automobiles and transportation
[Vision of Future Society under the 4 °C Scenario]
Still dependent on fossil fuels, increasing physical risk

- **Crude Oil Prices Rise**
  - Shutdown of fuel refineries due to disaster
  - Gas supply relay facilities were flooded.

- **Households still use fossil fuels and electricity derived from fossil fuels**
  - Fossil fuels are the main source of energy at power plants and other facilities

- **No regulations on carbon taxes will be introduced**
  - For the promotion of renewable energy
    - Deceleration or suspension of policies

- **Fossil fuel subsidies Continue**

- **Engines continue to be used. Changes in sales volume**

- **Incur disaster prevention costs for offshore oil fields**
  - At the receiving station damage caused by high tide

- **KEEP**
  - Crude Oil Prices Rise
  - Shutdown of fuel refineries due to disaster
  - Engines continue to be used. Changes in sales volume
  - Households still use fossil fuels and electricity derived from fossil fuels
  - Incur disaster prevention costs for offshore oil fields
  - Crude Oil Prices Rise
  - Shutdown of fuel refineries due to disaster
  - Engines continue to be used. Changes in sales volume
  - Households still use fossil fuels and electricity derived from fossil fuels
  - Incur disaster prevention costs for offshore oil fields
## (3) List of parameters in the automobile and transport sectors

For critical risk and opportunity, the forecast data for the 2 °C/4 °C scenario were collected as parameters.

| Important Items (object of analysis) | Configured Parameter | Current | 4 °C | | | 2 °C |
|--------------------------------------|----------------------|---------|------|-----------------|-----------------|
|                                      |                      |         | Before 2030 | 2040 and later | Before 2030 | 2040 and later |
| Carbon tax and price                 | (1) Carbon tax       | Japan: N/A | (2030) Japan: N/A | (2040) Japan: N/A | (2030) Developed Countries: 100 USD/t Developing countries: 75 USD/t | (2040) Developed Countries: 140 USD/t Developing countries: 75 USD/t |
|                                      | (2) Impacts on the transportation system | N/A | Rate of change in cargo volume in the introduction of a carbon tax For 10,000 yen/t-CO2 Motor vehicles: -5% Railway: + 10% | Motor vehicles: -10% Railway: + 30% |
| Energy price                         | (3) Crude oil price  | (base year) 2019 63 USD/barrel | (2030) 76 USD/barrel | (2040) 85 USD/barrel | (2030) 56 USD/barrel | (2040) 53 USD/barrel |
|                                      | (4) Vehicle sales with engines | (base year) 2015 +16% | (2030) +49% | (2030) ▲29% | (2060) ▲86% |
| Dissemination of next-generation technologies | (5) Dissemination of electric vehicles | (base year) 2016 Japan: 28000 (EV, PHV and FCV) | PHV/ZEV: 5% increase | PHV/ZEV: 7% increase | PHV/ZEV: 39% increase | PHV/ZEV: 63% increase |
| Increase in mean temperature         | (6) Increase in midsummer days in Japan | N/A | (2020 – 2039) Average 1.1 °C (2020 – 2039) + 14.7 days * | N/A |
|                                      | (7) Cost arising from buckling of tracks | (base year) 2016 1,800 mil USD | (2030) 2,200 mil USD | (2090) 9,000 mil USD | (2030) 2,100 mil USD | (2090) 7,000 mil USD |
| Intensification of extreme weather    | (8) Flood damage amount | (base year) 2010 +67% | (2030) N/A | N/A |
|                                      | (9) Typhoon           | N/A | N/A | (2100) All typhoons ▲ 5.7% Fierce typhoon + 3.6% | N/A | N/A |
**Definition of scenario groups:**
Accelerating the modal shift through expansion environmentally-friendly railcars and railcars for decarbonization

**Transportation and automobile**

### New entrant
- Companies involved in the use of renewable energy and environmentally friendly railcars enter the market in China and other countries.

### Buyer (customer)
- Increasing demand for EVs for a decarbonized society
- On the other hand, demand for vehicles with engines declines due to the expansion of ZEVs, etc.
- In addition to increasing demand for EVs, cost reduction will be promoted and the barrier to EV purchase will be lowered.
- Shift from automobile to rail freight is accelerated

### Industry/Company
- Withdrawal of production of gasoline vehicles and shift to production of ZEVs
- Promoting the use of renewable energy and environmentally friendly railcars and railcars
- Increasing need for additional energy-efficient capital investment
- Modal shift increases low-carbon freight traffic

### Seller (Suppliers)
- Development of low-carbon transportation equipment
- Increasing demand for products to reduce vehicle weight and improve energy efficiency
- Carbon tax results in need to pass on higher production costs in sales prices

### Seller (Energy, etc.)
- Increasing share of renewable energy in energy demand and decreasing demand for oil
- Crude Oil Prices Fall

### Government
- To achieve the 2 °C target, the government is promoting the introduction of carbon taxes and emissions trading, and carbon prices are rising.
- Implementation of preferential policies for domestic EV manufacturers
- Stricter regulations on internal combustion vehicles
- Expanding charging infrastructure to promote EVs

### Substrate
- Decarbonization Helps Modal Shift

---

*ZEV ・・・ zero-emission vehicles (Electric and hydrogen vehicles)
Definition of scenario groups:
The traditional market environment is maintained while increases physical risks such as severe disasters is assumed

Transportation and automobile

**New entrant**
➢ As ICE cars continue to be the core, the presence of new EV manufacturers is limited.

**Industry/Company**
➢ Significant increases in costs, delays, and cancellations due to damage to transportation equipment, railcars, and infrastructure caused by abnormal weather
➢ Increased risk of line buckling due to rising temperatures, resulting in delays and increased repair costs
➢ Increase in energy costs for cooling vehicles and transport facilities
➢ Production of ICE in manufacturing has continued and business portfolio is maintained

**Buyer (customer)**
➢ The lack of a product lineup for infrastructure and next-generation vehicles remains an issue.
➢ In addition, the subsidy policy has not progressed, and the product cost is high, so the customer’s desire to purchase the next generation car has not increased, and as a result, the market centering on ICE cars has continued.

**Government**
➢ As the low carbon/decarbonization trend weakens and external pressure from the international community weakens, slow or stop the spread of ZEVs and renewable energy policies
➢ No regulations on carbon taxes will be introduced
➢ Subsidies (Breakwater, etc.) for increased physical risks such as floods

**Seller (Suppliers)**
➢ Slow development and interest in low carbon technologies and products
Increasing need for countermeasures due to intensification of natural disasters

**Seller (Energy, etc.)**
➢ Crude Oil Prices Rise as Decarbonization Fails and Oil Demand Grows

**Changes in transport methods in response to local risks**

**(Substitute)**

Minimizing investment in EV development (Concentrate resources on improving ICE performance)

*ICE cars ⋅⋅⋅ internal combustion engines (gasoline and diesel vehicles)
[Vision of Future Society under the 2 °C Scenario]

Decarbonization will be strongly promoted and a carbon tax will be introduced. Increasing use of renewable energy and EVs accelerates modal shift in transportation.

- Crude Oil Prices Fall
- Renewable energy Diffusion
- Carbon taxes and emissions trading Deploying
- Strengthening regulations on internal combustion vehicles and implementing preferential policies for EVs
- Environmentally friendly vehicles / Promotion of railway vehicles
- Modal shift to low-carbon transport
- Expanded investment in energy-efficient facilities and energy-saving technologies to reduce CO2 emissions
- To the demand for EVs increase
- Internal-combustion Decrease in demand and production
- Emerging manufacturers such as EV enter the market.
[Vision of Future Society under the 4 °C Scenario]
Low carbon/decarbonization remains at an unacceptable level, increasing physical risk
3. Practical examples of scenario analysis

3-1. Shiga Bank
3-2. Hachijuni Bank

3-3. Higo Bank

① Assess materiality of climate-related risks
② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
④ Quantitative assessment of transition risk
⑤ Quantitative assessment of physical risk
[(2) Business impact of energy x 2 °C]
Decarbonization policies will be promoted and the introduction and use of renewable energy will be accelerated.

Climate Change Impacts flow chart

Legend: **Bold** Be particularly influential  **Gray** Impact considered relatively small  **Direction of change** Risk Opportunity

---

2 °C scenario  
Future assumptions and background

### Important risks and opportunities
- **Carbon tax** carbon price
- Addressing GHG emission regulations
- **Energy Mix, etc.**
- Customer behavioural change
- Climatic intensification

### Influencing factor (Parameter)
- **Introduction and expansion of carbon tax**
- Decarbonized formulation of international commitments
- **Promotion of renewable energy** (Abolition of Subsidies for Fossil Fuel Business)
- Expansion of Subsidies and Preferential Policies for EV Conversion
- **Raising awareness of low carbon**
- **Number of units sold** for vehicles equipped with engines
- **Energy mix share of fossil fuels in**
- **Household consumption of energy derived from fossil fuels**
- **Taxes on electricity derived from fossil fuels**
- **Taxes on fuel and electricity production equipment**
- **Unable to approve new projects**
- **Advancement in development of renewable energy power source**
- **Increase in new entrants of renewable energy companies**
- **Renewable increasing demand**
- **Number of units sold** for vehicles equipped with engines
- **Household consumption of energy derived from fossil fuels**
- **Decline in sales of fossil fuel business**
- **Decline in sales of renewable energy project**
- **Decline in electricity sales from fossil fuels**
- **Decline in electricity demand from fossil fuels**
- **Increase in sales of renewable energy project**
- **Increase in sales of fossil fuel business**
- **Increase in expenses**
- **Decline in expenses**
- **Potential downgrade in credit quality**
- **Possibility of an upward revision of credit quality**
- **Decrease in earnings**
- **Increase in revenue**
- **Deterioration in ROE**
- **Improvement in ROE**

### Impact on the energy sector
- Increased operating costs
- Decline in competitiveness due to higher selling prices
- Unable to approve new projects
- Power plant stranded assets, etc.
- Expansion of investment in low carbon technology
- Increase in sales of renewable energy project
- Decrease in sales of fossil fuel business
- Decline in electricity demand from fossil fuels
- Decline in electricity sales from fossil fuels

### Impact on the bank
- **Increase in expenses**
- **Decline in expenses**
- **Potential downgrade in credit quality**
- **Possibility of an upward revision of credit quality**
- **Decrease in earnings**
- **Increase in revenue**
- **Deterioration in ROE**
- **Improvement in ROE**

*Industry and the bank impacts are minor compared to 4 °C, but costs of responding to physical risk are assumed to be constant.
Climate Change Impacts flow chart

### Future assumptions and background

**4 °C scenario**

- **Impact on the energy sector**
  - Crude oil price
  - Increase in fossil-fuel demand
  - Fossil-fuel derived electricity sales
  - Increase in fossil-fuel derived electricity sales
  - Increase in fossil-fuel derived electricity sales
  - Sales of gasoline and diesel engines increased
  - Fossil-fuel derived increased demand for electricity
  - For plants and offices: Increase in property damage
  - Difficulty raising fees for raw materials e.g. crude oil
  - Repair and restoration costs incurred
  - Cost generation for disaster prevention

### Impact on the bank

- Decline in earnings
- Increase in revenue
- Increase in expenses
- Decrease in expenses
- Possibility of an upward revision of credit quality
- Deterioration in RDE
- Improvement in RDE
- Potential downgrade in credit quality

### Important risks and opportunities

- **Carbon tax**
  - Carbon price
- **Addressing GHG emission regulations**
- **Energy Mix, etc.**
- **Customer behavioural change**
- **Climatic intensification**

### Legend:

- **Bold**: Be particularly influential
- **Gray**: Impact considered relatively small
- **Direction of change**: Risk or Opportunity

#### Key Points

- **Frequent occurrence of torrential rains**
  - Increased frequency and intensity of typhoon landings
- **River flooding**
  - Surge in coastal occurrence of storms
  - Storm
- **Flood damage**
  - Typhoon damage
  - Cost generation for disaster prevention
- **Crude oil price**
  - Increase in fossil-fuel demand
- **Fossil-fuel derived electricity sales**
  - Increase in fossil-fuel derived electricity sales
- **Sales of gasoline and diesel engines increased**
- **Fossil-fuel derived increased demand for electricity**
- **For plants and offices: Increase in property damage**
- **Difficulty raising fees for raw materials e.g. crude oil**
- **Repair and restoration costs incurred**
- **Cost generation for disaster prevention**
- **Decrease in expenses**
- **Possibility of an upward revision of credit quality**
- **Deterioration in RDE**
- **Improvement in RDE**
- **Potential downgrade in credit quality**

#### Notes

- **Government’s Low-Carbon Policy is Limited**
- **Reluctance to introduce renewable energy**
- **Continuation of subsidies for fossil fuel business**
- **Decarbonization Stagnation in Corporate Customers**
- **Low-carbon maintenance of status quo**
- **Maintaining the low carbon consciousness of individual customers**

#### Energy Mix, etc.

- **Share of fossil fuels in the energy mix**
- **The spread of renewable energy is limited**

#### Customer behavioural change

- **Low-carbon maintenance of status quo**
- **Maintaining the low carbon consciousness of individual customers**

#### Climatic intensification

- **Surge in coastal occurrence of storms**
- **Storm**
- **Typhoon damage**
- **Disaster prevention measures to avoid impacts**

---

[(2) Business impact of energy x 4 °C]

Increased costs from extreme weather events while maintaining dependence on fossil fuels
((3) Vehicle and transportation x 2 °C business impact)
Decarbonization policy is promoted and modal shift and EV shift are accelerated.

