Practical guide for Scenario Analysis in line with TCFD recommendations

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

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Contents

[Objective of the Practical Guide]
Introduce “practical” examples, to which companies can refer when performing scenario analysis aligned the TCFD Recommendations

Issue	While Japan’s companies are prepared to meet the requirements of the TCFD recommendations, the process of scenario analysis itself is not well known among them, and almost no case studies are available.
Objective of the Guide	The Guide has compiled practice examples of the TCFD recommendations subject to the support programs of the Ministry of Environment to help companies to some extent perform scenario analysis on their own.

(Reference: Scenario analysis in the TCFD recommendations)

- The TCFD recommendations is a set of requirements that the financial industry has sent out based upon the Paris Agreement, calling on business management to make climate change efforts.
- The TCFD recommendations call for climate-related financial reporting and business management focusing on four core elements – i.e. governance, strategy, risk management, and metrics and targets.
- For strategy, in particular, companies are recommended to perform scenario analysis for financial impacts under multiple climate-change scenarios.
- Scenario analysis helps companies develop robust strategies under a wider range of uncertain future conditions.

[Structure and Usage of the Practical Guide]
The Guide consists of “Content of the TCFD Recommendations”, “Steps in Scenario Analysis”, “Practice Examples”, and “References”

Corporate needs	Chapters of the Practical Guide and Their Summaries
Companies want to know what the TCFD recommendations are, and what kind of climate-related financial disclosures are recommended.	**Chapter 1. Summary of the TCFD Recommendations** This chapter explains why the TCFD was established, what the TCFD recommends, and what kind of climate-related disclosures are recommended.
Companies want to know each step of scenario analysis performed by other Japanese companies.	**Chapter 2. Scenario Analysis - Practice Examples (six companies)** This chapter presents scenario analysis performed by selected companies under the support program of the Ministry of the Environment and explains how to undertake scenario analysis.
Companies want to see how to perform scenario analysis for climate-related disclosures	**Chapter 3. Publicly Available Scenario Analysis** This chapter presents corporate efforts for scenario analysis in accordance with the steps recommended by the TCFD.
Companies want useful references for risk importance assessment in scenario analysis.	**Chapter 4. References on Degree of Risk Importance in Selected Sectors** This chapter provides materials for scenario analysis, part of which were used for assessment of the degree of risk importance under the Ministry’s support program.

- The Practical Guide provides the method for TCFD scenario analysis created on its own methodology and interpretation of the “TCFD’s Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities” (July 2017).
- Facts and figures in the case studies are as of the time of acquisition.

1. What are the TCFD recommendations?

1-1. Summary of the TCFD recommendations

1-2. Requirements of the TCFD recommendations and meaning of scenario analysis

Chapter 1. Summary of the TCFD Recommendations

This chapter explains why the TCFD was established and what the TCFD recommends, and what kind of climate-related disclosures are recommended.

[Background of the TCFD]

Climate change risks could destabilize the financial system and become a possible threat to financial institutions

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

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

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

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

Source: Financial Times Online, September 30, 2015

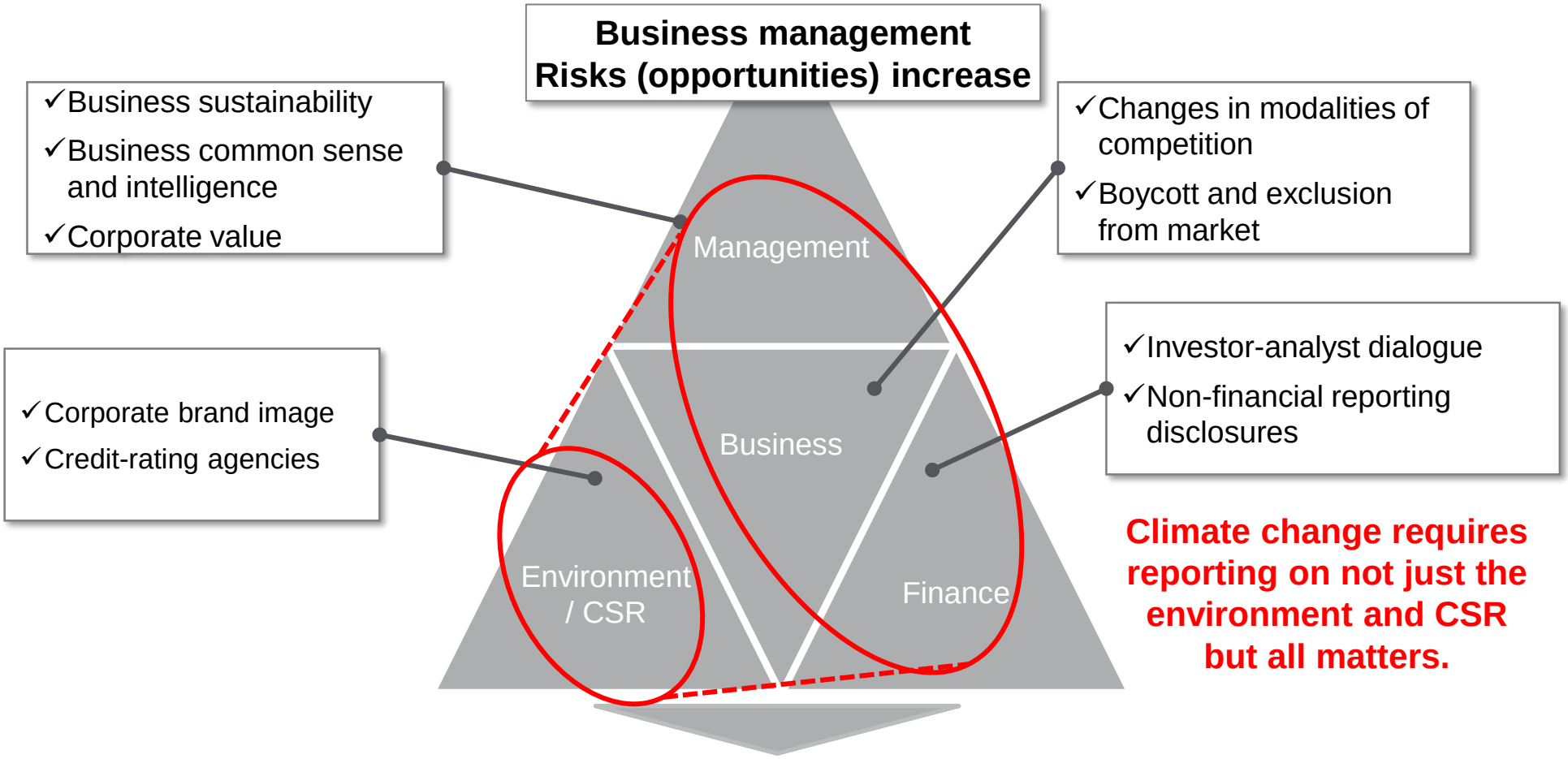
[What are the TCFD recommendations?]
The TCFD recommendations are financial disclosure framework focusing on climate-related information

- The TCFD final report sets out a framework to disclose climate-related financial information for investors.
- The TCFD recommends that businesses disclose the potential impacts of climate change on their organizations.

GRI	IIRC	TCFD
Global Reporting Initiative™	INTEGRATED REPORTING <IR>	TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES
For multi-stakeholders	For investors	For investors
ESG information	ESG information	Climate-related information

Focusing on climate-related information for investors

[Climate Change and Corporate Management]
Climate change can present clear risks and opportunities for business management



The TCFD recommendations serve as a tool for dialogue with investors, helping enterprises recognize climate-related risks and opportunities, and planning business strategies incorporating such risks and opportunities.

[Acceptance of the TCFD recommendations]
The TCFD is a Europe-led initiative, supported by an increasing number of Japanese companies

- (As of March 14, 2019), 537 financial and non-financial enterprises in 48 countries and 65 governments, international organizations, and industry organizations announced their support of the TCFD recommendations. The Ministry of the Environment announced July 27, 2018 that it agreed to adopt the TCFD recommendations.
- These supporters include financial firms responsible for assets of nearly $100 trillion, as of September 2018, and the figure is still increasing (according to the 2018 status report).

List of Japanese companies and other organizations supporting the TCFD recommendations
(as of March 14, 2019)

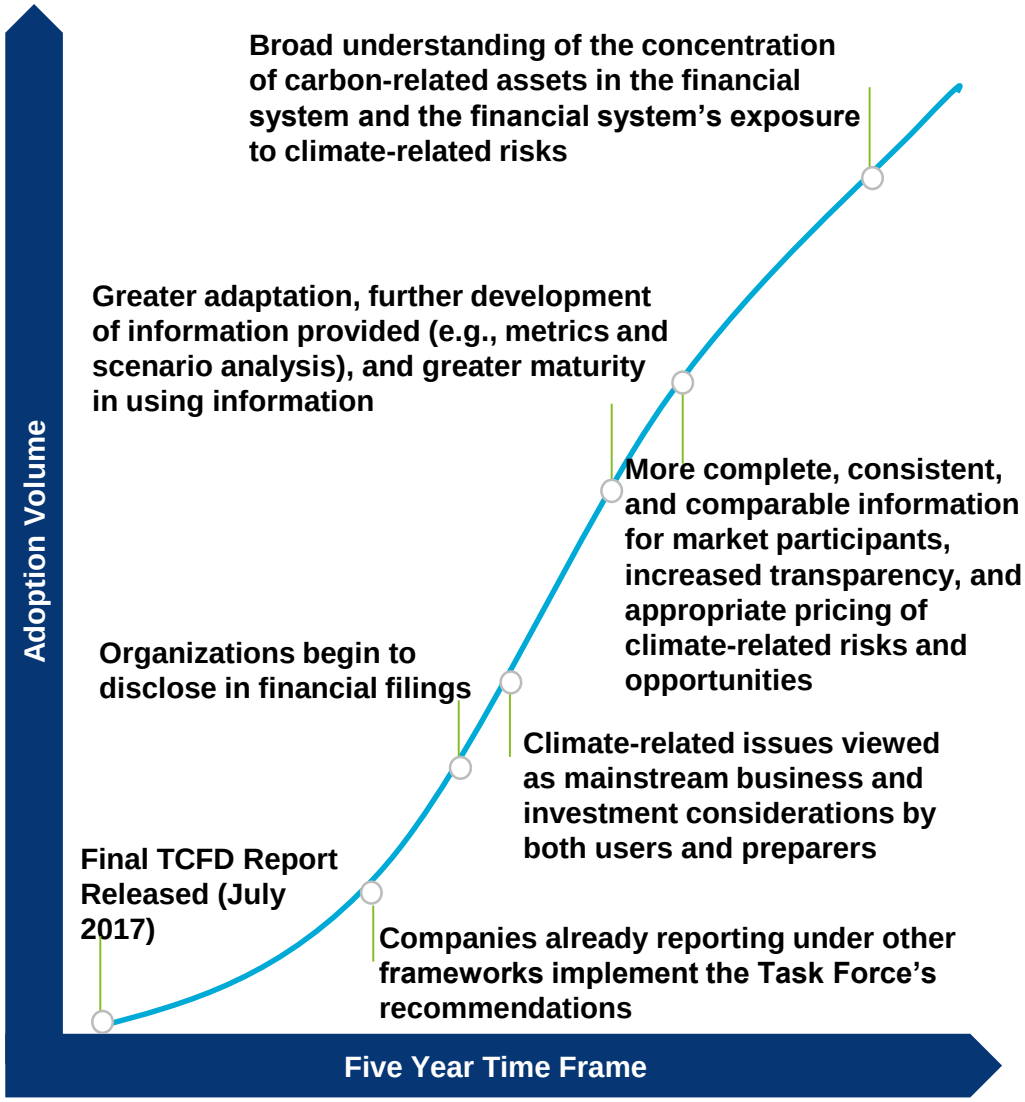
Financial (22)	MS&AD Insurance Group Holdings, Inc. / Rating and Investment Information, Inc. / THE SHIGA BANK, LTD. / Sophia University Endowment* / SOMPO Holdings, Inc. / Dai-ichi Life Holdings, Inc. / Daiwa Securities Group / Tokio Marine / Nikko Asset Management / Nissay Asset Management Corporation / Development Bank of Japan / Nippon Life Insurance Company / Japan Exchange Group Inc. / Government Pension Investment Fund (GPIF) / Nomura Holdings, Inc. / Mizuho Financial Group / Sumitomo Mitsui Trust Asset Management Co., Ltd. / Sumitomo Mitsui Trust Holdings, Inc. / Sumitomo Mitsui Financial Group / Mitsubishi UFJ Financial Group, Inc. / Meiji Yasuda Life Insurance Company / Resona Holdings, Inc.
Non-Financial (32)	E-Square Inc. / NEC Corporation / OMRON Corporation / Kao Corporation / Kawasaki Kisen Kaisha, Ltd. / Kirin Holdings Company, Limited. / Kokusai Kogyo Co., Ltd. / Konica Minolta, Inc. / CSR Design Green Investment Advisory, Co., Ltd. / JTEKT CORPORATION / Mitsui O.S.K. Lines, Ltd. / Sumitomo Chemical / Sumitomo Forestry Co., Ltd. / SEKISUI CHEMICAL CO., LTD. / Sekisui House, Ltd. / Sojitz Corporation / Daiwa House Industry Co., Ltd. / Teijin Group / Nikon Corporation / NYKLine / Neural / Nomura Research Institute, Ltd. / Hitachi, Ltd. / FUJIFILM Holdings Corporation / MARUI GROUP CO.,LTD. / Mitsui Chemicals, Inc. / Mitsui & Co., Ltd. / Mitsubishi Chemical Holdings Corporation / Mitsubishi Heavy Industries, Ltd. / Mitsubishi Corporation / Yokogawa Electric Corporation / Ricoh Company, Ltd.
Other (8)	Ministry of Environment (MOE) / Financial Services Agency (FSA) / Ministry of Economy, Trade and Industry (METI) / Japanese Bankers Association / The Investment Trusts Association, Japan (JITA) / Japanese Institute of Certified Public Accountants (JICPA) / Japan Securities Dealers Association / Japan Investment Advisers Association (JIAA)