**Climate Change Impacts flow chart**

<table>
<thead>
<tr>
<th>Important risks and opportunities</th>
<th>2 °C scenario Future assumptions and background</th>
<th>Influencing factor (Parameter)</th>
<th>Impact on the automobile and transport sectors</th>
<th>Impact on the bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon tax carbon price</td>
<td>Introduction and expansion of carbon-tax</td>
<td>Carbon tax</td>
<td>Taxes on transport and operation-related emissions</td>
<td>Increased operating costs</td>
</tr>
<tr>
<td></td>
<td>Tax on transport and operation-related emissions</td>
<td>Carbon tax</td>
<td>Association with emission reductions</td>
<td>Increase in demand for rail transport</td>
</tr>
<tr>
<td></td>
<td>Crude oil price</td>
<td>Crude oil price</td>
<td>Transportation switching costs</td>
<td>Increase in demand for rail transport</td>
</tr>
<tr>
<td></td>
<td>Reeneshift and drop in crude oil demand</td>
<td>Reeneshift and drop in crude oil demand</td>
<td>Lower transportation and operating costs</td>
<td>Potential downgrade in credit quality</td>
</tr>
<tr>
<td></td>
<td>Engine car number of units sold</td>
<td>Engine car number of units sold</td>
<td>Decline in sales of engine-powered vehicles</td>
<td>Decrease in expenses</td>
</tr>
<tr>
<td></td>
<td>Dissemination of electric vehicles</td>
<td>Dissemination of electric vehicles</td>
<td>Increase in sales of ZEVs, etc.</td>
<td>Increase in revenue</td>
</tr>
<tr>
<td></td>
<td>Increased opportunities for recovery from development investment due to increased demand for ZEVs</td>
<td>Dissemination of electric vehicles</td>
<td>Increase in sales of ZEVs, etc.</td>
<td>Decline in earnings</td>
</tr>
<tr>
<td></td>
<td>Increased additional investment such as EV</td>
<td>Increased additional investment such as EV</td>
<td>Reduction/withdrawal of low carbon technology investment</td>
<td>Possibility of an upward revision of credit quality</td>
</tr>
<tr>
<td></td>
<td><strong>Impact considered relatively small</strong></td>
<td><strong>Impact considered relatively small</strong></td>
<td>Increase in demand for rail transport</td>
<td>Increase in revenue</td>
</tr>
<tr>
<td></td>
<td><strong>Be particularly influential</strong></td>
<td><strong>Be particularly influential</strong></td>
<td>Improve the ability of debtors to repay debt</td>
<td>Potential downgrade in credit quality</td>
</tr>
</tbody>
</table>

**Legend:**
- **Bold** Be particularly influential
- **Gray** Impact considered relatively small
- **Direction of change**
- **Risk**
- **Opportunity**

- Industry and their bank impacts are minor compared to 4 °C, but costs of responding to physical risk are assumed to be constant.
[(3) Vehicle and transportation x 4 °C business impact]
The current regulatory and market environment will continue, while the costs of extreme weather will increase.

Climate Change Impacts flow chart

**Legend:**
- Bold: Be particularly influential
- Gray: Impact considered relatively small
- Direction of change: Change in impact
- Risk: Increase in expenses
- Opportunity: Possibility of an upward revision of credit quality

### Important risks and opportunities
#### 4 °C scenario
Future assumptions and background

<table>
<thead>
<tr>
<th>Influencing factor (Parameter)</th>
<th>Impact on the automobile and transport sectors</th>
<th>Impact on the bank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbon tax</strong>&lt;br&gt;Carbon price</td>
<td>Increase in transportation and operation costs</td>
<td>Increase in expenses</td>
</tr>
<tr>
<td><strong>Energy Price</strong></td>
<td>Increase in sales of engine-powered vehicles</td>
<td>Increase in revenue</td>
</tr>
<tr>
<td><strong>Dissemination of next-generation technologies</strong></td>
<td>Increased risk relating to return on investment in R&amp;D for EVs due to continued ICE market</td>
<td>Improvement in ROE</td>
</tr>
<tr>
<td><strong>Increase in mean temperature</strong></td>
<td>Increase in midsummer days in Japan</td>
<td>Increase in labor environment improvement costs</td>
</tr>
<tr>
<td><strong>Intensification of extreme weather</strong></td>
<td>Increased risk of line thermal expansion</td>
<td>Repair and response costs</td>
</tr>
<tr>
<td></td>
<td>Cost incurred Due to buckling of tracks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased repair of rail tracks and review of operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase in damage to product inventories and factories</td>
<td>Incurring repair costs</td>
</tr>
<tr>
<td></td>
<td>Difficulty procuring raw materials and stagnation of production</td>
<td>Incurring the cost of response</td>
</tr>
<tr>
<td></td>
<td>Increased shipping time</td>
<td></td>
</tr>
</tbody>
</table>

### Direction of change
- Increase
- Decrease

### Impact considered relatively small
- Gray

### Be particularly influential
- Bold

### Direction of change
- Upward
- Downward

### Risk
- Increase in expenses

### Opportunity
- Possibility of an upward revision of credit quality

### Future assumptions and background
- Government’s Low-Carbon Policy is limited
- Number of units of engine car sold
- Automobile market remains stable
- Crude oil price
- Increase in mean temperature
- Increase in midsummer days in Japan
- Increased risk of line thermal expansion
- Cost incurred Due to buckling of tracks
- Increased repair of rail tracks and review of operations
- Increase in damage to product inventories and factories
- Difficulty procuring raw materials and stagnation of production
- Increased shipping time
- Incurring repair costs
- Incurring the cost of response

### Increase
- Increase in expenses
- Potential downgrade in credit quality
- Possibility of an upward revision of credit quality
- Potential downgrade in credit quality

### Decrease
- Improvement in ROE
3. Practical examples of scenario analysis

3-1. Shiga Bank
3-2. Hachijuni Bank
3-3. Higo Bank

① Assess materiality of climate-related risks
② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
④ Quantitative assessment of transition risk
⑤ Quantitative assessment of physical risk
Approach to Analysis of the Impact of Transition Risk on Financial Statements
Example of analysis
(1): Energy sector (Electric Power Company (3))
If CO2 emissions are kept constant under the assumption of maintaining the status quo, and only the carbon tax scenario is included, the country would become insolvent.

**STEP 1: Carbon Tax Considerations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 emissions</td>
<td>approximately XX, X00,000 [t-CO2]</td>
<td>ESG Report 2019</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>105 yen/$</td>
<td>Level at the end of January 2020</td>
</tr>
</tbody>
</table>

**2 °C Scenario**

A carbon tax is introduced regardless of country or region.

<table>
<thead>
<tr>
<th>Current situation</th>
<th>Developed country</th>
<th>Developing country</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Reference) Average successful bid price in EU-ETS in Europe: approximately US $/ t <strong>Implementation and Review of Emissions Trading in Other Countries</strong> From (Ministry of the Environment Report 2016)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>100 US $/ tCO2</td>
<td>75 US $/ tCO2</td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td>140 US $/ tCO2</td>
<td>125 US $/ tCO2</td>
<td></td>
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</tbody>
</table>

**Consideration**

- (whole) As global carbon prices rise to achieve the 2 °C target, the government is promoting the introduction of carbon taxes and emissions trading. On the other hand, companies with high GHG emissions are more likely to be asked to do so by governments and business partners, and more likely to be engaged by investors.
- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings utilizing new low-carbon materials have become popular.
- (Tenants/Residents) Tenants will see an increase in decarbonization and demand for energy-efficient facilities

*Data source:
- Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario numbers
A decrease in the use of fossil fuels in favor of renewable energy is expected to lead to a reduction in the carbon tax burden and therefore an increase in net income

**STEP 2: Estimating Financial Impact Based on Changes in Power Supply Composition**

A reduction in carbon tax due to conversion to renewable energy is expected to increase net income and reduce excess liabilities.

Although this estimate assumes that the conversion will take place in stages, depending on the timing of the conversion, as shown in Step 1, the deficit may widen or the excess debt may be avoided.
An increase in the unit price of fossil fuels is forecast, but an increase in net income is expected due to a decrease in thermal power generation.

**STEP 3: Reflect Demand and Fuel Cost Forecasts**

**Domestic Power Demand Forecast**

- Slight decrease in electricity demand

**Step 2 Carbon Tax**

- Compared with Step 2, the carbon tax (LNG content) will decrease in Step 3 due to a slight decrease in electricity demand.

**Net Profit (Change in demands and fuel costs reflected)**

- Up to Step 2, it was assumed that the fuel cost was constant, but the forecast of fuel cost was reflected in Step 3, leading to a P&L increase driven by the decrease in ratio of thermal power generation

**Step 3 Estimation of Balance Sheet**

- Net assets increased as a result of an increase in net income
Example of analysis (2):
Manufacture of automobile parts
Assumptions regarding changes in profit and loss and the size of assets and liabilities are based recent financial statements; the impact of the carbon tax is insignificant and net income is expected to continue

**STEP 1: Carbon Tax Considerations (auto parts manufacturer)**

<table>
<thead>
<tr>
<th>Item</th>
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<th>Remarks</th>
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</thead>
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<th>Developing country</th>
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- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings utilizing new low-carbon materials have become popular.
- (Tenants/Residents) Tenants will see an increase in decarbonization and demand for energy-efficient facilities.

*Data source:
- Extracted from IEA “World Energy Outlook 2019” Sustainable Development Scenario numbers

Because CO2 emissions are assumed to be constant, the transition is linked to the 2 °C carbon tax scenario (but assuming linear interpolation for periods without values and constant after 2040)

In this case, even if the carbon tax is taken into account, the current net income will continue, so the current liabilities will be repaid and retained earnings will be retained after repayment.

(*) Only CO2 emissions for Scope 1 and 2 are counted.
Parameters for R&D expenditure and capital expenditure were estimated based on data disclosed by automobile parts manufacturers.

**STEP 2: Future Forecast of Next-Generation Vehicle Development Costs**

*Estimates from data disclosed by auto parts manufacturers*

Estimates from prior year data

Future projections from disclosed targets

The automotive parts manufacturer currently spends about 5% of its sales on R&D. There is a certain proportional relationship between R&D expenditure and capital investment by the auto parts manufacturer.

\[ y = 0.0478x + 7467.3 \]
\[ R^2 = 0.9483 \]

\[ y = 2.2869x - 120041 \]
\[ R^2 = 0.8306 \]

The ratio of R&D expenditure for advanced technologies tends to remain high in light of recent environmental and regulatory trends. The data disclosed by the manufacturer of automotive parts was interpolated by a quadratic polynomial, and it was found to be just around the top, so it was assumed that the value would remain unchanged.

\[ y = 0.0006x + 0.053 \]
\[ R^2 = 0.8646 \]

Our goal is to raise R&D expenditure from the current level of approximately 5% to the level of 6% in 2020. Considering the increase in the ratio of R&D expenditure for advanced technologies, we assume a rise in R & D expenditure over the medium to long term.
Net income and retained earnings are expected to decrease in order to achieve the reduction target for CO2 emissions. The R&D expenses and capital investments set forth in the previous page are also assumed to be required.

STEP 2: Taking into consideration R&D expenses and capital investment for achieving CO2 emission reduction targets
Since there is a high correlation between changes in sales of automobile manufacturers and auto parts manufacturers, we use simplified assumptions regarding auto parts manufacturers and apply them to automobile manufacturers.

**STEP 3: Concept of Sales Forecast**

- The sales transition of automobile parts manufacturers is estimated to be linked with the sales transition prediction of automobile manufacturers.
- The sales transition forecast of automobile manufacturers is estimated from the sales transition forecast (Assuming that the unit price does not change significantly).
- Automobile manufacturers’ sales are projected to be linked to the trend of the global automobile sales forecast (Use IEA WEO and private think tank values).
- R&D expenses and capital expenditures are expected to increase in line with sales forecasts.
In order to take into account future changes in unit sales, calculations have been made from estimates of the "Percentage and number of units sold" and "Proportion of use and number of units" for next-generation vehicles, using scenarios developed by external think tanks and the IEA WEO.

**STEP 3: Forecasting the Future of Next-Generation Vehicles (≈ PHV or ZEV) in the Overall Automotive Market**

**Proportion of PHV/ZEV Sales**

\[ y = 0.0005x^2 + 0.0057x + 0.0356 \]

\[ R^2 = 0.9987 \]

Estimates from external think tank projections

**Proportion of PHV/ZEV Spread**

\[ y = 2E-05x^3 - 0.0011x^2 + 0.045x + 0.005 \]

\[ R^2 = 1 \]

Interpolation by Third Order Polynomial Based on IEA WEO Scenario

**Number of PHV/ZEV Sales**

\[ y = 8.7864x^2 + 47.442x + 349.89 \]

\[ R^2 = 0.9986 \]

Figures for FY 2060 are estimated by the IEA WEO and are linear; an estimate from an estimate

**Number of PHV/ZEV Spread**

\[ y = 24.671x^2 + 4372.1x + 1163.5 \]

\[ R^2 = 0.9997 \]

Interpolation by Quadratic Polynomials Based on IEA WEO Scenario
Based on the assumption that it will be linked to the market for next-generation vehicles as described in the previous page, we calculated the number of units sold by automobile manufacturers based on the actual and projected figures shown in our environmental and annual reports.

**STEP 3: Automotive Manufacturers’ Forecasts for Future Sales of Next-Generation Vehicles (≒ PHV or ZEV)**

Forecasting future sales of a company using current data and the target set by a company itself.

Target set by a Auto Manufacture in its publication.

Current data disclosed by a Auto Manufacture.

Sales of Vehicles estimated by Automotive Manufacturers

Current data disclosed by the company.

Sales of next-generation car (estimated the left slide).

Sales of ICE car (estimated on previous page)
Based on the current scenario, it is expected that the growth of net assets will be restrained to a certain extent due to the increase in R & D expenses and capital investment (depreciation expenses associated with it).

**STEP 3: Financial Impact of Automotive Component Manufacturers Based on Sales Forecasts**

[Assumptions (Summary)]

- The sales of motor vehicle component manufacturers is assumed to be proportional to the sales of motor vehicle manufacturers.
- Automobile sales volume (Next-generation vehicles and gasoline-powered vehicles) is also assumed to be sold according to the scenario in accordance with the region and respective regulations. The unit selling price is assumed to be constant on average.
- R&D expenditure (and capital expenditure) increases in proportion to sales.
- The ratio of ordinary income to sales shall remain constant over the last three years, excluding the increase in R&D expenses and the increase in capital investment.
- Global CO2 emissions at plants are assumed to be reduced to zero by 2050 as planned.
Example of analysis (3):
Real estate (major player) (Omitted)
3. Practical examples of scenario analysis

3-1. Shiga Bank
3-2. Hachijuni Bank
3-3. Higo Bank

① Assess materiality of climate-related risks
② Identify and define range of scenarios
③ Evaluate Qualitative Business Impact
④ Quantitative assessment of transition risk
⑤ Quantitative assessment of physical risk
① Collateral valuation

[Properties in scope]
• "Buildings" among all real estate properties held in Kumamoto City

[Prerequisites for the Property]
• Number of building floors: Since data on the number of floors of each property was unavailable, it was calculated uniformly.
• The variable used for the damage ratio is the one after the rank correction (Leveling of mixed floors).
• Building structure: The analysis was made by combining wooden and non-wooden construction. As above, the variable used for the damage ratio is not structure-specific..

[Damage ratio variable]
• Adjustment due to inundation depth zones that do not match the inundation depth classification and damage ratio classification on the hazard map

<table>
<thead>
<tr>
<th>Hazard map inundation depth section</th>
<th>Flood control economic research manual</th>
<th>After adjustment loss ratio</th>
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<tr>
<td></td>
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<td>83.60%</td>
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<tr>
<td>5.0 m or more</td>
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*According to the flood control economic survey manual, inundation depth of 3 m or more is assumed

In order to reduce the loss ratio to a uniform 83.6%, it is necessary to reduce assumptions regarding the damage caused.

The expected damage of an inundation depth of ≥5 m cannot be estimated. Inundation of ≥ 5 m is assumed to be a total loss (100%)

For a distance between 2 m and less than 5 m captured in the hazard map, it is assumed that the midpoint is 3.5 m

The Economic Survey Manual includes a ratio of loss caused by damage of 83.6% for 3m or more.

[Calculation logic]
① Property identification: All collateral properties - land properties = buildings
② Understanding of inundation depth: building property address (latitude-longitude transformation) → inundation depth on hazard map
③ Damage Calculation: Collateral amount by inundation depth and building x Damage ratio by inundation depth = Loss on collateral due to flooding (Assumptions)
② Valuation of the company's decline in sales

[Properties in scope]
- Excerpts from enterprises located in the downtown (arcade) of Kumamoto City
- Understand the location and sales of each company

[Prerequisites for the Property]
- Number of building floors: Since data on the number of floors of each property was unavailable, it was calculated uniformly.
- The variable used for the damage ratio is the one after the rank correction (Leveling of mixed floors).
- Building structure: The analysis was made by combining wooden and non-wooden construction. As above, the variable used for the damage ratio is not structure-specific

[Number of days off work]
Adjustment due to inundation depth zones that do not match the inundation depth classification and damage ratio classification on the hazard map

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*According to the flood control economic survey manual, inundation depth of 3 m or more results in 56.1 days off work.

The number of business downtime days for inundation of 5m or more is based on the Dmap and interpolated linearly over the period (73 days).

For distances between 2 m and 5 m captured in the hazard map, it is assumed that the midpoint is 3.5 m.

Number of business suspension days by inundation depth = sales decrease due to flooding (Assumptions)

[Calculation logic]
① Understanding of inundation depth: building property address (latitude-longitude transformation) → inundation depth on hazard map
② Net Sales Decrease Calculation: Net Sales by Flood Depth and Property/Number of Business Days (Calculated for 242 days excluding holidays and national holidays)
Appendix

Appendix 1. Sector Climate Risk Assessment Materials
Appendix 2. Parameters used in the scenario group definition
Appendix

Appendix 1. Sector Climate Risk Assessment Materials
Appendix 2. Parameters used in the scenario group definition
GICS conducted a high-level evaluation of the impact of climate change for each of its 69 industries

**Evaluation matrix excerpts**

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<tr>
<th>Sector</th>
<th>Source of information</th>
<th>Sectoral evaluation (Up to 34)</th>
<th>Investor</th>
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Sources that cover only specific sectors

The source of the "*" mark shall be 3 points (Key sources of TCFD information) where there is a reference to the sector, 0 points where there is no reference;

Information sources for the "* *" mark are rated 1 point (Minor sources of TCFD information) if there is a sector reference, and 0 point if there is no reference.

Sources covering a wide range of sectors

For information sources that are not marked with an asterisk (*), the top 30% received 3 points, the next 31-60% received 2 points, and below 60% received 1 point. Roughness is evaluated on a scale of one to three (High/Medium/Low, etc.).
## Climate-related risks evaluation matrix (1/2)

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Source: Deloitte Tohmatsu
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<td>TOFD Final Report</td>
<td>EBRD</td>
<td>Calvert</td>
<td>GPIF</td>
</tr>
<tr>
<td></td>
<td>Specific sector</td>
<td>Specific sector</td>
<td>Broad sector</td>
<td>Broad sector</td>
</tr>
<tr>
<td>201070</td>
<td>Trading Companies &amp; Distributors</td>
<td>11</td>
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</tr>
<tr>
<td>202010</td>
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<td>Professional Services</td>
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<tr>
<td>253010</td>
<td>Hotels, Restaurants &amp; Leisure</td>
<td>11</td>
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</tr>
<tr>
<td>352030</td>
<td>Life Sciences Tools &amp; Services</td>
<td>11</td>
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<tr>
<td>451000</td>
<td>IT Services</td>
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<td>452010</td>
<td>Communications Equipment</td>
<td>11</td>
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<td>0</td>
</tr>
<tr>
<td>452020</td>
<td>Technology Hardware, Storage &amp; Peripherals</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>452030</td>
<td>Electronic Equipment, Instruments &amp; Components</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>501010</td>
<td>Diversified Telecommunication Services</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>453010</td>
<td>Semiconductors &amp; Semiconductor Equipment</td>
<td>11</td>
<td>0</td>
<td>0</td>
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<td>252010</td>
<td>Household Durables</td>
<td>10</td>
<td>0</td>
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</tr>
<tr>
<td>252030</td>
<td>Textiles, Apparel &amp; Luxury Goods</td>
<td>10</td>
<td>0</td>
<td>0</td>
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<tr>
<td>351020</td>
<td>Health Care Providers &amp; Services</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>451030</td>
<td>Software</td>
<td>10</td>
<td>0</td>
<td>0</td>
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<tr>
<td>601010</td>
<td>Equity Real Estate Investment Trusts (REITs)</td>
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<tr>
<td>203050</td>
<td>Transportation Infrastructure</td>
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<td>255030</td>
<td>Multiline Retail</td>
<td>9</td>
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<td>0</td>
</tr>
<tr>
<td>255040</td>
<td>Specialty Retail</td>
<td>9</td>
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<td>303020</td>
<td>Personal Products</td>
<td>9</td>
<td>0</td>
<td>0</td>
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<tr>
<td>351010</td>
<td>Health Care Equipment &amp; Supplies</td>
<td>9</td>
<td>0</td>
<td>0</td>
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<td>402010</td>
<td>Diversified Financial Services</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>402030</td>
<td>Capital Markets</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>255020</td>
<td>Internet &amp; Direct Marketing Retail</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>253020</td>
<td>Diversified Consumer Services</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>255010</td>
<td>Distributors</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>303010</td>
<td>Household Products</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>501020</td>
<td>Wireless Telecommunication Services</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>502010</td>
<td>Media</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>502020</td>
<td>Entertainment</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>402020</td>
<td>Consumer Finance</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>402040</td>
<td>Mortgage Real Estate Investment Trusts (REITs)</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>502030</td>
<td>Interactive Media &amp; Services</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>351030</td>
<td>Health Care Technology</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Deloitte Tohmatsu
In the financial and non-financial sectors, the TCFD has also developed supplemental guidance for sectors that are particularly affected by recommendations for financial disclosure of climate-related risks and opportunities.

**Investors (1/6): TCFD Final Report**

(Reference) Report of recommendations on disclosure of climate-related financial information

**Outline of the Agency**
- TCFD (Task Force on Climate-related Financial Disclosure): A task force to examine how financial institutions should consider climate-related issues. Established by the Financial Stability Board in 2015 at the request of the Group of 20 Finance Ministers and Central Bank Governors.

**Overview of Reports**
- Recommendations for disclosure of governance, strategies, risk management, indicators and targets for climate-related risks and opportunities in financial reports.
- In addition to guidance available for a wide range of industries, supplementary guidance is provided for industries that are likely to be particularly impacted.

4 financial industries, 4 non-financial industries and 13 sectors are identified as industries and sectors that may be greatly affected by climate change.