* A fund operated by Sophia School Corporation (https://www.sophia.ac.jp/jpn/news/PR/2018/20190218tcfd.html)

 Source: website of the TCFD

[Objectives of the TCFD recommendations and Widespread Adoption]
The TCFD recommendations expect companies to gradually adopt the recommendations. A growing number of countries are putting them into their official frameworks

Objectives of the TCFD



(Resources) Task Force on Climate-related Financial Disclosures, 2017

Government Support

EU to revise its directive to comply with the TCFD recommendations

EU

- The European Commission held a stakeholder meeting to revise the guidelines of the Non-Financial Reporting Directive (by 2Q 2019). It will publish the final report within 2018.

UK requests its regulators to support the TF recommendations

United Kingdom

- The UK Green Finance Taskforce, established by the government to transition to a low-carbon economy.
- Recommends that relevant financial regulators should support TCFD recommendations (Mar 2018).

Canada considers institutionalizing the TCFD recommendations

Canada

- The Minister of Environment and Climate Change and the Minister of Finance launched an Expert Panel on Sustainable Finance, which discussed and published an interim report on institutionalization of the recommendations (Oct 2018).

France to make the TCFD recommendation mandatory

France

- Secretary of State Brune Poirson stated that the government would push for the recommendations to be made mandatory (Jun 2017).

China to revise the guidelines for environment reporting

China

- The government established a pilot project jointly with the UK government, examining the possibility of incorporating the TCFD recommendations in its guidelines for environmental reporting (Jan 2018)

The central bank requests companies to support the TCFD recommendations

Netherlands

- A working group on climate risks was established by the central bank, requesting companies to support the recommendations (Apr 2018).

Government support to integrate the recommendations in official framework

Sources: TCFD, "2018 Status Report", websites of the Ministry of Environment of Japan, the European Commission, and other governmental organizations, and publicly available information

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1-2. Requirements of the TCFD recommendations and meaning of scenario analysis

Chapter 1. Summary of the TCFD Recommendations

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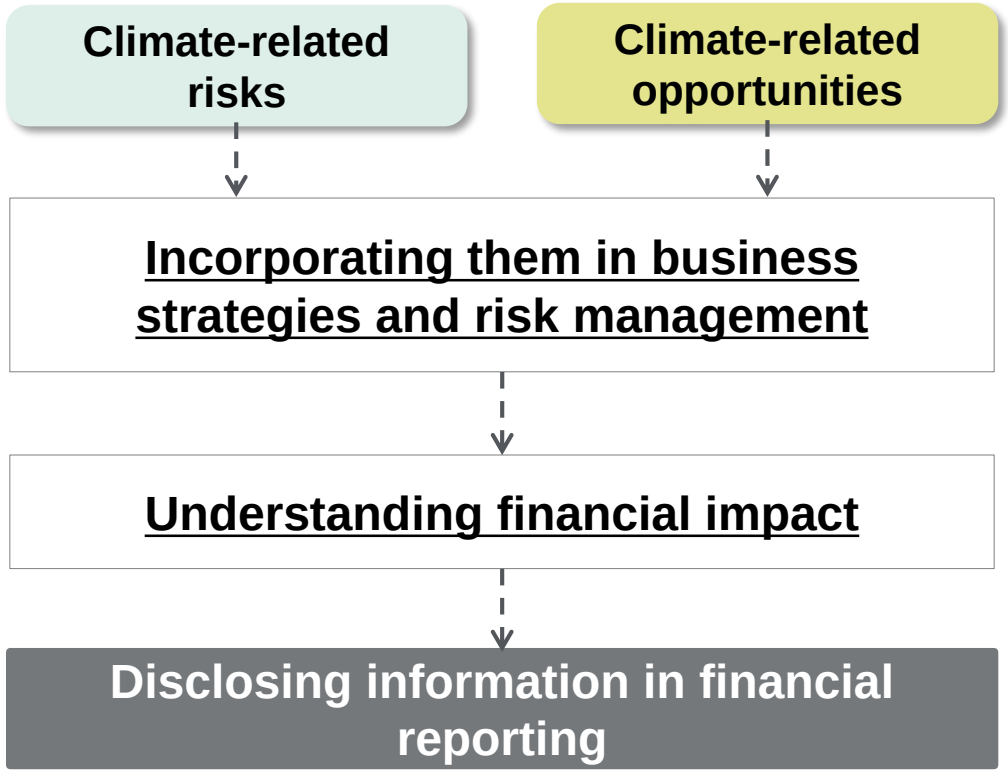
[Requirements of the TCFD Recommendations]
The TCFD recommends disclosure of information related to climate change that poses financial risks and opportunities

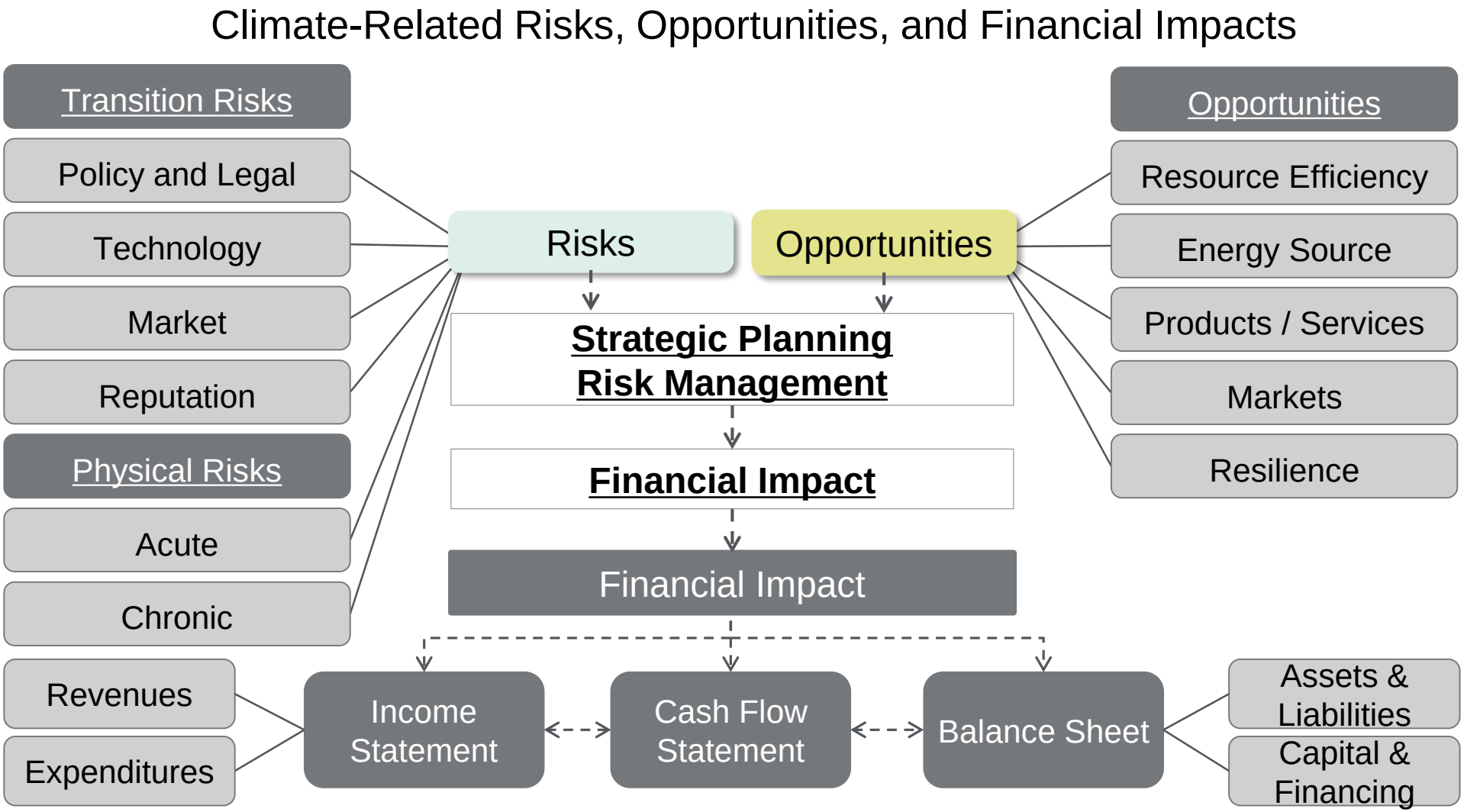


The TCFD recommendations request all companies to (i) use different climate-related scenarios, including a 2°C or lower scenario to (ii) assess their climate-related risks and opportunities, (iii) incorporate such risks and opportunities in their business strategies and risk management, and (iv) understand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

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

[Financial Impact]

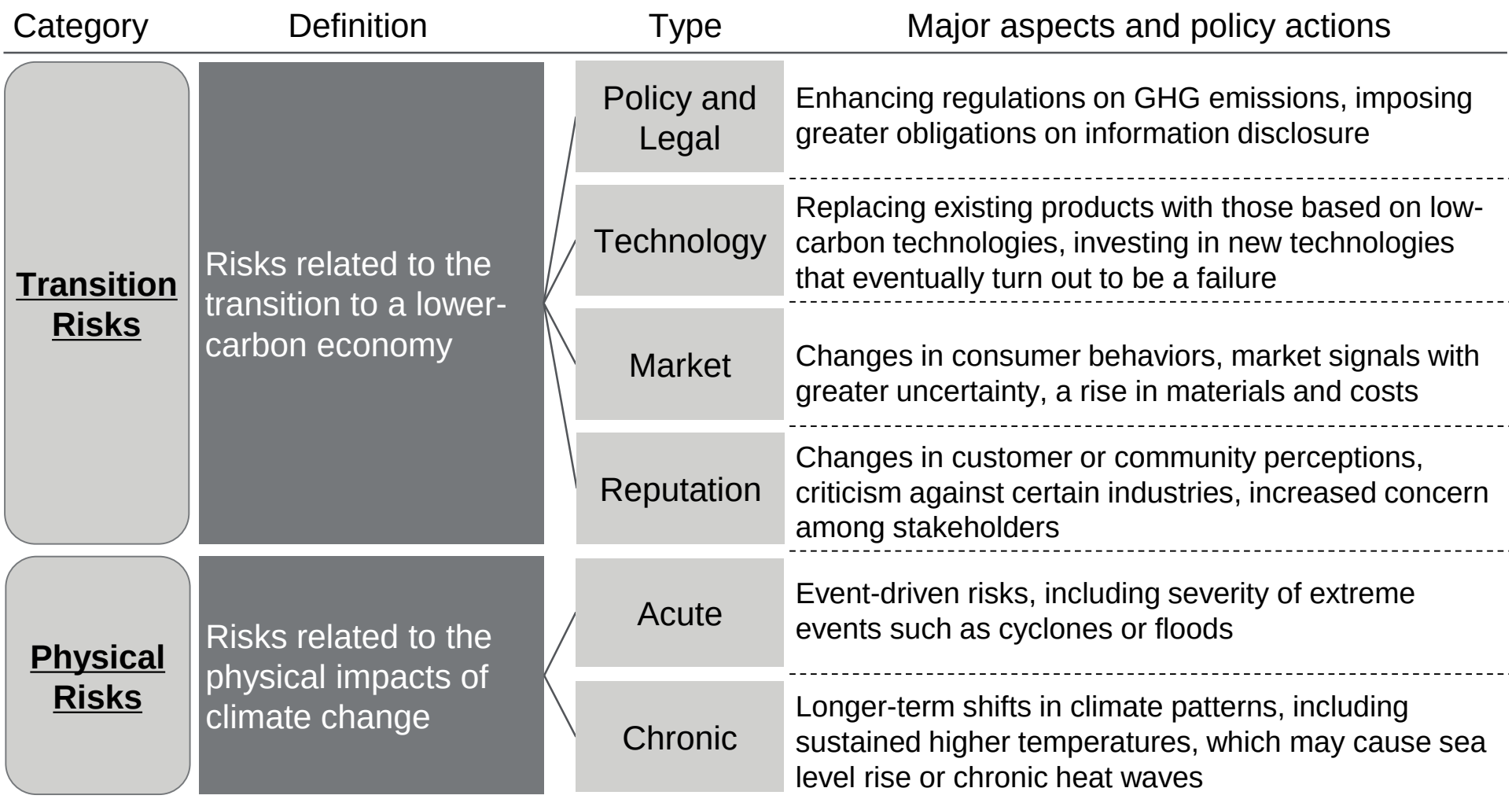
The TCFD recommendations present the scope of climate-related risks and opportunities, and financial impacts to be disclosed