<table>
<thead>
<tr>
<th>Bank</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit risk impacts on carbon-related assets, climate-related risk impacts on loans, and the positioning and classification of such risks in general risk analysis</td>
<td>Assessment of legal compliance, changes in operating expenses, risks and opportunities, regulatory revisions, changes in consumer and investor trends, and changes in investment strategies, and disclosure of potential impacts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>insurance</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>New insurance products and competitiveness, climate change scenario analysis results, business impacts, climate-related risk assessment and assessment models in the insurance portfolio</td>
<td>Assessment and disclosure of potential impacts of financial risks to existing plants and equipment, investment in research and development of new technologies, and opportunities to use new technologies to meet low emission standards and fuel efficiency regulations, based on strengthened regulations and new technologies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>asset owner</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment strategy, scenario analysis, risk and opportunity assessment methodology, portfolio positioning for low-carbon energy transition, engagement practices, portfolio carbon share</td>
<td>Assessment and disclosure of potential impacts of financial risks to existing plants and equipment, investment in research and development of new technologies, and opportunities to use new technologies to meet low emission standards and fuel efficiency regulations, based on strengthened regulations and new technologies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asset Manager</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as asset owner except for positioning</td>
<td>Assessment of changes in business and consumer trends toward GHG emissions reduction, recycling and waste management, and low-GHG-emitting foods and textiles and disclosure of potential impacts</td>
</tr>
</tbody>
</table>

**Source:** TCFD, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures*
The 2 °C Investment Initiative provides transition risk parameters for risk assessment in highly affected sectors

**Investors (2/6): 2 °C Investment Initiative**

(Reference) 2 °C Investment Initiative Transition Risk Scenarios for TCFD Ready Enterprises (Including investment side)

**Outline of the Agency**

2 °C Investment Initiative: A think tank that develops climate change risk indicators and policy options in financial markets

**Overview of Reports**

- Provide transition risk scenarios as required by TCFD for reference when performing financial risk and scenario analysis (ACT (ambitive climb transition) and 3 ~ 4 °C LCT (limited climb transition))
- Key parameters for the carbon-intensive fossil fuel, electric power, automotive, steel, cement, aviation, and transport sectors based on existing scenarios such as the IEA

Identify sectors with high carbon emissions that are highly affected by transition risks

- **electric power company**
- **motor vehicle**
- **Steel**
- **cement**
- **aviation**
- **Transportation**

Set up four risk factors

- Production & Technology
- market price
- Policy Obligations, Incentives and Taxes
- unconventional risk

Set indicators and parameters for each risk factor
The EBRD evaluates the impact of climate change driven physical risk by sector

**Investor (3/6): EBRD**

(Reference) Assessment guidance for physical risks and opportunities from the TCFD Recommendation

**Outline of the Agency**
- The EBRD (European Bank for Reconstruction and Development) was established to develop market economies in Central and Eastern Europe after the Cold War. Promote "environmentally sustainable development" and actively invest in climate change.
- GCECA (Global Environment Adaptation Center) is an organization established by the United Nations and governments of countries such as the Netherlands. Partnership with NGOs and financial institutions to promote climate adaptation through sharing knowledge and developing evaluation methods

**Overview of Reports**
- Based on the TCFD, this document provides guidance on matters to be considered and reference indicators for each company's assessment of physical risks and opportunities. Compiled based on discussions in working groups involving financial institutions and companies
- Require analysis by value chain, geography based disclosure, and asset impact assessment

Public utilities (Electricity, gas, etc.) and the materials sector are considered to be highly affected by the physical risks of climate change.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>motor vehicle</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>durable consumer goods</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>apparel</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>consumer service</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>media</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>retail</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>food retail</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Food, beverages, and tobacco</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Home personal goods</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>

GICS applies a three-stage assessment of physical risk due to climate change across the 24 industry category groups.

**The utility sector (Electricity, gas, etc.) and the materials sector are rated high for all risk categories.**

**The food, beverage, and tobacco sectors, as well as capital goods, also have a high number of risks that are rated high.**

**Risk Type**
- storm cyclone
- Heavy rains and flooding
- intense heat
- variation in precipitation
- temperature fluctuation
- water stress
- sea level rise
- Others (air and soil pollution, melting of permafrost, forest fires, etc.)
Analysis by German asset management firm on vulnerability to climate-related risks by sector

Investor (4/6): 427/DWS

(Reference) Guidance for investors in assessing physical risk

Outline of the Agency
- Four Twenty Seven: A market intelligence research firm specializing in the economic risks of climate change. Providing services, including climate risk assessment of financial portfolios and development of climate resilience strategies (Moody’s Acquired)
- DWS (Deutsche Asset Management): an asset management company based in Germany

Overview of Reports
- Sets out the approach to climate-related physical risk scoring (Business risk, supply chain risk, and market risk) which is provided by industries industry and country
- Reported that climate-related physical risks are particularly pronounced in Asia.

Four Twenty Seven’s assessment is broadly divided into three risk types and developed climate-related risk indicators
- Assessment of climate-related risks across GICS 24 segment industry groups
- Each indicator included in the risk type is evaluated at 0-100
- The numbers represent resilience, with lower numbers more vulnerable to climate-related risks

<table>
<thead>
<tr>
<th>Risk Type</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Risk</td>
<td>• Hot, water stress, torrential rain, forest fire, sea level rise, tropical cyclone, socioeconomic vulnerability</td>
</tr>
<tr>
<td>supply chain Risk</td>
<td>• Countries with production and manufacturing bases, dependency on resources</td>
</tr>
<tr>
<td>Market Risk</td>
<td>• Countries where products and services are sold, sensitivity to weather</td>
</tr>
</tbody>
</table>

Market risk tends to be low in all sectors. Overall, the top 20% of the least resilient sectors are:
- **Material**
- **Public utilities (Electricity, gas, etc.)**
- **Pharmaceutical and Biotechnology**
- **Semiconductor**
By linking the SASB materiality map for investors with the SDGs, Calvert’s analysis assesses the long-term financial impact of each SDGs by sector.

**Investors (5/6): Calvert**

**Outline of the Agency**
- Calvert Research and Management is a subsidiary of Eaton Vance, a U.S. investment management company, and a socially responsible investment (SRI: Socially Responsible Investment) management company. Asset value as of November 2017 is approximately USD 10 billion.

**Overview of Reports**
- Mapping of SASB’s sectoral materiality map * with sustainable development goals (SDGs) (SASB 71% meets SDGs)
- Clarifying the long-term financial impact by sector SDGs, with the aim of supporting investors make ESG investment decisions. *Detailed on SASB description slides

*Expressing the financial impact of the SDGs by sector (The same color indicates the same sector, and the size of the box indicates the degree of influence.)*

- See "SDG 13 Climate Change" for sector impacts on climate change
- high-impact sector
  - non-renewable resource
  - Consumer Goods 1 (Crops, meats and dairy products, processed foods, non-alcoholic beverages, alcoholic beverages, tobacco, household goods and general consumer goods)
  - Infrastructure
  - Finance
  - Transportation

Source: Calvert, "ESG Integration INSIGHTS"
The GPIF provides historical performance and future scenario data as the basis for TCFD disclosures. CO2 emissions by sector (Net sales to net sales) are calculated for carbon intensity.

**Investors (6/6): GPIF**

**Outline of the Agency**
- GPIF: Government Pension Investment Fund. An organization whose purpose is to contribute to the stability of the employees’ pension insurance business and the national pension business. Assets at the end of June 2019 were approximately 161 trillion yen.

**Overview of Reports**
- Quantitative data on climate change analyzed by Trucost, the world’s leading environmental assessment organization. Includes “Past Performance” and ”forward looking scenario analysis”
- Provides data that can be used by GPIF asset owners and asset managers to disclose climate-related information in accordance with TCFD recommendations.

![GPIF Chart](image)

**Source:** GPIF, “Climate Change Risk Analysis of GPIF Portfolio”

- Calculate carbon intensity (C/R: CO2 emissions as a percentage of sales) by sector (t-CO2/1 million yen)
- Industry classification is based on the World Industrial Classification Standard. 11 sectors of (GICS = Global Industry Classification Standard).
  - high-intensity sector
    - public utility
    - Material
    - Energy
DJSI’s Corporate Sustainability Assessment looks at the importance of "climate strategy" as determined by industry participants

ESG Assessment (1/2) – DJSI/RobecoSAM

Outline of the Agency
• Dow Jones Sustainability Index (DJSI): The Jones Sustainability Index is organized by Dow Jones and is aimed at sustainability investors. The results of RobecoSAM will be used to create the index.
• RobecoSAM: An ESG research organization based in Switzerland. The company has been conducting sustainability evaluations (Corporate Sustainability Assessment) of major listed companies since 1999.

Overview of Corporate Sustainability Assessment (CSA)
• Questionnaire ESG Survey Responded by Major Listed Companies
• The questions consist of three major sections: 1) economy, 2) environment, and 3) ESG structure of society.
• CSA 2018 evaluates 2,686 companies across 60 industry segments, covering approximately 3,500 global companies (Of which 381 are Japanese companies).

The industry weighting for climate strategy has been set at 2 ~ 10 (10 step adjustment)

Source: Created by Tohmatsu from Criterion Weight by SAM Industry
The ESG Data Model provides an industry assessment of climate change related risks

ESG Assessment (2/2) - FTSE

**Outline of the Agency**
- An independent company 100% owned by the London Stock Exchange that has been designing and maintaining indexes for more than 50 years and has worked on the governance of indexes.
- Leading global provider of benchmarking, analytics and data solutions for investors

**ESG Data Model Overview**
- Approximately 100 dedicated research analysts conduct ESG Data Model analysis and assessment
- The question consists of three pillars: (1) Environment, (2) Society, and (3) ESG Structure of Governance.
- About 4,100 companies were surveyed (Of which 750 are Japanese companies)

**Industry Weighting of Climate Change Questions**

<table>
<thead>
<tr>
<th>first impact subsector</th>
<th>second impact subsector</th>
<th>third impact subsector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil and Gas Exploration and Development</td>
<td>oil crisis service</td>
<td>electronic equipment</td>
</tr>
<tr>
<td>integrated oil and gas</td>
<td>Pipeline</td>
<td>settlement and transfer services</td>
</tr>
<tr>
<td>basic chemistry</td>
<td>renewable energy crisis</td>
<td>home electronics</td>
</tr>
<tr>
<td>Construction materials and equipment</td>
<td>Electrical parts and equipment</td>
<td>Toys</td>
</tr>
<tr>
<td>Forestry</td>
<td>Railroads</td>
<td>clothing and accessories</td>
</tr>
<tr>
<td>paper industry</td>
<td>automotive component</td>
<td>healthcare provider</td>
</tr>
<tr>
<td>Aluminum</td>
<td>processed food</td>
<td>medical device</td>
</tr>
<tr>
<td>nonferrous</td>
<td>housing construction</td>
<td>medical supplies</td>
</tr>
<tr>
<td>Iron and Steel</td>
<td>defence</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>coal</td>
<td>industrial equipment</td>
<td>Broadcasting and Entertainment</td>
</tr>
<tr>
<td>motor vehicle</td>
<td>Pharmaceuticals</td>
<td>Bank</td>
</tr>
<tr>
<td>shipping</td>
<td>entertainment goods</td>
<td>comprehensive insurance</td>
</tr>
<tr>
<td>motor vehicle</td>
<td>semiconductor</td>
<td>life insurance</td>
</tr>
</tbody>
</table>

*First impact sector = risk exposure set to high

Source: FTSE Russel, “ESG Data Model”
The SASB sets sustainability priorities for each industry, from which it identifies sectors where GHG emissions, energy management, and physical impacts of climate change are significant.

Initiatives (1/4): SASB

(Reference) SASB standards for disclosure of sustainability information to investors by industry

Outline of the Agency
- SASB (Sustainability Accounting Standard Board) is a non-profit organization that promotes the disclosure of sustainability information to meet investor needs.

Report Summary
- Establishment and publication of sustainability accounting standards for financial information disclosure for each industry
- Preparation of sustainability standards by presenting sector-specific items for sustainability disclosure items (GHG emissions, energy, water, occupational health and safety, environmental and social impacts of supply chains, raw material procurement, etc.)

The following are sectors where GHG emissions, energy management, and the physical impacts of climate change are key issues:
- Mining and Minerals
- Food and beverages
- Transportation
- Renewable resources and alternative energy
- Resource utilization
- Technology & Communication

Source: SASB, "Materiality Map"
ClimateWise identifies the infrastructure industry as particularly vulnerable to climate change risks and analyzes sectoral Transition risks in 2.7 °C and 2 °C scenarios

Initiatives (2/4): ClimateWise

Outline of the Agency
- ClimateWise: An insurance industry initiative led by the University of Cambridge. Participation by Tokio Marine & Nichido from Japan
- The Climate Wise policy is based on the TCFD recommendations, and participating institutions are required to submit reports in accordance with the policy every year.

Overview of Reports
- Providing an "open source modeling framework" as a support tool for calculating the financial impact on infrastructure investment, etc. associated with the transition to a low-carbon society
  - Insurance companies also conduct business as institutional investors, and it is necessary to understand the transition risks of the companies in which they invest.
  - Analysis of Transition risks in the infrastructure industry based on the perception that the infrastructure industry is particularly vulnerable to Transition risks

- Assessment of 2020, 2030, and 2040 Transition risks by sector and region (United States, EU and India) in the infrastructure industry
- Evaluated in Paris Agreement scenario (2.7 °C) and 2 °C scenario
- Sectors identified as high risk in 2040 under the 2 °C scenario are "coal-fired power generation" "gas-fired power generation" "Oil pipelines and midstream sector infrastructure" and "Gas supply facility"

Source: Cambridge ClimateWise "Transition risk framework", Japan Institute for Environmental Finance website
GA Institute analyzes more than 1,000 sustainability reports and aggregates sectoral disclosures linked to SDGs. Sectors with high exposure to climate change are identified

Initiatives (3/4): GA Institute

Outline of the Agency
- Governance & Accountability Institute is a U.S. consulting firm specializing in sustainability. Conducted analysis of sustainability reports for companies that comply with GRI guidelines.

Report Summary
- Analyzes the sustainability reports of 1,387 companies in the GRI's sustainability report database.
- Industry category: FTSE Russell's "industry classification benchmark" (ICB = Industry Classification Benchmark) 41 sectors.
- Heat map of sustainable development goals (SDGs) and industrial sector matrix. It is intended to be used for materiality analysis by companies and ESG investment decisions by investors.

- Tabulated disclosure status by sector for each SDG goal (The larger the number, the more companies disclose in their reports.)
- See "SDG 13 Climate Change" for sector impacts on climate change.
- The sectors in the top 20% are:
  ➢ aerospace and defense
  ➢ alternative energy
  ➢ automobiles and parts
  ➢ Chemistry
  ➢ electrical and electronic equipment
  ➢ leisure goods
  ➢ oil and gas refining

Source: GA Institute, “Sustainability Materiality of the SDGs Targets & GRI Indicators”
Finch & Beak aggregates market sizes (opportunity) by SDGs and industry sectors. Industries with large markets (opportunity) associated with climate change are identified.

Initiatives (4/4): Finch & Beak

Outline of the Agency
- Finch & Beak is a sustainability consulting firm based in the Netherlands. Providing services mainly in Europe

Report Summary
- Market size (opportunity) calculated by sustainable development goals (SDGs) and industry sectors
- 24 sectors according to the World Industrial Classification Standard (GICS = Global Industry Classification Standard)
- It is intended to be used for materiality analysis by each company and ESG investment decisions by investors.

Estimation of potential market size by SDGs based on DJSI

<table>
<thead>
<tr>
<th>GICS Industry Groups</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2179</td>
<td>2051</td>
<td>3810</td>
<td>652</td>
<td>1189</td>
<td>2501</td>
</tr>
<tr>
<td>Total</td>
<td>3450</td>
<td>3450</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- For each SDG goal, the market size (opportunity) is calculated for each sector of the industry segment used in DJSI.
- The sector impacts of climate change
  Refer to "SDG 13 Climate Change"
- The sectors in the top 20% by market size (opportunity)
  ➢ Bank
  ➢ capital goods
  ➢ Material
  ➢ real estate

Source: Finch & Beak, “SDG mapping with 2016 DJSI industries”
Appendix

Appendix 1. Sector Climate Risk Assessment Materials

Appendix 2. Parameters used in the scenario group definition

① Real estate sector
② Energy sector
③ Automotive sector
For risk opportunities assessed as importance, predicted data for the 2 °C/4 °C scenario were collected as parameters.

<table>
<thead>
<tr>
<th>Important Item (Subject of Analysis)</th>
<th>Configured Parameter</th>
<th>Current</th>
<th>4 °C</th>
<th>2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>After 2040</td>
</tr>
<tr>
<td>Carbon tax and carbon price</td>
<td>(1) carbon tax</td>
<td>Japan: None Overseas: Some</td>
<td>(2030) Japan: N/A EU: 33 USD/t</td>
<td>(2040) Japan: N/A EU: 43 USD/t</td>
</tr>
<tr>
<td>Compliance with GHG emission regulations</td>
<td>(2) Energy consumption per unit of building</td>
<td>(base year) Global 2014</td>
<td>(2030) Improvement rate of 6%</td>
<td>(2040) Improvement rate of 21%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(base year) 2018</td>
<td>0.48 kg CO2/kWh</td>
<td>0.29 kg CO2/kWh</td>
</tr>
<tr>
<td></td>
<td>(3) Grid electricity emission factor</td>
<td>(base year)</td>
<td>(2030) 0.31 kg CO2/kWh</td>
<td>(2040) 0.29 kg CO2/kWh</td>
</tr>
<tr>
<td></td>
<td>(4) Mandatory introduction of ZEB/ZEH (government target)</td>
<td>(base year) 2014</td>
<td>(2020) ZEB Total Floor Area 0 Billion m²</td>
<td>(2040) ZEB Total Floor Area 5 Billion m²</td>
</tr>
<tr>
<td>changes in customer behavior</td>
<td>(5) Rent increase/decrease due to environmental performance</td>
<td>Increase rent by 4.4%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(6) Flood damage</td>
<td>(base year) Japan: 2010</td>
<td>(2030) +121%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(7) Changes in flood frequency</td>
<td>(base year) 2019</td>
<td>N/A</td>
<td>(2040) The frequency of flood occurrence is about 4 times</td>
</tr>
<tr>
<td></td>
<td>(8) Occurrence of typhoons and cyclones</td>
<td>(base year) Japan: 2016</td>
<td>N/A</td>
<td>(2100) Observations are highly uncertain, and the number of annual typhoons is unclear.</td>
</tr>
<tr>
<td></td>
<td>(9) Sea level rise</td>
<td>(base year) 2015</td>
<td>(2030) 0.18 m</td>
<td>(2040) 0.25 m</td>
</tr>
</tbody>
</table>
[Carbon price/tax: (1) Carbon tax]
Carbon taxes will be introduced in both developed and developing countries under the 2 °C scenario

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>The introduction of carbon tax is limited to some countries.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Japan</td>
</tr>
<tr>
<td>2018</td>
<td>N/A</td>
</tr>
<tr>
<td>2030</td>
<td>N/A</td>
</tr>
<tr>
<td>2040</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 °C Scenario</th>
<th>Carbon tax will be introduced regardless of country or region</th>
</tr>
</thead>
<tbody>
<tr>
<td>developed country</td>
<td>developing country</td>
</tr>
<tr>
<td>current situation</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>N/A</td>
</tr>
<tr>
<td>2030</td>
<td>N/A</td>
</tr>
<tr>
<td>2040</td>
<td>N/A</td>
</tr>
<tr>
<td>2030</td>
<td>100 US $/ tCO2</td>
</tr>
<tr>
<td>2040</td>
<td>140 US $/ tCO2</td>
</tr>
</tbody>
</table>

Discussion

- (Entire): Estimates of Japan’s carbon tax are unclear, but high tax rates are not expected.
- (Real Estate) Green buildings will not become widespread because conventional buildings with low environmental performance will continue to be used, and new low-carbon materials will remain expensive.

*Data Source:
- Ministry of the Environment "Introduction of carbon taxes in other countries July 2018"
- Extracted from IEA "World Energy Outlook 2019" New Policies Scenario (NPS) numbers

- (Entire) As global carbon prices increase to reach the 2 °C target, the government promotes the introduction of carbon taxes and emissions trading. On the other hand, companies that emit large amounts of GHGs are increasingly requested by governments and business partners and engaged by investors.
- (Real Estate) Due to rising steel and cement prices and transportation costs, green buildings using new low-carbon materials have become popular.
- (Tenant) The demand for energy-efficient facilities will increase as more companies promote decarbonization on the tenant side.

*Data Source:
- Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario figures
Addressing GHG emissions regulations: (2) Energy intensity of buildings

Energy intensity of buildings targeted in the 4 °C and 2 °C scenarios are expected to make a difference of around 20%

### 4 °C Scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate of improvement in unit energy consumption: Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2014)</td>
<td>0%</td>
</tr>
<tr>
<td>2020</td>
<td>6%</td>
</tr>
<tr>
<td>2040</td>
<td>21%</td>
</tr>
<tr>
<td>2060</td>
<td>29%</td>
</tr>
</tbody>
</table>

### 2 °C Scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate of improvement in unit energy consumption: Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2014)</td>
<td>0%</td>
</tr>
<tr>
<td>2020</td>
<td>7%</td>
</tr>
<tr>
<td>2040</td>
<td>34%</td>
</tr>
<tr>
<td>2060</td>
<td>49%</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire) Energy efficiency continues to improve, but there is no active investment compared to 2 °C
- (management and operation) The risk of fines and other penalties is small even if buildings with low energy efficiency are maintained, but it is possible that a certain level of efficiency standards will need to be met.
- (Real Estate) It is undeniable that the company may be exposed to a certain reputation risk, and it is also possible to add value to the company based on its high performance despite the low energy efficiency of other companies.

*Data Source:
- IEA "Energy Technology Perspective 2017" RTS Scenarios

---

**Discussion**

- (Entire) As energy efficiency improves globally, the real estate industry may require high standards (ZEB/ZEH + promotion, etc.)
- (Real Estate) Penalties, etc. shall be imposed on buildings that do not meet the requirements.
- (Real Estate) Buyers and renters will be excluded from buildings with insufficient environmental measures
- (Tenant) Energy efficiency of buildings becomes an important factor in purchasing decisions, and utilization of building environmental performance labeling system is activated.
- (management and operation) Expected to improve standards for new construction and renovation, resulting in higher construction and maintenance costs

*Data Source:
- IEA "Energy Technology Perspective 2017" RTS Scenarios
Addressing GHG emissions regulations: (3) Grid-electricity emission factors

GHG emissions reductions from electricity are limited in the 4 °C scenario. The contribution of buildings to the reduction of unit energy consumption is small.

**4 °C Scenario**

Emission factor for grid electricity halved

<table>
<thead>
<tr>
<th>Year</th>
<th>CO2 emission factor for electricity: Japan [kg-CO2/kWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2018)</td>
<td>0.48</td>
</tr>
<tr>
<td>2025</td>
<td>0.38</td>
</tr>
<tr>
<td>2030</td>
<td>0.31</td>
</tr>
<tr>
<td>2035</td>
<td>0.29</td>
</tr>
<tr>
<td>2040</td>
<td>0.27</td>
</tr>
<tr>
<td>2050</td>
<td>0.23 (estimated value)</td>
</tr>
</tbody>
</table>

**Discussion**

• (Entire) A certain amount of renewable energy will be introduced, but the rise in carbon prices will be small and the improvement in the emission factor of electricity will be limited.
• (Property/Facility) The improvement in the grid electricity emission factor is small and does not significantly improve the energy intensity of buildings.
• No increase in electricity rates as seen in the (Tenant) 2 °C scenario
• (Real Estate) CO2 reduction cannot be expected by improving the grid electricity emission factor, and other means of reduction must be sought.

(Source)

• IEA “World Energy Outlook 2019” STEPS Scenario
*Based on regional and national data available in World Energy Outlook 2019, the value of CO2 emissions from the power generation sector (t-CO2)/power generation (TWh) is treated as the regional power emission factor for convenience. Figures for power generation and CO2 emissions from the power generation sector by region and country are only available for the period up to 2040, figures for 2040 and beyond are estimated.
[Addressing GHG emissions regulations: (3) Grid-electricity emission factors]

In the 2 °C scenario, the electric power emission coefficient is large due to the promotion of renewable energy measures, etc. and building energy intensity is expected to improve.

**2 °C Scenario**

Grid electricity emission factor to nearly 0 in 2050

<table>
<thead>
<tr>
<th>Year</th>
<th>CO2 emission factor for electricity: Japan [kg-CO2/kWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2018)</td>
<td>0.48</td>
</tr>
<tr>
<td>2025</td>
<td>0.30</td>
</tr>
<tr>
<td>2030</td>
<td>0.19</td>
</tr>
<tr>
<td>2035</td>
<td>0.10</td>
</tr>
<tr>
<td>2040</td>
<td>0.06</td>
</tr>
<tr>
<td>2050</td>
<td>0.00 (estimated value)</td>
</tr>
</tbody>
</table>

**Discussion**

- ( Entire) The introduction of renewable energy and an increase in carbon prices will lead to an improvement in the emission factor of electricity.
- (Property/Facility) Unit energy consumption of buildings is enhanced by improving grid electricity emission factors
- ( Tenant) Higher grid stabilization costs and higher retail electricity prices
- (Real Estate) Although retail electricity prices are expected to rise, CO2 reduction through improved emission factors is expected.

(Source)

- IEA “World Energy Outlook 2019” SDS Scenario

*Based on regional and national data available in World Energy Outlook 2019, the value of CO2 emissions from the power generation sector (t-CO2)/power generation (TWh) is treated as the regional power emission factor for convenience. Figures for power generation and CO2 emissions from the power generation sector by region and country are only available for the period up to 2040, figures for 2040 and beyond are estimated.
Compliance with GHG emission regulations: (4) mandatory introduction of ZEB/ZEH
While the introduction of ZEB/ZEH did not proceed in the 4 °C scenario, It is assumed that ZEB/ZEH conversion is mandatory in the 2 °C scenario.

**4 °C Scenario**

<table>
<thead>
<tr>
<th>Year</th>
<th>Limited penetration of ZEB</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2014)</td>
<td>0</td>
</tr>
<tr>
<td>2020</td>
<td>0</td>
</tr>
<tr>
<td>2040</td>
<td>5</td>
</tr>
<tr>
<td>2060</td>
<td>13</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire) The total floor area will not increase until around 2040, and will be used only in a limited number of countries/regions.
- (Real Estate) Demand for ZEB properties is low and the attractiveness and competitiveness of properties are low.
- (Real Estate) ZEB will not be widely used, and the cost of construction, acquisition and operation management will remain high.