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

[Climate-related Risks]

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



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

[Climate-related Opportunities]

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

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

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

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

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

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

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

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

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

[Governance = Involvement of Management]

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

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

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

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

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

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

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

[Strategy]

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

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

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

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

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

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

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

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

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

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

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

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

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

The organization's processes for managing climate-related risks

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

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

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

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

[Metrics and Targets]

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

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

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

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

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

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

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

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

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

[Significance of Scenario Analysis (i)]
The TCFD recommends that organizations perform scenario analysis to assess the potential business implications of climate-related risks and opportunities, and disclose assessments. The TCFD's technical supplement provides more information on scenario analysis

The TCFD recommends that organizations perform scenario analysis to assess the potential business implications of climate-related risks and opportunities, and disclose assessments. The TCFD's technical supplement provides more information on scenario analysis.

Why scenario analysis is a useful tool

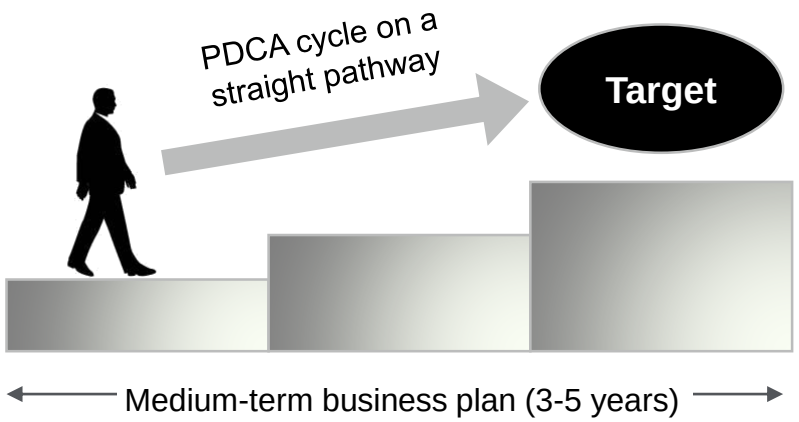
- Scenario analysis can help organizations consider issues whose possible outcomes are highly uncertain and will play out over the medium to longer term. It can also enhance organizations' strategic conversations about the future.
- **Organizations with more significant exposure to climate-related issues should consider disclosing key assumptions and pathways related to the scenarios they use.** Scenario analysis is complex and requires resources, but brings benefit to organizations.

Target	Applicable scenarios
Transition risks	■ IEA WEO 450/ETP 2DS/IEA WEO Bridge/IEA WEO INDC (2°C or lower scenarios and other scenarios) ■ Deep decarbonizaion Pathways Project (2°C or lower scenario) ■ IRENA Remap (the renewable energy ratio to be doubled by 2030) ■ Greenpeace Advanced Energy [R]evolution (2°C or lower scenario)
Physical risks	■ IPCC Representative Concentration Pathway (RCP) Scenarios: RCP8.5, RCP6.0, RCP4.5, RCP2.6

Sources: prepared by the Ministry of Environment based on the Task Force on Climate-related Financial Disclosures, "Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures", 2017. p. 25-29, the Task Force on Climate-related Financial Disclosures, "Technical Supplement - The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities", 2017. p.21 and p.25

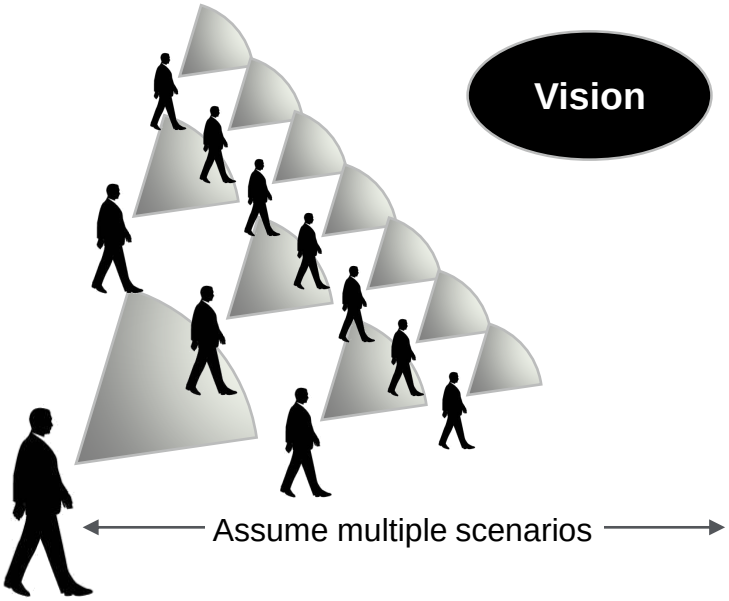
[Significance of Scenario Analysis (ii)]
Scenario analysis can enhance strategic planning in response to uncertainty in future, as well as internal and external dialogue

In a reasonably foreseeable term...



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

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



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

[Corporate Challenges in Performing Scenario Analysis]
The Practical Guide supports companies in handling three challenges frequently faced when performing scenario analysis

- **When undertaking scenario analysis, companies often face the following three challenges.**
  - (i) Actual scenarios for analysis and key parameters to be tied are not easily accessible to a wide majority of companies.
  - (ii) Scenario analysis requires different execution processes and participation of different divisions or departments, depending on the nature of companies. One cannot say that a certain division or department in the organization should undertake scenario analysis.
  - (iii) It is fairly hard work to make management understand the results of scenario analysis.

- **The Practical Guide offers solutions to these challenges.**
  - * (i) and (ii): Understand “Practice Examples”, “Disclosure Examples”, and “Importance of Risks”.
  - * (iii): Perform scenario analysis with parameters that you can handle. Start dialogue with management over the (quantitative) results.

- **The key is to begin scenario analysis with what you understand, and progress and deepen your knowledge and experience.**
  - * e.g. First, conduct qualitative scenario analysis. Then, try quantitative scenario analysis.
  - * e.g. First, apply scenario analysis to a certain segment. Then, apply to a greater part of your company.

2. Scenario Analysis - Practice Examples

Chapter 2. Scenario Analysis - Practice Examples (six companies)

This chapter presents scenario analysis performed by selected companies under the support program of the Ministry of Environment and explains how to undertake scenario analysis.

The Ministry sorted points to consider when a company performs scenario analysis in line with the TCFD recommendations. A selected six companies tentatively performed scenario analysis.

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

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

1 Ensure governance is in place

Integrate scenario analysis into strategic planning and/or enterprise risk management processes.
Assign oversight to relevant board committees/sub-committees.
Identify which internal (and external) stakeholders to involve and how.

Get management and operation divisions involved!

2 Assess materiality of climate-related risks

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

What are the current and anticipated organizational exposures to climate-related risks and opportunities?
Do these have the potential to be material in the future? Are stakeholders concerned?

Pick and choose from your industry and company viewpoint!

3 Identify and define range of scenarios

Scenarios inclusive of a range of transition and physical risks relevant to the organization

What scenarios (and narratives) are appropriate, given the exposures?
Consider input parameters, assumptions, and analytical choices. What reference scenario(s) should be used?

Clearly imagine a future world under certain assumptions!

4 Evaluate business impacts

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

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

Try not to seek too much accuracy!

5 Identify potential responses

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

Use the results to identify applicable, realistic decisions to manage the identified risks and opportunities.
What adjustments to strategic/financial plans would be needed?

Do not narrow down! Take multiple scenarios into account.

6 Document and disclose

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

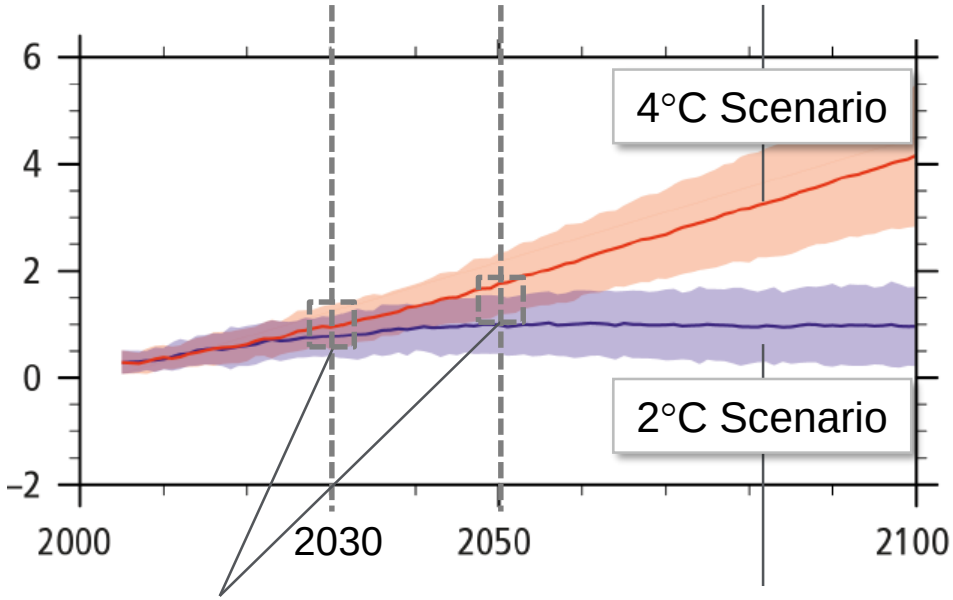
Disclose information from readers' viewpoint!

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

[Scientific Scenarios for Analysis]
Consider climate change in an uncertain future with multiple scenarios

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

The temperature will rise 2.6-4.8°C above pre-industrial levels, unless more rigorous measures are taken.



The 2°C and 4°C scenarios describe <u>similar temperature changes</u> by 2030. They describe <u>considerably different futures</u> 30 years ahead.

The temperature will rise 0.3-1.7°C above pre-industrial levels, if strict measures are taken.

4°C Scenario

An example of TCFD 4°C scenario

<u>Transition Scenario (IEA)</u>
- IEA WEO New Policies Scenario (4°C)

<u>Physical Scenario (IPCC)</u>
- RCP8.5 Scenario (2.6-4.8°C)
- ✓ States “business as usual”.

2°C Scenario

An example of TCFD 2°C scenario

<u>Transition Scenario (IEA)</u>
- IEA ETP 2DS Scenario
- IEA WEO 450 Scenario

<u>Physical Scenario (IPCC)</u>
- RCP2.6 Scenario (0.3-1.7°C)

Other scenarios

Other TCFD scenarios

<u>Transition Scenario (IEA)</u>
- IEA WEO current policy scenario (6°C)
  - ✓States “business as usual”.