*Data Source:

- IEA "World Energy Outlook 2018" NPS Scenario

**2 °C Scenario**

<table>
<thead>
<tr>
<th>Year</th>
<th>The spread of ZEB/ZEH will activate related markets.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total floor area of ZEBs: Global [billon m²]</td>
<td></td>
</tr>
<tr>
<td>current situation (2014)</td>
<td>0</td>
</tr>
<tr>
<td>2020</td>
<td>1</td>
</tr>
<tr>
<td>2040</td>
<td>32</td>
</tr>
<tr>
<td>2060</td>
<td>68</td>
</tr>
</tbody>
</table>

**ZEH diffusion target in Japan**

<table>
<thead>
<tr>
<th>Year</th>
<th>ZEH accounts for 16.0% of newly built detached houses Custom-built housing (Mochie) 15.3% Houses built for sale (sale): 0.7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>ZEH now accounts for more than 50% of new homes</td>
</tr>
<tr>
<td>2020</td>
<td>ZEH of 100% expected for new homes</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire) Japan will make ZEB/ZEH mandatory in order to achieve energy conservation targets.
- (Real Estate) Construction and refurbishment costs will increase due to ZEB/ZEH construction.
- (Real Estate) As companies aggressively introduce ZEB/ZEH, the presence of companies possessing more advanced technologies is expanding.
- (Tenant) Interest in ZEB/ZEH and the introduction of renewable energy will increase, and ZEB/renewable energy will become an important item in investment/purchase/occupancy decision making.

*Data Source:

- Ministry of Economy, Trade and Industry "Policy Trends for Promoting ZEH Dissemination and Proposed Fiscal 2018 Budget" (March 2018)
- Co-Creation Initiative for the Environment, Net Zero Energy House Support Project
- ZEH3 Joint Measures Briefing Session (Ministry of the Environment)
- IEA "Energy Technology Perspective 2017" 2DS Scenario
The trend varies depending on the scenario, but overall rent is higher for properties that have acquired building environment certification.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rent increase for properties with environmental certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2015)</td>
<td>4.4%</td>
</tr>
<tr>
<td>future</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Discussion
- (Entire) If the premium added to the rent increases by acquiring the building environment certification, the environmental certification will increase.
- (Real Estate) When demand for products with high environmental performance increases, companies that have been promoting the acquisition of environmental certification will have a competitive advantage.
- (Real Estate) The spread of environmental certification may lead to a relative decrease in the premium for environmental certification itself.

*Data Source:
- xymax "Economic analysis of environmental management"
At 4 °C, domestic flood damage more than doubles

Flood Damage Rises Nationwide

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>Flood Damage in urban areas (Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(No data at 2 °C)</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>3.3 billion USD/year (base year)</td>
</tr>
<tr>
<td>2030</td>
<td>7.3 billion USD/year +121%</td>
</tr>
<tr>
<td></td>
<td>(Increase due to socioeconomic change 1.7 billion USD)</td>
</tr>
<tr>
<td></td>
<td>Increase due to climate change (USD 2.2 billion)</td>
</tr>
</tbody>
</table>

Discussion

- Inundation of inland water due to heavy rain increases and inundation occurs in low-lying areas
- Flooding damage frequently occurs in low-lying real estate, and land prices fall as repair costs increase
- Disaster-prevention buildings increase through policy guidance (Mandatory regulation of minimum height under floor level in inundation areas and measures against inundation)
- Customer Interest in Flood Control Performance Grows, and Location and Flood Control Measures Become Key Items in Investment/Purchasing Decisions
- Supply stoppage due to flooding in the building materials production area
- Delays in transportation of building materials and human resources due to flooding in transportation routes

*Data Source: WRI “The Aqueduct Global Flood Analyzer” (Scenario based on RCP 8.5 (4 °C Scenario) and SSP2 (moderate socioeconomic fluctuations) with flood prevention measures implemented over a period of 50 years)
Rainfall, rate of change of flow rate, and frequency of flood occurrence are expected to increase in both the 2 °C and 4 °C scenarios.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>4 °C/2 °C</th>
<th>Rainfall, runoff and flood frequency increase at 4 °C from 2 °C</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>amount of rainfall</th>
<th>Flow rate</th>
<th>flood occurrence Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 °C (2040)</td>
<td>1.3 times</td>
<td>about 1.4 times</td>
<td>About 4 times</td>
</tr>
<tr>
<td>2 °C (2040)</td>
<td>1.1 times</td>
<td>about 1.2 times</td>
<td>about twice</td>
</tr>
</tbody>
</table>

Discussion

- (Entire) Inundation of inland water due to heavy rain and frequent floods increases, causing inundation damage to low-lying properties
- (government) Review of disaster prevention and mitigation plans, revision of building standards, and promotion of disaster-response buildings guided by the government
- (Real Estate) Expected to improve standards for new construction and renovation, increasing construction and maintenance costs
- (Real Estate) Due to the frequent occurrence of heavy rain, field work is suspended and the construction period is delayed
- (Real Estate) Incurs the costs of moving its portfolio of properties to areas with a lower probability of flooding, as well as the costs of safety measures
- (Real Estate) Inundated assets become inoperable and opportunity losses increase
- (Real Estate) Higher weather insurance premiums increase costs and squeeze earnings
- (Real Estate) Lack of access to buyers and renters for buildings with inadequate disaster preparedness, leading to a long-term decline in earnings
- (Tenant) Flood damage frequently occurs in low-lying areas, and maintenance and repair costs of assets increase, which puts pressure on profits

(Source)

- Technical Review Committee on Flood Control Planning in Light of Climate Change “Proposals for flood control plans based on climate change” (p. 15), 2019
Observations for storms, cyclones, and typhoons are highly uncertain and do not have clear projections.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Global</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation Frequency</strong></td>
<td>• Overall, no change</td>
<td>Past statistics show no clear long-term trend in the number of...</td>
</tr>
<tr>
<td></td>
<td>• Large tropical cyclones may decline in southern hemisphere</td>
<td></td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>• Augmentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Potential increase in large tropical cyclones (Categories 4 and 5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Small tropical cyclones may decline</td>
<td></td>
</tr>
<tr>
<td><strong>Precipitation</strong></td>
<td>• Increase</td>
<td>+ 8% to + 36% (Rate of future increases in precipitation due to heavy rain)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Number of typhoons in Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current situation</strong></td>
<td>26 (Nos.)</td>
</tr>
<tr>
<td><strong>Future (~ 2100 years)</strong></td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>(Global warming is expected to reduce the number of typhoons occurring in the Northwest Pacific and shift the area of typhoons to the east, resulting in a decrease in the number of typhoons approaching the area and changes in the route of typhoons, but there is high uncertainty.)</td>
</tr>
</tbody>
</table>

(Source)  
- National Oceanic and Atmospheric Administration (NOAA)  
- Japan Meteorological Agency "Extreme Weather Report 2014"  
- Ministry of the Environment, Japan Meteorological Agency, "Climate of Japan at the end of the 21 century (2015)"  
- Ministry of the Environment "Integrated Report on Observations, Forecasts and Impacts of Climate Change 2018: Japan's Climate Change and its Impacts"  
[Extreme weather events: (9) Sea level rise]
Although no significant sea level rise is expected until 2030, it is assumed that the risk of water disasters in coastal areas increases due to combined factors such as large typhoons and inland flooding.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>The average rise in global sea level will be higher depending on how long a 4 °C scenario prevails.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>4 °C: 0.1 (m) 2 °C: 0.1 (m)</td>
</tr>
<tr>
<td>2040</td>
<td>4 °C: 0.18 (m) 2 °C: 0.15 (m)</td>
</tr>
<tr>
<td>2050</td>
<td>4 °C: 0.25 (m) 2 °C: 0.2 (m)</td>
</tr>
<tr>
<td>2081–2100 years</td>
<td>4 °C: 0.45 ~ 0.82 (m) 2 °C: 0.26 ~ 0.55 (m)</td>
</tr>
</tbody>
</table>

*Values for 2030, 2040, and 2050 are averages; values for 2081 through to 2100 represent the width of the forecast (Comparison with the average value from 1986 to 2005).*
Appendix

Appendix 1. Sector Climate Risk Assessment Materials

Appendix 2. Parameters used in the scenario group definition

① Real estate sector
② Energy sector
③ Automotive sector
For risk opportunities assessed as importance, predicted data for the 2 °C/4 °C scenario were collected as parameters.

<table>
<thead>
<tr>
<th>Important Item (subject of analysis)</th>
<th>Configured Parameter</th>
<th>Current</th>
<th>4 °C</th>
<th>2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>After 2040</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>After 2040</td>
</tr>
<tr>
<td>Carbon tax and carbon price</td>
<td>(1) carbon tax</td>
<td>Japan: None</td>
<td>(2030)</td>
<td>(2040)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overseas: Some</td>
<td>Japan: N/A</td>
<td>Japan: N/A</td>
</tr>
<tr>
<td>Compliance with GHG emission regulations</td>
<td>(2) carbon emission reduction target</td>
<td>(base year) 4 °C: Varies by country 2 degrees C: 2018 years</td>
<td>(2030) High targets limited to certain countries</td>
<td>N/A</td>
</tr>
<tr>
<td>Energy mix, etc.</td>
<td>(3) energy mix</td>
<td>primary energy (base year) 2018</td>
<td>N/A</td>
<td>(2040) dependent on fossil fuels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4) oil price</td>
<td>(base year) 2018</td>
<td>(2025) + 10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5) power configuration</td>
<td>(base year) Japan: 2018</td>
<td>(2030) Fossil fuels down 32%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6) sales of engine-powered vehicles</td>
<td>(base year) 2015</td>
<td>(2030) + 16%</td>
</tr>
<tr>
<td>changes in customer behavior</td>
<td>(3) energy mix</td>
<td>Same as item (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7) Household energy consumption</td>
<td>(base year) 2017</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Extreme severity of abnormal weather</td>
<td>(8) flood damage</td>
<td>(base year) Japan: 2010</td>
<td>(2030) + 121%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(9) typhoon</td>
<td>(base year) Japan: 2016</td>
<td>N/A</td>
<td>(2100) Observations are highly uncertain, and typhoon figures are unclear</td>
</tr>
</tbody>
</table>
**Under the 2 °C scenario Carbon taxes will be introduced in both developed and developing countries**

**Table:**

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>2 °C Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The introduction of carbon tax is limited to some countries.</td>
<td>Carbon tax will be introduced regardless of country or region</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Japan</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>N/A</td>
<td>8  US $/ tCO2</td>
</tr>
<tr>
<td>2030</td>
<td>N/A</td>
<td>33 US $/ tCO2</td>
</tr>
<tr>
<td>2040</td>
<td>N/A</td>
<td>43 US $/ tCO2</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire): Estimates of Japan's carbon tax are unclear, but high tax rates are not expected.
- (Real Estate): Green buildings will not become widespread because conventional buildings with low environmental performance will continue to be used, and new low-carbon materials will remain expensive.

*Data Source:*
- Ministry of the Environment “Introduction of carbon taxes in other countries July 2018”
- Extracted from IEA "World Energy Outlook 2019" New Policies Scenario (NPS) numbers

- (Entire): As global carbon prices rise to reach the 2 °C target, the government promotes the introduction of carbon taxes and emissions trading. On the other hand, companies that emit large amounts of GHGs are increasingly requested by governments and business partners and engaged by investors.
- (Real Estate): Due to rising steel and cement prices and transportation costs, green buildings using new low-carbon materials have become popular.
- (Tenant): The demand for energy-efficient facilities will increase as more companies promote decarbonization on the tenant side.

*Data Source:*
- Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario figures
An annual CO2 emission reduction of about 2.5% is required in order to achieve the 2 °C scenario.

### 4 °C Scenario

<table>
<thead>
<tr>
<th>Japan</th>
<th>EU 28</th>
</tr>
</thead>
<tbody>
<tr>
<td>base year</td>
<td>2013</td>
</tr>
<tr>
<td>target year</td>
<td>2030</td>
</tr>
<tr>
<td>reduction target</td>
<td>▲26%</td>
</tr>
</tbody>
</table>

### 2 °C Scenario

<table>
<thead>
<tr>
<th>SBT target (Global)</th>
</tr>
</thead>
<tbody>
<tr>
<td>base year</td>
</tr>
<tr>
<td>target year</td>
</tr>
<tr>
<td>reduction target</td>
</tr>
</tbody>
</table>

*Scope 1 + 2

- Reduction targets vary from country to country, and many countries targets remain low. Development and utilization of low-carbon materials are not promoted due to weak external pressure for low-carbon materials.

*Data Source:
- Draft Agreement Documents
  - EU 28: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom

**Discussion**

- SBT requires a 30% reduction in Scope 1 + 2 from 2018 to 2030
- **It is necessary to strengthen activities to improve energy efficiency and to invest in energy-saving equipment**
- Demand for low-energy products increases

*Data Source:
- SBTi-tool WB2C Scenario
In the 4 °C scenario, a high global reliance on fossil fuels remains. In the 2 °C scenario, there is a significant shift to renewable energy sources.

**4 °C Scenario**
- **Coal**: 3,793 Mt, 2,040 STEPS ('19), 3,141 Mt, 2,040 STEPS ('20)
- **Petroleum**: 4,453 Mt, 2,040 STEPS ('19), 4,453 Mt, 2,040 STEPS ('20)
- **Natural Gas**: 3,128 Mt, 2,040 STEPS ('19), 3,128 Mt, 2,040 STEPS ('20)
- **Bio Power (Other renewable energy)**: 1,202 Mt, 2,040 STEPS ('19), 1,202 Mt, 2,040 STEPS ('20)
- **Nuclear Power**: 687 Mt, 2,040 STEPS ('19), 896 Mt, 2,040 STEPS ('20)
- **Hydroelectric Power**: 296 Mt, 2,040 STEPS ('19), 575 Mt, 2,040 STEPS ('20)

**2 °C Scenario**
- **Coal**: 3,793 Mt, 2,040 SDS ('19), 3,141 Mt, 2,040 SDS ('20)
- **Petroleum**: 4,453 Mt, 2,040 SDS ('19), 4,453 Mt, 2,040 SDS ('20)
- **Natural Gas**: 3,128 Mt, 2,040 SDS ('19), 3,128 Mt, 2,040 SDS ('20)
- **Bio Power (Other renewable energy)**: 1,202 Mt, 2,040 SDS ('19), 1,828 Mt, 2,040 SDS ('20)
- **Nuclear Power**: 687 Mt, 2,040 SDS ('19), 906 Mt, 2,040 SDS ('20)
- **Hydroelectric Power**: 296 Mt, 2,040 SDS ('19), 524 Mt, 2,040 SDS ('20)

*Other renewables include "solar heat," "geothermal power," "CSP," and "marine energy"*

Source:
- Extracted from IEA “World Energy Outlook 2018” New Policies Scenario and Sustainable Development Scenario numbers
- Extracted from IEA “World Energy Outlook 2019” Stated Policies Scenario and Sustainable Development Scenario numbers
- Extracted from IEA “World Energy Outlook 2020” Stated Policies Scenario and Sustainable Development Scenario numbers
**Energy price: (4) Crude oil price**

Crude oil prices rise under a 4 °C scenario, and fall under a 2 °C scenario

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>Crude oil prices continue to rise between 2019-2040</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>oil price</strong></td>
<td><strong>IEA member countries</strong></td>
</tr>
<tr>
<td>current situation (2019)</td>
<td>63 (USD/barrel) (base year)</td>
</tr>
<tr>
<td>2025</td>
<td>71 (USD/barrel) +13%</td>
</tr>
<tr>
<td>2040</td>
<td>85 (USD/barrel) +35%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 °C Scenario</th>
<th>Crude Oil Prices Fall between 2019-2040</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>oil price</strong></td>
<td><strong>IEA member countries</strong></td>
</tr>
<tr>
<td>current situation (2019)</td>
<td>63 (USD/barrel) (base year)</td>
</tr>
<tr>
<td>2030</td>
<td>57 (USD/barrel) ▲10%</td>
</tr>
<tr>
<td>2040</td>
<td>53 (USD/barrel) ▲16%</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire) Energy demand is increasing, particularly in developing countries. Oil prices rise as decarbonization slows and demand for oil rises.

*Data Source:
- Stated Policies Scenario (oil price) for IEA "World Energy Outlook 2020"
[Energy mix, etc.: (5) Power supply configuration]
In both the 4 °C/2 °C scenarios, the proportion of fossil fuels share of the power mix declines

**4 °C Scenario**
In 2030, 35% less than in 2018

<table>
<thead>
<tr>
<th>Fiscal year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
</tr>
<tr>
<td><strong>power configuration (TWh) (Japan)</strong></td>
</tr>
<tr>
<td>fossil fuel</td>
</tr>
<tr>
<td>coal</td>
</tr>
<tr>
<td>2030</td>
</tr>
<tr>
<td><strong>2030</strong></td>
</tr>
<tr>
<td><strong>2030</strong></td>
</tr>
<tr>
<td>2030</td>
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<tr>
<td><strong>2030</strong></td>
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<td>2030</td>
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<td><strong>2030</strong></td>
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<tr>
<td>2040</td>
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<td><strong>2040</strong></td>
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<tr>
<td>2040</td>
</tr>
<tr>
<td><strong>2040</strong></td>
</tr>
<tr>
<td>2040</td>
</tr>
<tr>
<td><strong>2040</strong></td>
</tr>
<tr>
<td><strong>Discussion</strong></td>
</tr>
<tr>
<td>• (Entire) Demand for gas-fired power generation will remain at a certain level over the long term, although the shift to electricity with lower environmental impact will continue.</td>
</tr>
<tr>
<td>• (energy industry) The gas-fired power generation business will continue to meet a certain level of demand.</td>
</tr>
<tr>
<td>*Data Source:</td>
</tr>
<tr>
<td>• Stated Policies Scenario for IEA &quot;World Energy Outlook 2020&quot;</td>
</tr>
</tbody>
</table>

**2 °C Scenario**
Approximately half the 2018 level by 2030

<table>
<thead>
<tr>
<th>Fiscal year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
</tr>
<tr>
<td><strong>power configuration (TWh) (Japan)</strong></td>
</tr>
<tr>
<td>fossil fuel</td>
</tr>
<tr>
<td>coal</td>
</tr>
<tr>
<td>2030</td>
</tr>
<tr>
<td><strong>2030</strong></td>
</tr>
<tr>
<td><strong>2030</strong></td>
</tr>
<tr>
<td>2030</td>
</tr>
<tr>
<td><strong>2030</strong></td>
</tr>
<tr>
<td>2040</td>
</tr>
<tr>
<td><strong>2040</strong></td>
</tr>
<tr>
<td>2040</td>
</tr>
<tr>
<td><strong>2040</strong></td>
</tr>
<tr>
<td>2040</td>
</tr>
<tr>
<td><strong>2040</strong></td>
</tr>
<tr>
<td><strong>Discussion</strong></td>
</tr>
<tr>
<td>• (Entire) In 2030, demand for coal-fired and oil-fired thermal power plants, which have a large environmental impact, will decline significantly, but demand for gas-fired thermal power plants, which have a relatively small environmental impact will remain relatively small due to issues securing power sources.</td>
</tr>
<tr>
<td>• (Entire) The share of gas-fired power generation will decline at an accelerated pace in the long run due to stricter emission regulations at power plants and increased demand for environmentally friendly power.</td>
</tr>
<tr>
<td>• (Energy Industry) Shifting to nuclear power generation and renewable energy businesses due to stricter regulations and changes in demand</td>
</tr>
<tr>
<td>*Data Source:</td>
</tr>
<tr>
<td>• IEA &quot;World Energy Outlook 2020&quot; Sustainable Development Scenario</td>
</tr>
</tbody>
</table>
**[Energy mix, etc.: (6) Engine sales]**

Unit sales increase under the 4 °C scenario but decrease under the 2 °C scenario

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>Sales of Engine-Equipped Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Global sales of engine-powered vehicles *</td>
<td>**</td>
</tr>
<tr>
<td>2015</td>
<td>98.5 million units/year</td>
</tr>
<tr>
<td>2060</td>
<td>147.08 million units/year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 °C Scenario</th>
<th>Sales of engine-powered vehicles declined sharply</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Global sales of engine-powered vehicles *</td>
<td>**</td>
</tr>
<tr>
<td>2015</td>
<td>98.5 million units/year</td>
</tr>
<tr>
<td>2060</td>
<td>14.04 million units/year</td>
</tr>
</tbody>
</table>

* Vehicles equipped with an internal combustion engine (Including HV, PHV, CNG and LNG vehicles), excluding EVs (electric (al) vehicle) and FCVs (fuel cell vehicle)

**Discussion**

- (Entire) The production volume of ZEV has been fluctuating. Production volume of in-vehicle engines as a percentage of new vehicle sales remain steady
- (Energy Industry) ZEV promotion support policies such as purchase subsidies will be phased out (The same goes for infrastructure policy.)

*Data Source:
- IEA "Energy Technology Perspectives 2017" RTS Scenarios
  * Deloitte estimates for 2030 are based on IEA projections

- (Entire) Expanding market share of ZEV towards low-carbon society. As a result, sales of engine-powered vehicles declined substantially.
- (Energy Industry) Decreased production of in-vehicle engines and decreased demand for oil and natural gas

*Data Source:
- IEA "Energy Technology Perspectives 2017" B2DS Scenario
  * Deloitte estimates for 2030 are based on IEA projections
[Changes in customer behavior: (7) Energy consumption at home]

Household consumption of fossil fuels decreases substantially in the 2 °C scenario

**2 °C Scenario**

Dramatic decrease in household oil and gas consumption

<table>
<thead>
<tr>
<th>Year</th>
<th>Electrical</th>
<th>Petroleum</th>
<th>Gas</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>10,655 base year</td>
<td>3,190 base year</td>
<td>10,817 base year</td>
<td>4,467</td>
</tr>
<tr>
<td>2040</td>
<td>10,867 +2%</td>
<td>787 ▲75%</td>
<td>8,132 ▲25%</td>
<td>4,688</td>
</tr>
<tr>
<td>2050</td>
<td>11,163 +5%</td>
<td>357 ▲88%</td>
<td>6,974 ▲36%</td>
<td>4,716</td>
</tr>
</tbody>
</table>

**Discussion**

- Policies for electrification of residential facilities is actively implemented to meet the government's ZEH target (Achieved average ZEH for new buildings by 2030)
- Demand for electricity is rising, while demand for gas is falling
- Demand for petroleum (kerosene) as an energy source has decreased by approximately 90% due to rising prices driven by the introduction of a carbon tax and a decline in re-energy costs.

*Data Source:*
1. IEA "Energy Technology Perspectives 2017" 2 °C Scenario
**[Extreme Extreme Weather: (8) Flood Damage]**

**At 4 °C, domestic flood damage more than doubles**

<table>
<thead>
<tr>
<th>4 °C Scenario (No data at 2 °C)</th>
<th>Flood Damage Rises Nationwide</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Flood damage in urban areas (Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2010</strong></td>
<td>3.3 billion USD/year (base year)</td>
</tr>
<tr>
<td><strong>2030</strong></td>
<td>7.3 billion USD/year</td>
</tr>
<tr>
<td></td>
<td>(+121% Increase due to socioeconomic change 1.7 billion USD)</td>
</tr>
<tr>
<td></td>
<td>(+121% Increase due to climate change (USD 2.2 billion))</td>
</tr>
</tbody>
</table>

**Discussion**
- Inundation caused by heavy rain increases, and inundation damage in low-lying areas increases.
- Inundation damage occurs at low ground around rivers, and if the relay facilities are inundated, there is a possibility that electricity and gas supply will be cut off.

*Data Source:
WRI “The Aqueduct Global Flood Analyzer”
(Scenario based on RCP 8.5 (4 °C Scenario) and SSP2 (moderate socioeconomic fluctuations) with flood prevention measures implemented over a period of 50 years)*

**Estimating Flood Range and Damage (2030)**

Current probability of inland flooding in any given year:
- 0%
- 0% - 0.1%
- 0.1% - 1%
- 1% - 2%
- 2% - 4%
- 4% - 10%
- > 10%

![Map of Japan with flood risk areas]
Observations for storms, cyclones, and typhoons are highly uncertain and do not have clear projections. Typhoons may decrease in number and increase in power.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Global</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>generatio</strong></td>
<td>Overall, no change</td>
<td>Past statistics show no clear long-term trend in the number of typhoons occurring, the number of typhoons approaching, and the power of typhoons. However, in the future, the frequency of typhoons may decrease or not change, while the power of typhoons may increase.</td>
</tr>
<tr>
<td><strong>on Frequenc</strong></td>
<td>Large tropical cyclones may decline in southern hemisphere</td>
<td></td>
</tr>
<tr>
<td><strong>power</strong></td>
<td>augmentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potential increase in large tropical cyclones (Categories 4 and 5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small tropical cyclones may decline</td>
<td></td>
</tr>
<tr>
<td><strong>precipitation</strong></td>
<td>increase</td>
<td>+ 8% to + 36% (Rate of future increases in precipitation due to heavy rain)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In Japan Number of typhoons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>curren</strong></td>
</tr>
<tr>
<td><strong>situation</strong></td>
</tr>
<tr>
<td><strong>future</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

- (Entire) Technology for observing and predicting storms, cyclones, and typhoons advances, but it is difficult to completely avoid damage.
- (government) Establishment of incentives such as subsidies for technological development of observation and prediction concerning storms, cyclones and typhoons.