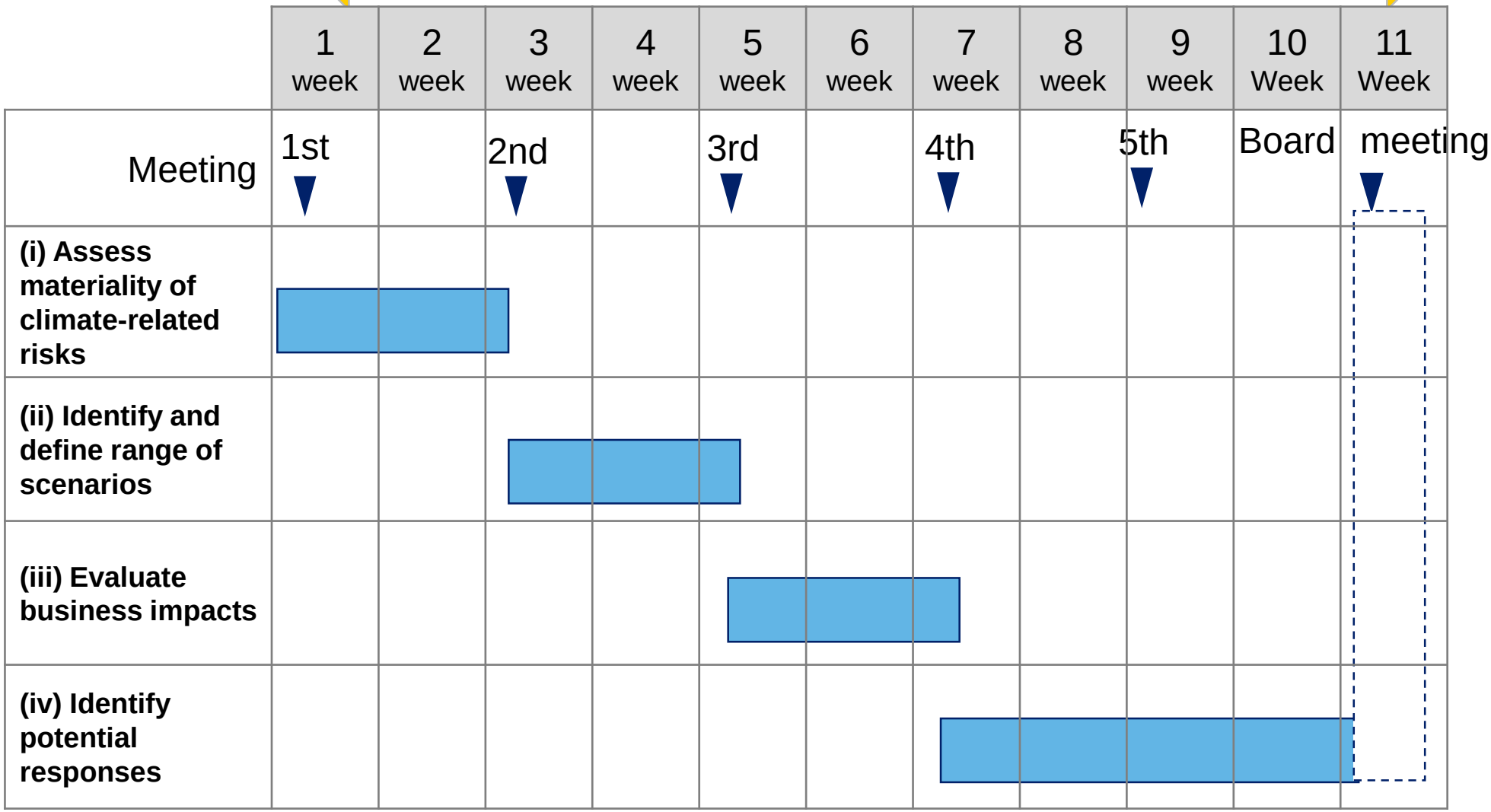
<u>Physical Scenario (IPCC)</u>
- RCP4.5 Scenario (1.1-2.6°C)
- RCP6.0 Scenario (1.4-3.1°C)

Sources: Figure SPM.6 in the Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5); International Energy Agency (IEA), “ETP 2017”; UNEP, “the Emission Gap Report 2015”; website of the Ministry of Foreign Affairs; and TCFD, “The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities”

[Example Schedule]

Approximately three months are spent on the scenario analysis process from assessment of importance of risks to definition of countermeasures

The support program has revealed that it is possible to perform scenario analysis with the assistance of a consulting firm in approximately three months.

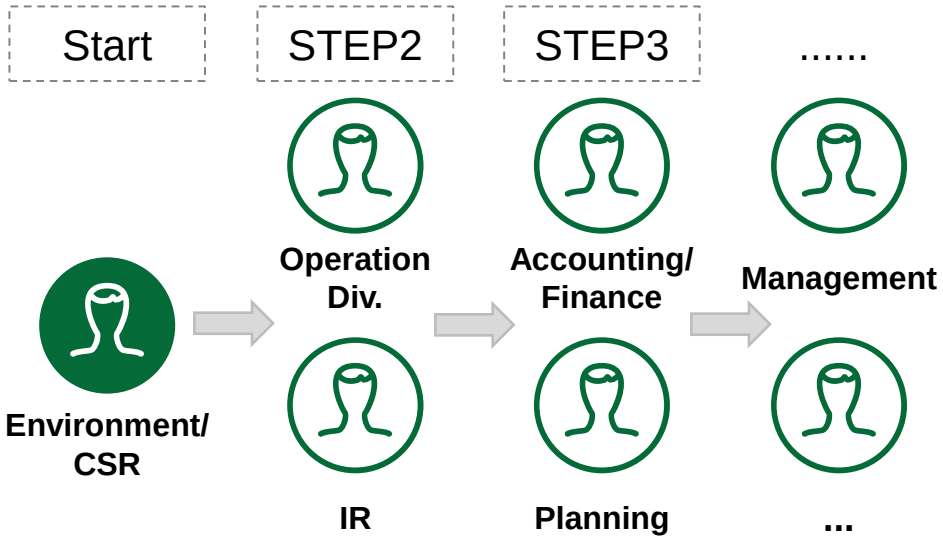


[Implementing Structure]

The key to success is to get everyone involved, according to staff in charge of scenario analysis at the companies participating in the support program

Pattern A

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



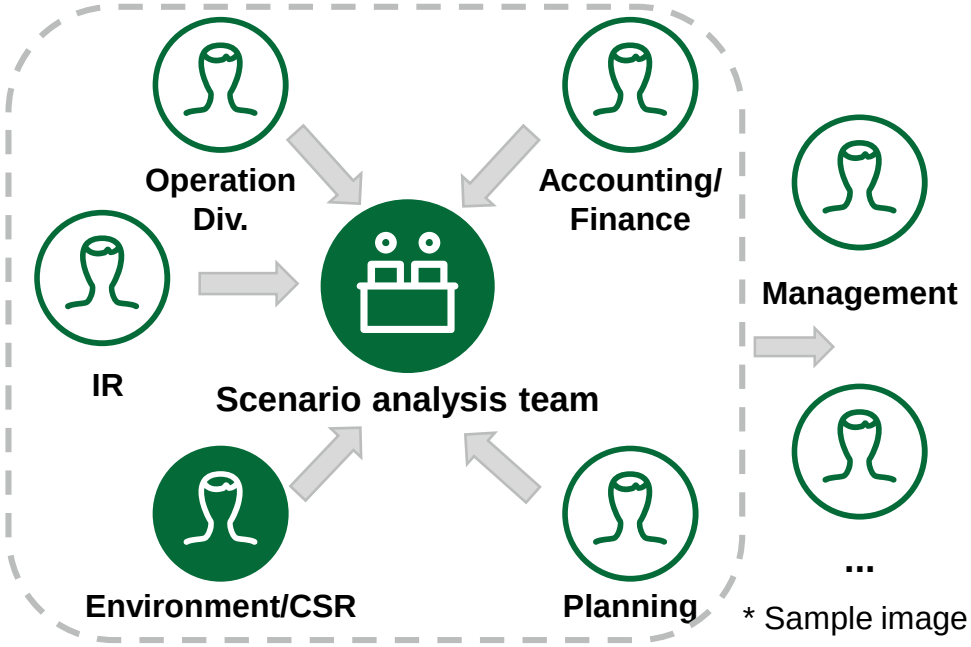
* Sample image

Advantages
- Easy to start
- Minimum burden on divisions concerned

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

Pattern B

Form a team within company before embarking on scenario analysis.



* Sample image

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

Disadvantages
- It takes time to start analysis
- Great burden on divisions concerned

Contents (Practice Examples)

Examples of scenario analysis performed by the selected companies, and references for importance of risks

Sector under the TCFD definition	Company	Pages in the Practical Guide for Scenario Analysis			References for importance of risks
		STEP2	STEP3	STEP4	
Energy	**(i) ITOCHU Corporation**	p.33	p.34-37	p.38	p.106-118
Transportation	**(ii) Mitsui O.S.K. Lines, Ltd.**	p.40	p.41-47	p.48-49	p.120-126
	(iii) Japan Airlines Co., Ltd.	p.51	p.52-54	p.55	p.127-136
	(iv) MITSUBISHI MOTORS CORPORATION	(p.58, 61)	p.57, 60	p.58, 61	p.137-145
Buildings/ Forest Products	**(v) Sumitomo Forestry Co., Ltd.**	p.63-64	p.65-73	p.74-75	p.147-160
	(vi) Tokyu Fudosan Holdings Corporation	p.78	p.79, 81	p.78, 80	p.147-160

2. Scenario Analysis - Practice Examples

(i) ITOCHU Corporation

(ii) Mitsui O.S.K. Lines, Ltd.

(iii) Japan Airlines Co., Ltd

(iv) MITSUBISHI MOTORS CORPORATION

(v) Sumitomo Forestry Co., Ltd.

(vi) Tokyu Fudosan Holdings Corporation

ITOCHU Corporation

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

Department in charge of scenario analysis

Power Project Department

- As of 2018

STEP 2 "Assess materiality of climate-related risks"
Climate-change risks and opportunities for the power generation segment

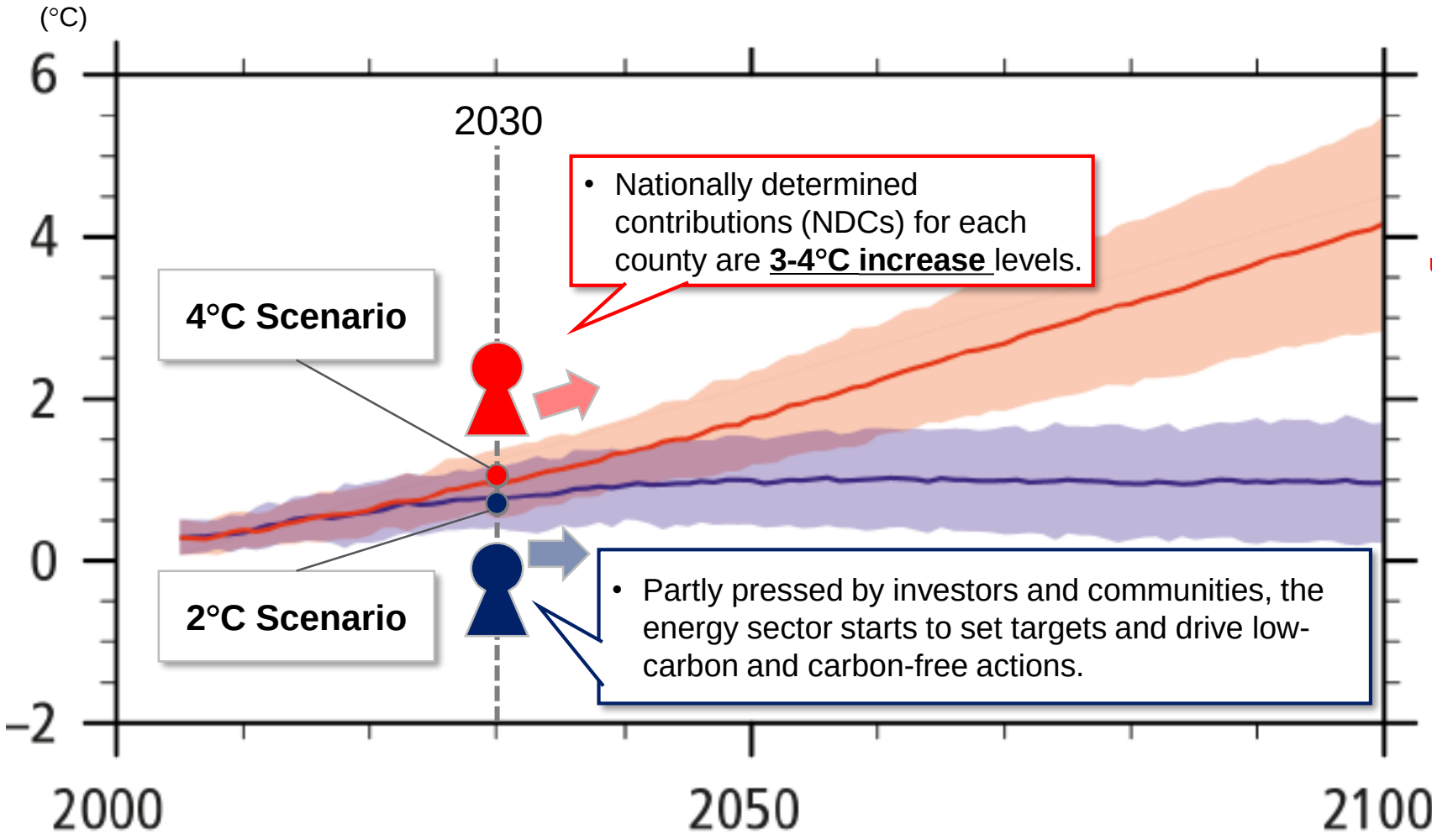
Risk item	Business impact (examples of considerations)	
Carbon pricing/emission rights trading	• Introduction of carbon pricing and emission rights trading will **increase the cost of thermal power generation.** (It is highly likely that the cost will not be able to be passed on in the sales price.) • **Competitive advantages for renewable energy will increase.**	**Large**
Carbon dioxide emission targets/policies of countries	• Strict regulations will **require the company to consider selling assets or making additional capital investment.**	**Large**
Change in energy mix	• Electricity from particular resources will **become unsaleable, opportunity loss** will occur, or **sales will decrease.** • The Company will **have to consider selling assets, or making capital investment in alternative energy resources.**	**Large**
Spread of recycling and energy-saving technologies (CCS, storage batteries, resource-saving design, etc.)	• If carbon capture and storage (CCS) is made mandatory for thermal power generation, **extra costs will be incurred**. • A drastic shift to renewable energy will **require huge investment in storage batteries and grid systems**. • If a new, low-cost and high-efficiency renewable or energy-saving technology emerges, the **demand for thermal power generation will decrease.**	**Large**
Renewable energy prices (FIT price)	• **Sales prices of new renewable energy projects will decline.** • **Competitive advantages for renewable energy will increase.**	**Large**
Changes in the reputations among investors	• Divestment will accelerate, and continuation of the thermal power generation business will **increase fund-raising costs.**	**Large**

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

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

STEP 3 "Identify and define range of scenarios"
Consider society in 2040 with two scenarios of climate change that are highly uncertain.

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



The temperature will rise 2.6-4.8°C above pre-industrial levels, unless more rigorous measures are taken.

The temperature will rise 0.3-1.7°C above pre-industrial levels, if strict measures are taken.

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

STEP 3 "Identify and define range of scenarios"
IEA's and Other Assumptions based on Scientific Grounds

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

STEP 3 “Identify and define range of scenarios”

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

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

A certain policy effort towards a low-carbon society
Government
- ✓ Gradual abolishment of subsidies to fossil fuels
- ✓ Enhanced standards for power generation efficiency
- ✓ Adoption of carbon tax by some countries

Pressure on fossil fuels
Investor
- ✓ Divestment from coal and petroleum
- ✓ Steady or slightly increased investment in renewable energy

Action ***Encourage disclosure and dialogue***

Increased entries in the IPP and PPS markets
New entry
- ✓ More IPPs and PPSs in some regions

A rise in material costs
Supplier (raw materials)
- ✓ Increased demand for coal and gas, and a rise in their prices

A drop in the cost of renewable energy
Technology
- ✓ Evolution of low-carbon power generation technology, and a drop in the cost of renewable energy
- ✓ The adoption cost of renewable energy stabilizing technology will remain high.
- ✓ CCS will not become common.

The portfolio will remain on an extension of the present path
Industry/ Itochu
- ✓ Overall electricity demand will increase.
- ✓ The share of renewable energy will gradually increase, while demand for coal power generation will also increase in developing countries.
- ✓ The additional cost of carbon tax and CCS will be limited, so thermal power generation will remain profitable.
- ✓ Physical risks will increase power generation costs.

Action ***Enhance disaster preparedness and BCP***

A worldwide increase in electricity demand
Power company/ consumer
- ✓ Overall electricity demand will increase.
- ✓ Advanced countries will see a decline in demand for coal and other thermal power generation (though gas power generation will increase).
- ✓ A drop in the cost of renewable energy will encourage some consumers to shift to renewable energy.
- ✓ Typhoons and floods will cause power failures.

Departure from centralized power generation
Alternatives
- ✓ Spread of decentralized and self-power generation

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

STEP 3 “Identify and define range of scenarios”

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

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

Enhanced efforts towards a low-carbon society

Government

- ✓ Abolishment of subsidies to fossil fuels
- ✓ Enhanced standards for power generation efficiency
- ✓ Adoption of carbon tax by many countries
- ✓ Subsidies to CCS will be granted/increased.
- ✓ More countries will adopt “Capacity Market”.

Pressure on fossil fuels

Investor

- ✓ Divestment from coal and petroleum
- ✓ Increased investment in renewable energy

Changes in material costs

Supplier (raw materials)

- ✓ Gas prices will increase.
- ✓ Coal prices will gently decrease.
- ✓ Land prices for renewable energy will increase, and the land market will be more competitive.

More entries in the IPP and PPS markets

New entry

- ✓ More IPPs and PPSs in some regions

A drop in the cost of renewable energy

Technology

- ✓ Evolution of low-carbon power generation technology, and a drop in the cost of renewable energy
- ✓ Further development of renewable energy and electric vehicles, and inflated prices of storage battery and scares resources
- ✓ CCS will become common.

Action ***Increase investment related to renewable energy***

The share of renewable energy will considerably increase.

Industry/Itochu

- ✓ Overall electricity demand will increase.
- ✓ Most electricity will be generated with renewable energy.
- ✓ Gas will replace coal as a backup source for renewable energy stabilization. (A drop in coal demand)
- ✓ Because of the additional cost of carbon tax and CCS, thermal power generation will become less profitable.

Action ***Increase the share of renewable power generation***

A worldwide increase in electricity demand

Power company/consumer

- ✓ Overall electricity demand will increase.
- ✓ Carbon pricing will be adopted, dampening demand for thermal power generation.
- ✓ A drop in the cost of renewable energy will encourage consumers to shift to renewable energy.

Action ***Review the portfolio, and supply highly competitive energy***

Departure from centralized power generation

Alternatives

- ✓ Spread of decentralized and self-power generation

Action ***Go into decentralized and self-power generation businesses***

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

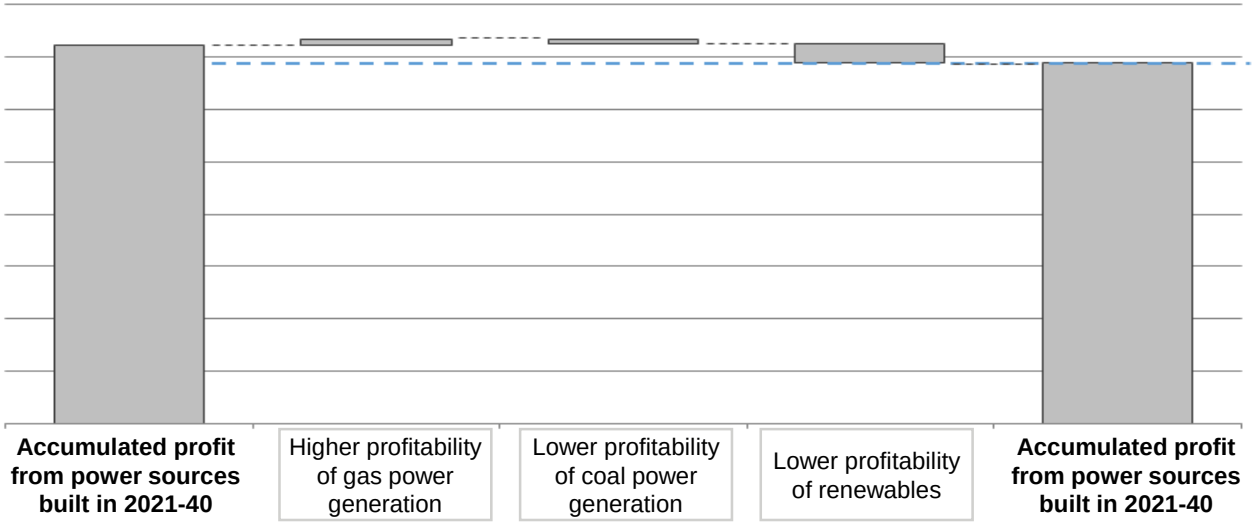
STEP 4 “Evaluate business impacts”

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

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

4°C Scenario

(Image)

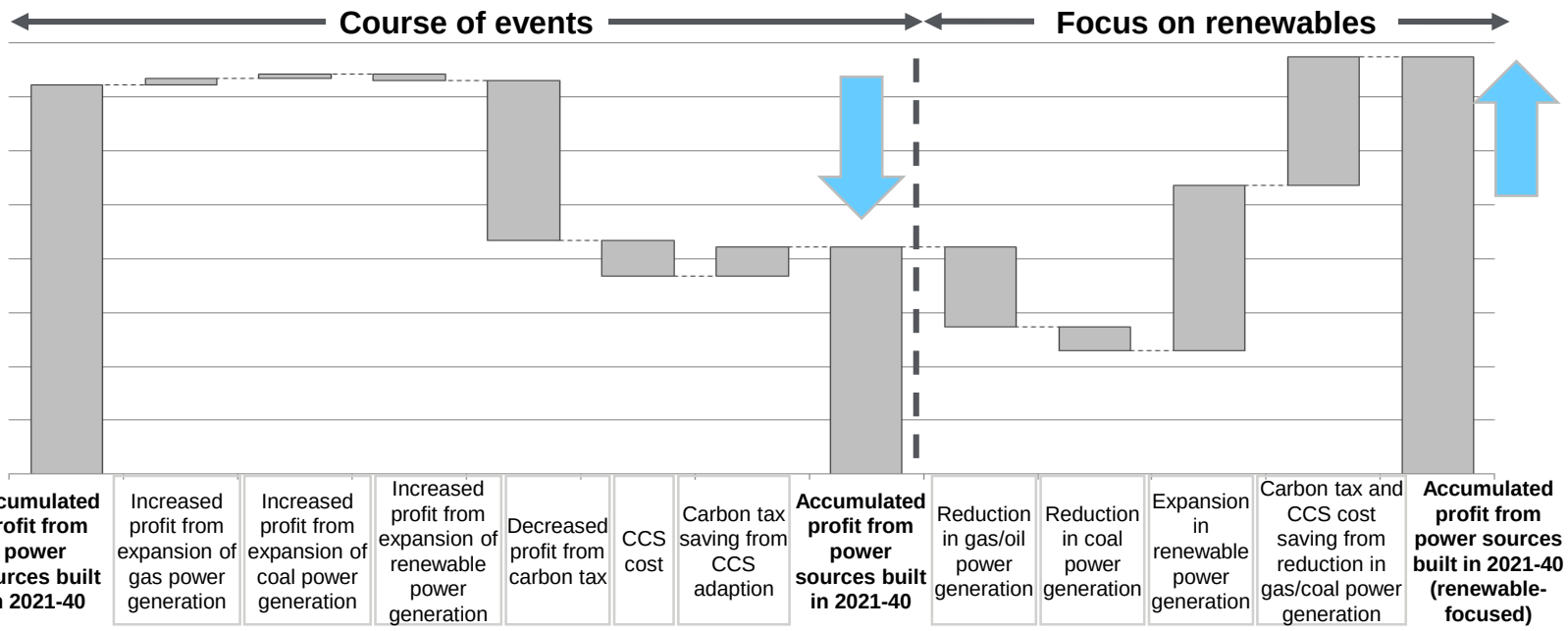


There are possibilities that:

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

2°C Scenario (100% carbon tax)

(Image)



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

2. Scenario Analysis - Practice Examples

(i) ITOCHU Corporation

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(iii) Japan Airlines Co., Ltd

(iv) MITSUBISHI MOTORS CORPORATION

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(vi) Tokyu Fudosan Holdings Corporation