(Source)
- National Oceanic and Atmospheric Administration (NOAA)
- Japan Meteorological Agency "Extreme Weather Report 2014"
- Ministry of the Environment, Japan Meteorological Agency, "Climate of Japan at the end of the 21 century (2015)"
Appendix

Appendix 1. Sector Climate Risk Assessment Materials

Appendix 2. Parameters used in the scenario group definition

① Real estate sector
② Energy sector
③ Automotive sector
### [(3) Automobile sector parameters]

For key risks and opportunities, forecast data for the 2 °C/4 °C scenario was collected as parameters for consideration.

<table>
<thead>
<tr>
<th>Important Item (Subject of Analysis)</th>
<th>Configured Parameter</th>
<th>Current</th>
<th>4 °C</th>
<th>2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before 2030</td>
<td>After 2040</td>
</tr>
<tr>
<td>Carbon tax and carbon price</td>
<td>(1) carbon tax</td>
<td>Japan: N/A</td>
<td>(2030) N/A</td>
<td>(2040) N/A</td>
</tr>
<tr>
<td>Compliance with GHG emission regulations</td>
<td>(2) carbon emission reduction target</td>
<td>(base year) 4 °C: Varies by country 2 degrees C: 2018 years</td>
<td>(2030) High targets limited to certain countries</td>
<td>N/A</td>
</tr>
<tr>
<td>Energy price</td>
<td>(3) oil price</td>
<td>(2019) 63 USD/barrel</td>
<td>(2030) 76 USD/barrel</td>
<td>(2040) 85 USD/barrel</td>
</tr>
<tr>
<td>(4) sales of engine-powered vehicles</td>
<td>(2015) base year</td>
<td>(2030) +16%</td>
<td>(2060) +49%</td>
<td>(2030) ▲29%</td>
</tr>
<tr>
<td>Extreme severity of abnormal weather</td>
<td>(6) flood damage</td>
<td>(2010) base year</td>
<td>(2030) +67%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(7) typhoon</td>
<td>N/A</td>
<td>N/A</td>
<td>(2100) All typhoons - 5.7% Fierce typhoon + 3.6%</td>
</tr>
</tbody>
</table>
[Carbon price/tax: (1) Carbon tax]
Under the 2 °C scenario, both developed and developing countries are introducing carbon taxes.

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>The introduction of carbon tax is limited to some countries.</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2018)</td>
<td>Japan</td>
</tr>
<tr>
<td>N/A</td>
<td>8 US $/ tCO2</td>
</tr>
<tr>
<td>2030</td>
<td>N/A</td>
</tr>
<tr>
<td>2040</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 °C Scenario</th>
<th>Carbon tax will be introduced regardless of country or region</th>
</tr>
</thead>
<tbody>
<tr>
<td>current situation (2018)</td>
<td>developed country</td>
</tr>
<tr>
<td>(Reference) Average winning bid price in European EU-ETS: approximately US $8/t “Implementation and review of emissions trading in other countries” From (Ministry of the Environment Report, 2016)</td>
<td>N/A</td>
</tr>
<tr>
<td>2030</td>
<td>100 US $/ tCO2</td>
</tr>
<tr>
<td>2040</td>
<td>140 US $/ tCO2</td>
</tr>
</tbody>
</table>

Discussion:
- (Entire): As global carbon prices rise in order to reach the 2 °C target, the government promotes the introduction of carbon taxes and emissions trading. On the other hand, companies that emit large amounts of GHGs are increasingly requested by governments and business partners and engaged by investors.
- (Automobile Industry) Higher carbon taxes increase production costs and reduce price competitiveness
- (Automobile Industry) Requires additional energy efficient capital expenditures
- (Buyer) to buy low-carbon, low-cost energy with lower GHG emissions
- (Substitute) Mainstreaming low carbon energy with low GHG emissions

Data Source:
- Extracted from IEA "World Energy Outlook 2019" New Policies Scenario (NPS) numbers
- Extracted from IEA "World Energy Outlook 2019" Sustainable Development Scenario figures
**[Energy price: (2) Crude oil price]**

**Crude oil prices rise under the 4 °C scenario, and fall under the 2 °C scenario**

<table>
<thead>
<tr>
<th><strong>4 °C Scenario</strong></th>
<th>Crude oil prices rise in 2040 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>oil price</strong></td>
<td><strong>IEA member countries</strong></td>
</tr>
<tr>
<td>current situation (2019)</td>
<td>63 (USD/barrel) (base year)</td>
</tr>
<tr>
<td>2030</td>
<td>76 (USD/barrel) +21%</td>
</tr>
<tr>
<td>2040</td>
<td>85 (USD/barrel) +35%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>2 °C Scenario</strong></th>
<th>Crude Oil Prices Fall in 2040 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>oil price</strong></td>
<td><strong>IEA member countries</strong></td>
</tr>
<tr>
<td>current situation (2019)</td>
<td>63 (USD/barrel) (base year)</td>
</tr>
<tr>
<td>2030</td>
<td>56 (USD/barrel) -11%</td>
</tr>
<tr>
<td>2040</td>
<td>53 (USD/barrel) -16%</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire) Energy demand is increasing, particularly in developing countries. Oil prices rise as decarbonization slows and demand for oil rises.

*Data Source:
- Stated Policies Scenario (oil price) for IEA "World Energy Outlook 2020"

---

<table>
<thead>
<tr>
<th><strong>4 °C</strong></th>
<th><strong>2 °C</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>+21%</td>
<td>-11%</td>
</tr>
<tr>
<td>85</td>
<td>53</td>
</tr>
<tr>
<td>+35%</td>
<td>-16%</td>
</tr>
</tbody>
</table>

**Discussion**

- (Entire) Demand for oil decreases as the share of demand for renewable energy increases. Crude oil prices fall slightly.

*Data Source:
- IEA "World Energy Outlook 2020" Sustainable Development Scenario (oil price)
In the 4 °C scenario sales of engine-powered vehicles continue to grow, while under the 2 °C scenario they are expected to decrease substantially.

### 4 °C Scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Global sales of engine-powered vehicles *</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>98.5 million units/year base year</td>
</tr>
<tr>
<td>2060</td>
<td>147.08 million units/year +49%</td>
</tr>
</tbody>
</table>

* Vehicles equipped with an engine: Vehicles equipped with an internal combustion engine (Including HV, PHV, CNG and LNG vehicles), excluding EVs (electric(al) vehicle) and FCVs (fuel cell vehicle)

### 2 °C Scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Global sales of engine-powered vehicles *</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>98.5 million units/year base year</td>
</tr>
<tr>
<td>2060</td>
<td>14.04 million units/year -86%</td>
</tr>
</tbody>
</table>

* Data Source:
  - IEA "Energy Technology Perspectives 2017" RTS Scenarios
  - Deloitte estimates for 2030 are based on IEA projections

**Discussion**

- (Entire) The production volume of ZEV has been fluctuating. Production volume of in-vehicle engines as a percentage of new vehicle sales remains steady.
- (Automobile Industry) ZEV promotion support policies such as purchase subsidies will be phased out (the same goes for infrastructure policy.)

**Data Source:**
- IEA "Energy Technology Perspectives 2017" RTS Scenarios
- Deloitte estimates for 2030 are based on IEA projections

- (Entire) The market share of ZEV towards low-carbon society is expanding. As a result, sales of engine-powered vehicles declined substantially.
- (Automobile Industry) There is decreasing production of in-vehicle engines and decreasing demand for oil and natural gas.

**Data Source:**
- IEA "Energy Technology Perspectives 2017" B2DS Scenario
- Deloitte estimates for 2030 are based on IEA projections
Under the 4 °C scenario, sales of PHVs and ZEVs increase slightly in 2030, whereas under the 2 °C scenario they are expected to increase significantly.

<table>
<thead>
<tr>
<th>4 °C Scenario</th>
<th>2 °C Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% of UIO base will be PHV/ZEV in 2030</td>
<td>Approximately 40% of UIO base will be converted to PHV/ZEV in 2030</td>
</tr>
</tbody>
</table>

### Sales Achievement (17 years)

<table>
<thead>
<tr>
<th>Year</th>
<th>Japan</th>
<th>US * Reference</th>
<th>China * Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>28000 @ '16 (EV, PHV, FCV)</td>
<td>760,000 units (EV and PHV)</td>
<td>1.23 million units (EV and PHV)</td>
</tr>
<tr>
<td>2040</td>
<td>PHV/ZEV: 5% (72.38 million units)</td>
<td>*Percentage and number of UIOs globally</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>PHV/ZEV: 8% (189.07 million units)</td>
<td>*Percentage and number of UIOs globally</td>
<td></td>
</tr>
</tbody>
</table>

### Discussion

- (Entire) Same as before
- (Government) Suspension of ZEV promotion support policies such as purchase subsidies
  *The same is true for infrastructure development support measures*
- (Buyer) Due to infrastructure issues, a small product lineup for next-generation vehicles, and high costs, customers’ willingness to purchase next-generation vehicles does not increase, and as a result, the ICE-centered market continued.

*Data Source:
- IEA Report (30 May 2018) * Japan: Statistics from Next-Generation Vehicle Promotion Center
- Global Calculator’s IEA2DS Proactive ZEV Deployment Scenario
  (Tools using IEA Energy Technology Outlook 2014 data)
Under the 4 °C scenario, domestic flood damage more than doubles

<table>
<thead>
<tr>
<th>4 °C Scenario (No data at 2 °C)</th>
<th>Flood Damage Rises Nationwide</th>
</tr>
</thead>
</table>

### Flood damage in urban areas (Japan)

<table>
<thead>
<tr>
<th>Year</th>
<th>Damage</th>
<th>Increase Due To Socioeconomic Change</th>
<th>Increase Due To Climate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3.3 billion USD/year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>730 million USD/year</td>
<td>+121%</td>
<td>2.2 billion USD</td>
</tr>
</tbody>
</table>

*Data Source: WRI “The Aqueduct Global Flood Analyzer” (Scenario based on RCP 8.5 (4 °C Scenario) and SSP2 (moderate socioeconomic fluctuations) with flood prevention measures implemented over a period of 50 years)*

**Discussion**

- Inundation caused by heavy rain increases, and inundation damage in low-lying areas also increases
- Inundation damage can occur in the low-lying areas around rivers, causing disruptions to the transport industry’s supply network
- In the event that a warehouse or manufacturing base for finished vehicles is flooded, facilities will be damaged and there will be an opportunity loss due to suspension of operations.
**Observations for storms, cyclones, and typhoons are highly uncertain and do not have clear projections**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Global</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>generation Frequency</strong></td>
<td>Overall, no change</td>
<td>Past statistics show no clear long-term trend in the number of typhoons occurring, the number of typhoons approaching, and the power of typhoons. However, in the future, the frequency of typhoons may decrease or not change, while the power of typhoons may increase.</td>
</tr>
<tr>
<td><strong>power</strong></td>
<td>Augmentation</td>
<td>(Global warming is expected to reduce the number of typhoons occurring in the Northwest Pacific and shift the area of typhoons to the east, resulting in a decrease in the number of typhoons approaching the area and changes in the route of typhoons, but there is high uncertainty.)</td>
</tr>
<tr>
<td><strong>precipitation</strong></td>
<td>Increase</td>
<td><strong>+ 8% to + 36%</strong> (Rate of future increases in precipitation due to heavy rain)</td>
</tr>
</tbody>
</table>

### Discussion
- (Entire) Technology for observing and predicting storms, cyclones, and typhoons advances, but it is difficult to completely avoid damage.
- (government) Establishment of incentives such as subsidies for technological development of observation and prediction concerning storms, cyclones and typhoons

### In Japan

<table>
<thead>
<tr>
<th>In Japan Number of typhoons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current situation</strong> (16 years)</td>
</tr>
<tr>
<td><strong>Future (~ 2100 years)</strong></td>
</tr>
</tbody>
</table>

### (Source)
- National Oceanic and Atmospheric Administration (NOAA)
- Japan Meteorological Agency "Extreme Weather Report 2014"
- Ministry of the Environment, Japan Meteorological Agency, "Climate of Japan at the end of the 21 century (2015)"