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

STEP 2 3 4 5

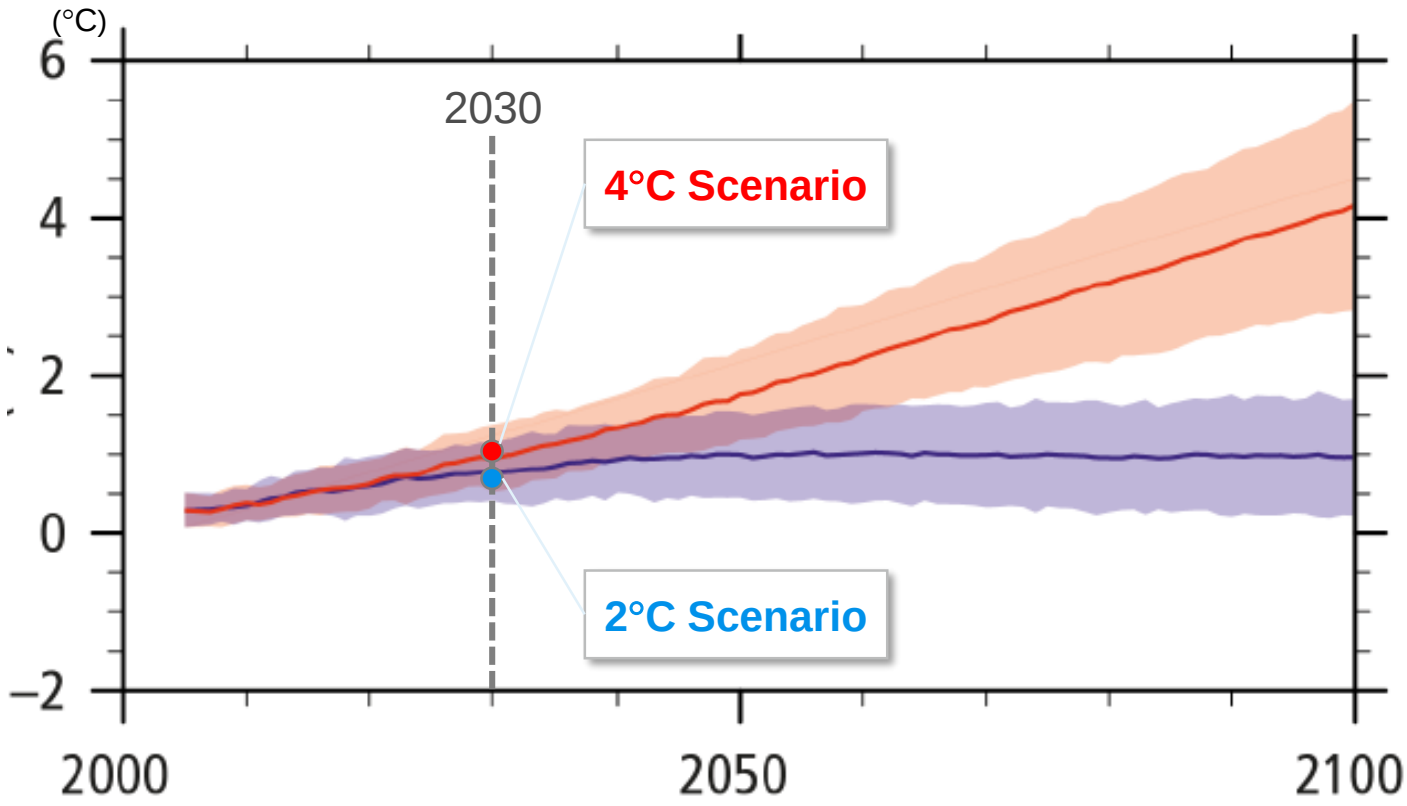
	Risk item	Business impact	
Transition risk	Increase/decrease in Key products and prices	• Changes in energy mix will impact the **demand for key cargo transport (crude oil, petroleum products, petrochemicals, coal, LNG),** leading to fluctuations in profit of ocean shipping business • Transition to a low-carbon society will **decrease the demand for coal and petroleum**, which **will reduce** the cargo volume **and profit in the ocean shipping business.** • However, the **spread of CCS and CCU** can revive the **demand for coal transport**, enabling the shipping business to maintain profit. • **Spread of EVs and other next-generation** vehicles will **substantially change the ways of completed vehicle transport and supply chains.** This will **reduce the vehicle transport volume** and lower profit in the ocean shipping business. • **Spread of renewable energy will increase the demand for hydrogen transport**, which can help maintain profit in the ocean shipping business. • **Increased demand for onshore wind power generation will increase profit from development of onshore facilities (costs of transport and installation)**, which will increase profit in the ocean shipping business. • Climate change will adversely impact cereal crop harvests, which will lower the **demand for bulk cargo transport and reduce** profit in the ocean shipping business.	Large
	Promotion of next-generation vessels	• **Shippers will expect environmental considerations in transport,** calling on the ocean shipping **business to shift to next-generation vessels**. This will **increase R&D costs, capital investments**, and overall expenditures. • **Adaption of next-generation vessels will save fuel costs and payments of carbon tax**, reducing overall expenditures.	
	National regulations on SOx/NOx	• The 2020 IMO **fuel sulphur regulations will require the ocean shipping business to purchase appropriate fuel**. This will **increase operating costs** and overall expenditures. • **Installation of SOx scrubber systems will increase capital costs** and overall expenditures. Promotion of alternative fuels, though not directly related to climate change or global warming, can indirectly contribute to CO2 emissions reduction.	
	Energy-saving policy (EEDI/Energy efficiency laws)	• The **EEDI for new ships will tighten the regulations** (Phase 2 from 2020 and Phase 3 from 2025), which will inflate ship prices, **and increase maintenance costs** and overall expenditures.	
	Energy-saving subsidies	• **Access to energy-saving subsidies will save capital investment**, and reduce overall expenditures. • **FIT and other policies to promote renewable energy will reduce the demand for crude oil, coal and LNG transport**, the transport volume, and income in the ocean shipping business. • **An increase in the demand for biomass fuel transport** will increase the transport volume and income in the ocean shipping business.	
	Trend in energy demand	• **Stricter regulations on the use of cleaner fuels or those with less environmental impact will increase the costs of technology development, capital, fuel and vessels (including crew training costs)**, and overall expenditures.	
	Carbon pricing	• If **market-based measures (MBMs)** for GHG from ships are **made obligatory** by IMO, **fuel will be charged**, and ship operators **will have to purchase emission rights** for emissions exceeding their allocated volumes. This will increase overall expenditures.	Medium to large
Others	Change in reputation among customers (shippers) and investors; melting of permafrost and glaciers; extremely abnormal weather; etc.	• General preference to transport means with environmental considerations will increase the demand for vessels. • Development of the North Sea Route will reduce traveling time, and the capital and travel costs. This will lead to more new contracts and increase freight revenue. • Abnormal whether and typhoons require ship operators to change navigation routes to longer routes. This can damage reputation from shippers.	Small to medium

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

Consider society in 2030 with two scenarios

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

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



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

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

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

MOL

Assumptions in the Scenarios

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

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

MOL

CO2 Emissions from the Global Maritime Transport Sector

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

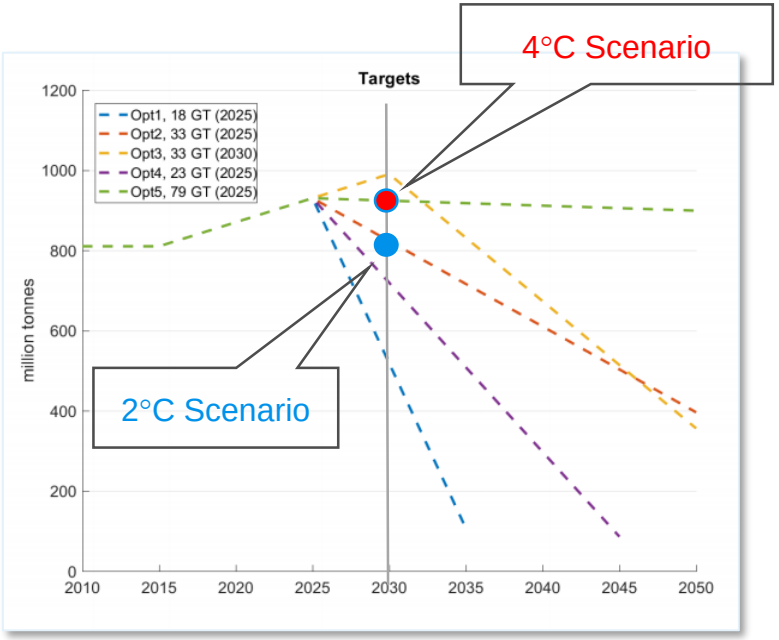


Figure 16: CO_2 targets quantified

Table 14: Absolute CO_2 emissions targets for international shipping under five different target derivations (million tonnes)

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Opt.1 - Responsibility principle, 1.5 degrees, 18 Gt (2025)	810	810	870	930	518	106			
Opt.2 - Responsibility principle, 2 degrees, 33 Gt (2025)	810	810	870	930	823	716	610	503	396
Opt.3 - Responsibility principle, 2 degrees, 33 Gt (2030)	810	810	870	930	990	831	673	514	356
Opt.4 - Egalitarian principle, developed country based, 23 Gt (2025)	810	810	870	930	719	508	297	86	
Opt.5 - Egalitarian principle, developing country based 79 Gt (2025)	810	810	870	930	924	917	911	905	898

Opt 2 = Scenario 8:

- The scenario sets CO2 emissions targets at 33Gt during the period 2010 to 2100 on the assumption that MBM starts in 2025 and 20% of the total revenue derived from a carbon pricing can be used to purchase CO2 offsets. It is used as an ACT scenario (2°C) in the 2ii report.

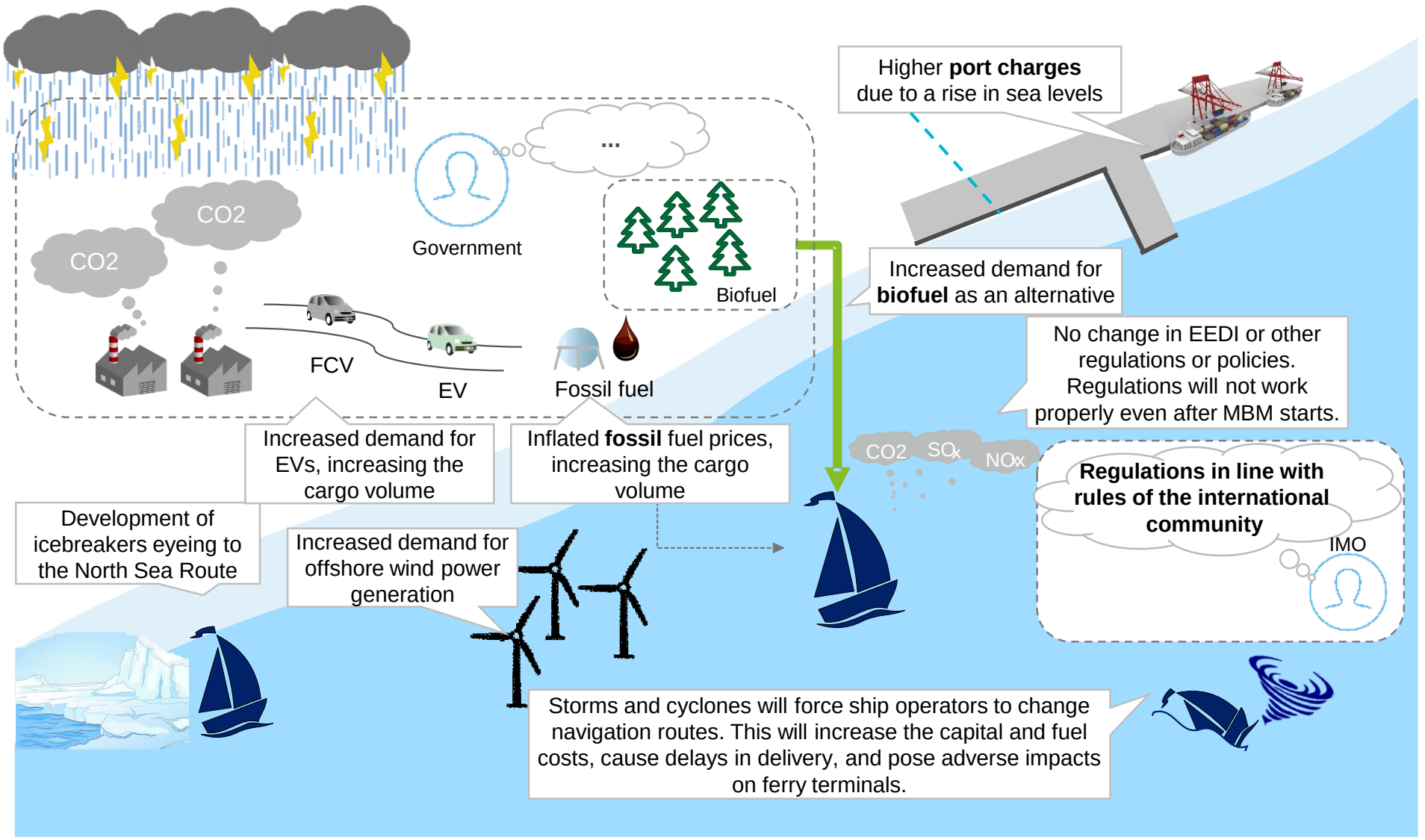
Opt 5 = Scenario 10:

- The scenario sets CO2 emissions targets at 79Gt during the period 2010 to 2100 on the assumption that MBM starts in 2025 and 80% of the total revenue derived from a carbon pricing can be used to purchase CO2 offsets. It is used as an LCT scenario (4°C) in the 2ii report.

Source: UMAS, "CO2 Emissions from International Shipping - Possible reduction targets and their associated pathways", 2016. P.45

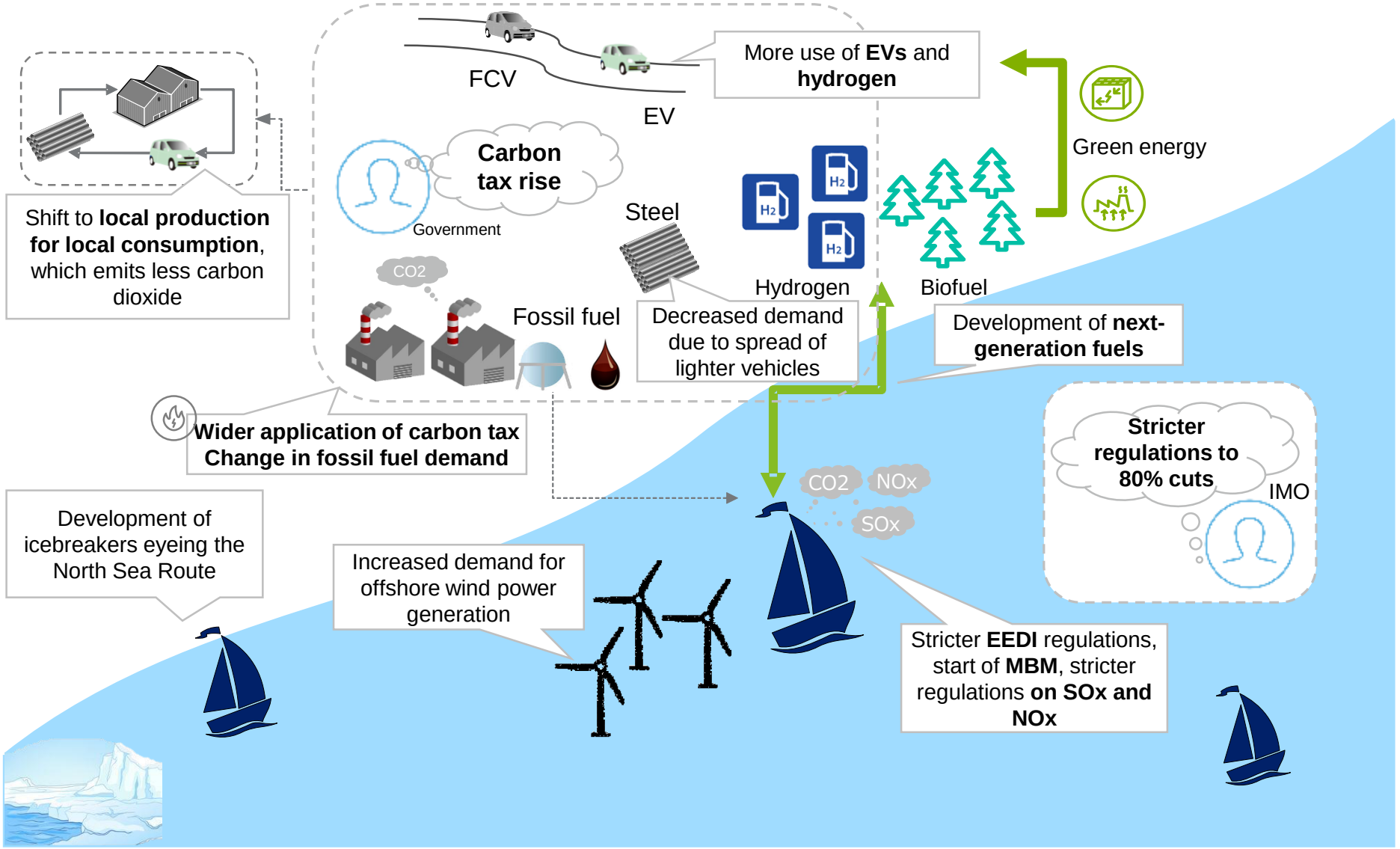
World in the 4°C Scenario: More Natural Disasters and Inflated Fuel Costs

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



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

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



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

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

World in the 2030s in the 4°C scenario

Shipping industry

Supplier

Accelerating technology innovation

- ✓ Suppliers will develop EEDI-compatible, high-fuel efficiency technologies, and see increased development costs of next-generation vessels. Subsidy schemes will help them save capital investment.

Action **Request incentives/ subsidies**

Energy business

Higher demand for fossil fuel

- ✓ Adoption of carbon tax and MBM will increase petroleum and coal fuel prices.
- ✓ More use of LNG as alternative
- ✓ Increased demand for biofuel as alternative, but increase will be limited due to prices and supply volume

Action **Consider prices of alternative fuels and suppliers**

New entry

No impact on new entry

- ✓ New entries will have no impact from climate change.

(No particular action needed)

Industry/MOL

Rainstorm, typhoon, rise in sea levels

- ✓ Physical risks will emerge, which will increase insurance costs.
- ✓ Traffic volume will increase as a result of population growth.
- ✓ A rise in sea levels will result in higher port charges.

Action **Comply with EEDI regulations and develop technology to reduce environmental burden**

Alternatives

Entry in related businesses

- ✓ Development of the North Sea Route and related businesses

(No particular action needed)

Customer

Change in transport demand

- ✓ Changes in navigation routes will increase the capital and fuel costs, and cause delays in delivery.
- ✓ Promotion of renewable energy will slightly decrease coal transport, increase oil and biomass fuel transport, and substantially increase natural gas transport.
- ✓ Increased demand for offshore wind power generation
- ✓ Poor harvests will reduce transport demand.
- ✓ Substantial increase in demand for EVs will change transport supply chains.
- ✓ Adverse impacts on ferry and terminal businesses

Action **Develop navigation routes and vessels compatible with climate change**

Call for understanding of an increase in capital investment

Government

More subsidies

- ✓ No change in EEDI or other regulations or policies
- ✓ IMO targets of 50% cuts by 2050 will continue.
- ✓ Adoption of carbon tax and MBM (charges on vessel fuel, and obligation to purchase emission rights)
- ✓ Harbors and ports will be developed to meet the new regulations
- ✓ Enhanced SOx/NOx regulations will accelerate the use of alternative fuels.

Action **Enhance and maintain liaison with the government to swiftly gain information about any revisions to regulations**

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

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

World in the 2030s in the 2°C scenario

Shipping industry

Supplier — Accelerating technology innovation

- ✓ Suppliers will develop EEDI-compatible, high-fuel efficiency technologies, and see increased development costs of next-generation vessels. Subsidy schemes will help them save capital investment.
- ✓ Low-carbon technology will help increase vessel prices and lease charges.

Action: **Investment in next-generation technology (joint investment)**

Energy business — Increased fossil fuel costs

- ✓ Adoption of carbon tax and MBM will increase fossil fuel prices.
- ✓ Rapid spread of LNG fuel as alternative
- ✓ Hydrogen supply chain will be put into practice.
- ✓ Increased demand for biofuel as an alternative, but the increase will be limited due to prices and supply volume

Action: **Shift from fossil fuel to alternative fuels**

New entry — No impact on new entry

- ✓ New entries will have no impact from climate change.

(No particular action needed)

Industry/MOL — Predict moves towards a low-carbon society based on climate change external factors.

- ✓ Vessels will consume less fuel. (LNG ships, higher engine efficiency, higher propeller efficiency, reduced ship resistance)
- ✓ The industry will promote technology development of next-generation fuels.

Action: **Develop technology towards a low-carbon society**

Alternatives — Consider impacts of land transport on marine transport

- ✓ Accelerated modal shift
- ✓ Development of the North Sea Route and related businesses

Customer — Decline in fossil fuel transport

Increase in renewable/EV transport

- ✓ Promotion of renewable energy will decrease coal and oil transport, and increase biomass fuel transport.
- ✓ Increased demand for offshore wind power generation
- ✓ Consumers will opt for low-carbon-oriented, local production for local consumption. Traffic volume will not increase in proportion to population growth.
- ✓ Substantial increase in demand for EVs will change transport supply chains.
- ✓ Spread of lighter vehicles will decrease steel demand. Increase in electric furnaces will decrease iron ore demand. Impacts of population growth will be minimal.
- ✓ Poor harvest will reduce transport demand.
- ✓ Adverse impacts on ferry and terminal businesses

Action: **Change in portfolio (gradual shift from fossil fuel transport)**

Government — Intensified actions for climate change

(Stricter MBMs and carbon tax)

- ✓ Many countries will raise carbon tax rates, which will impact office and onshore businesses.
- ✓ IMO targets of 50% cuts of GHG by 2050 will continue.
- ✓ EEDI regulations will continue, and more effective MBMs will be adopted. (charges on vessel fuel, and obligation to purchase emission rights)
- ✓ Enhanced SOx/NOx regulations will accelerate the use of alternative fuels.
- ✓ Harbors and ports will be developed to respond to short-term abnormal weather.

Action: **Adopt next-generation ships under partnership with government, and build a supply chain**

MOL

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

STEP 2 3 **4** 5 Scenario **4°C** 2°C

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

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

STEP 2 3 **4** 5 Scenario 4°C **2°C**

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

2. Scenario Analysis - Practice Examples

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

JAPAN AIRLINES

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

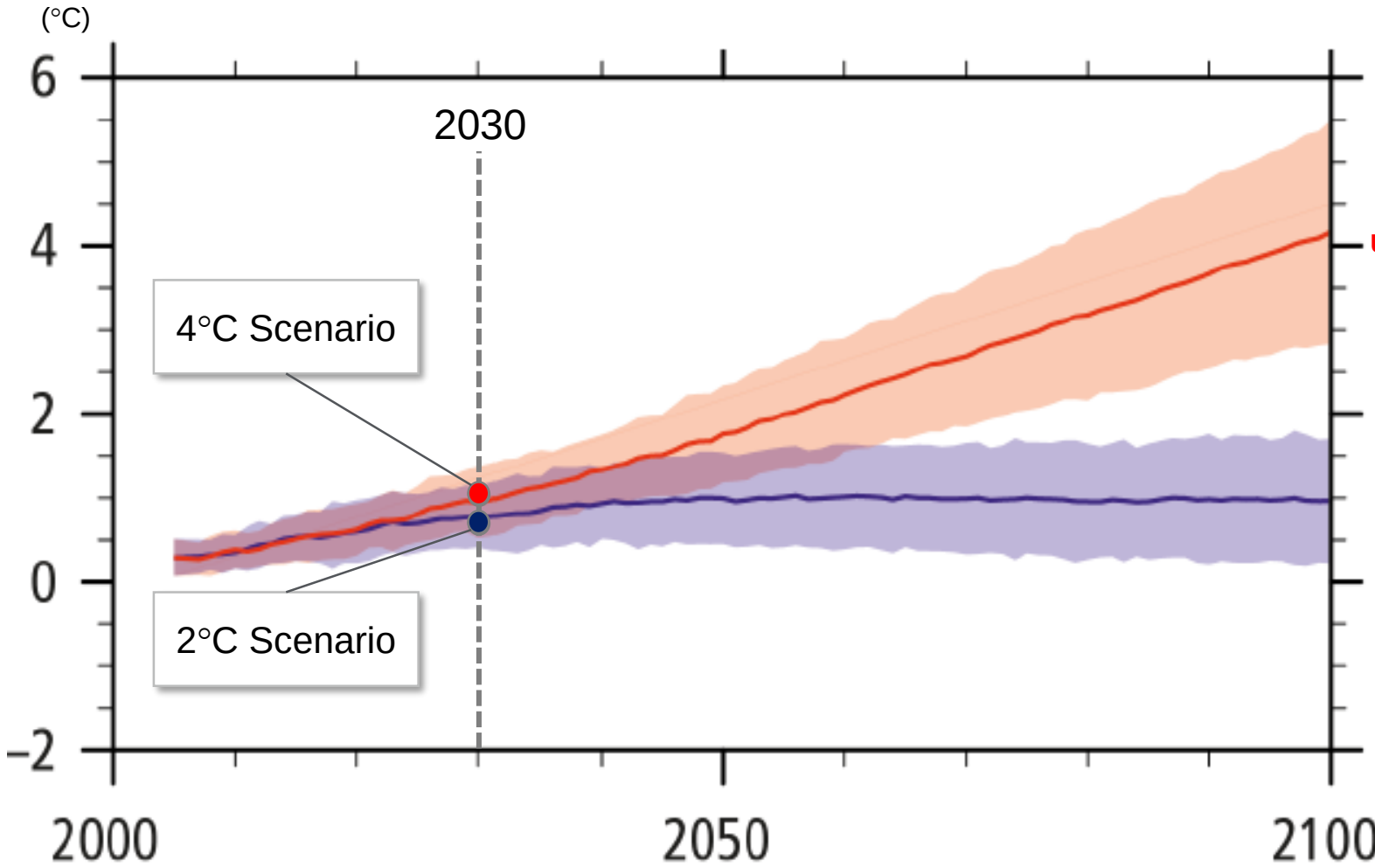
Category	Risk item	Assessment
Policy and Legal	Targets and regulations on carbon emissions and fuel efficiency in the airline industry	Large
	Targets and regulations on carbon emissions and fuel efficiency in relevant countries	Medium
	Carbon pricing	Medium
Technology Shifts	Spread of alternative fuels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

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

JAPAN AIRLINES

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

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



The temperature will rise 2.6-4.8°C above pre-industrial levels, unless more rigorous measures are taken.

The temperature will rise 0.3-1.7°C above pre-industrial levels, if strict measures are taken.

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

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

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

4°C Scenario

Further policy effort towards a low-carbon society

Government

✓ Some countries and regions will adopt carbon tax.
✓ Enhanced fuel efficiency regulations

Continued increase in new entries in the LCC market

New entry

✓ New LCC focusing on low-price oriented customers will enter the airline market at the present pace.

Rise in material costs

Supplier (raw materials)

✓ Gentle spread of biofuels
✓ Inflated conventional jet fuel prices

Fuel efficiency will continue improving.

Supplier (airframe makers)

✓ Airframe fuel efficiency will improve.
✓ Development of supersonic transports will progress.

Increased costs

Industry/JAL

✓ Fuel efficiency will improve, but development of next-generation airplanes and spread of alternative fuels will be limited.
✓ Dependency on conventional jet fuel will remain high and inflated crude oil prices will increase fuel costs.

Substitutes

No particular change

Considerable increase in demand for international flights

Customer

✓ Demand will particularly increase in developing countries.
✓ Population growth and vital economy will boost demand for logistics.
✓ Interest in low-carbon energy and modal shift to railways, etc., will be limited.
✓ Extreme weather events will be more sever and more frequent, causing concerns over service rates and punctuality.

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

JAPAN AIRLINES

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

2°C Scenario

Considerable policy effort towards a low-carbon society

Government

- ✓ More countries and regions will adopt carbon tax towards a carbon-free/low-carbon society.
- ✓ Enhanced fuel efficiency regulations
- ✓ More countries and regions will promote development and spread of alternative fuels towards a carbon-free/low-carbon society.

Fluctuations in material costs

Supplier (raw materials)

- ✓ Use of biojet fuel will vary among regions, which can raise differences in costs among regions

Fuel efficiency will continue improving.

Supplier (airframe makers)

- ✓ Development of next-generation airplanes will progress.
- ✓ Demand for higher fuel-efficiency, next-generation airplanes will increase.

New entry

Carriers with electric airplanes will enter the airline market.

More efforts towards a low-carbon society

Industry/JAL

- ✓ Enhanced regulations will raise carbon pricing.
- ✓ More airline companies will use biojet fuel.

Substitutes

Modal shift to railways and vessels

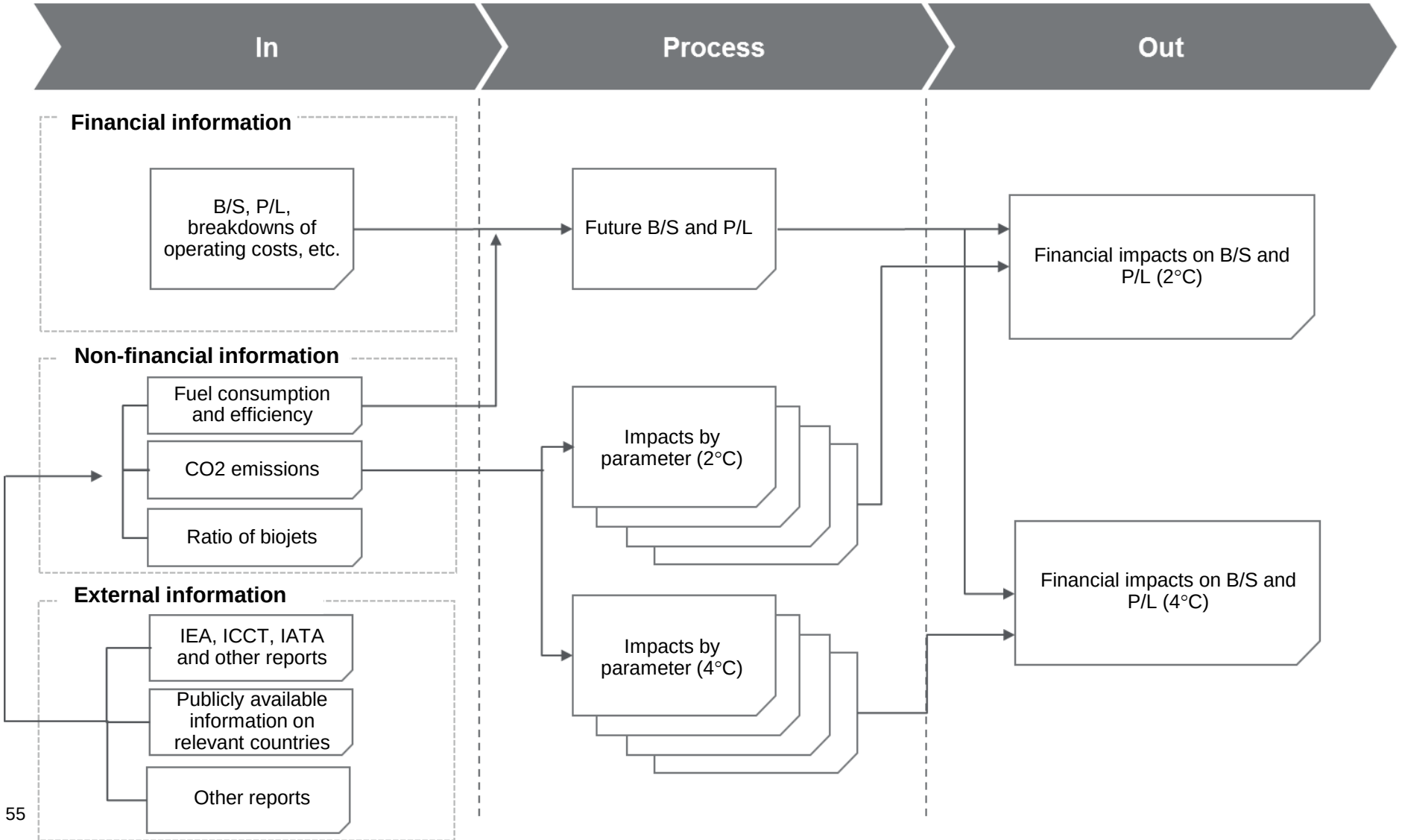
Increase in demand for international flights

Customer

- ✓ Demand will particularly increase in developing countries.
- ✓ Interest in the environment will heighten, and some customers may shift transport modes to railways, vessels, and other modes with lower environmental burdens.

Scenario Analysis in Practice: STEP 4 Evaluate business impacts

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



2. Scenario Analysis - Practice Examples

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

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

Renewables will account for 15% of all energy supply

Fossil fuel costs will increase 2.5 times

Automobile industry

Conventional business form (production/ development/sale)

Conventional market (advanced country-oriented)

Conventional corporate management

Energy society

Thermal power generation

Centralized

High demand for fossil fuels

Mitsubishi Motors

Government policy

Conventional policy

Regulations, subsidies, and other policy will have less impact.

Sales of EVs will increase 1.5 times

People's lives

ICE vehicles

Travel chiefly by car

Severer physical risks

Natural disasters will occur 3.5 times more often

ICE vehicles will remain the dominant form, while the necessity for disaster-countermeasures will arise.

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

Changes in social environment Events that can take place in the future	Future prediction Choice and combinations of information, story-making	Impacts on business Interpretation of actual impacts	Business impacts Impacts on annual profit
• Changes in customer behaviors • Enhanced carbon tax and ZEV regulations • Progress of next-generation vehicle technology • Drop in battery prices	**Further spread of EVs** • Changes in consumer behaviors, government policy, and technology progress will increase car sales to 3 million cars per year. (Global market)	**Expanded share of EVs** • The share of EV sales will grow at a certain rate. • Demand will increase chiefly for PHEV. The average battery capacity will slightly increase. • Battery costs will remain the same because of increased demand for scarce resources and increased battery production. • Capital investment and R&D will slightly increase to meet the increased share of EVs.	
		Government subsidies • Subsidies at the present level will be secured (for capital investment in renewables)	
• Inflated energy prices • Accelerating renewable energy and energy-saving development	**Inflated energy prices** • Increased demand for fossil fuels will raise fuel prices from 2,200 yen to 4,950 yen/barrel. • The share of renewables will increase from 7% to 15% in Japan. Demand for ancillary services will increase, leading to higher electricity rates. • Grid power procurement costs will increase from 14,300 yen to 15,620 yen/Mwh.	**Increased energy procurement costs** • Increased demand for fossil fuels will increase energy prices.	
		Further efforts for energy-saving and renewable energy development • Energy consumption will be reduced to the mandatory annual rate set in the Energy-Saving Act.	
• More frequent and severe natural disasters	**Natural disasters will cause greater damage to the economy.** • Temperature rises will lead to more frequent and severer natural disasters. In particular, Japan will experience more torrential rains, 0.2 to 0.7 more times per year. • Increased natural disasters will increase car accidents and flood damage cars. This will increase payments for insurance companies.	**Increased damage to production facilities and supply chains** • The Company will have overall physical damage to supply chain, suspension of operations, and worsening of working environment.	
		Enhanced efforts to protect supply chain • The Company will enhance countermeasures against natural disasters to minimize damage to supply chains to at least present levels.	
		Development of new technology to avoid physical risks • Development of flood-ready vehicles • Enhancement of V2X function	
		Sale of new-tech vehicles to avoid physical risks • The Company will seek to expand the market share with new value added.	

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

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

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

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

Impacts of West Japan Torrential Rains and Typhoons

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

* Impacts in the 1st half of FY2018

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

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

Mazda Motor expects a **roughly 28 billion yen ($248 million) hit to operating profit due to production cuts** at the main factory (Hiroshima pref.) and the Hofu plants (Yamaguchi pref.) from the torrential rains that flooded western Japan in July, the company said.
They operated at reduced capacity in August and September, as paralyzed transportation networks hampered workers’ commutes. …
For the year ending March, many factors squeezed earnings, such as the higher costs of materials such as steel and precious metals, as well as spending to bolster the automaker’s sales network in the U.S. and comply with tougher environmental regulations. This leaves the company **with little room to absorb the losses from the rains from the reduced production of 28 billion yen**.

(Nikkei Shimbun, September 21, 2018)

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

The General Insurance Association of Japan (GIAJ headed by Keiji Nishizawa) compiled the number of car accident claims related to the torrential rains in west Japan. A total of 48,303 insurance claims including vehicles (including commercial vehicles), fire, and new types (including accident insurance) insurance claims were brought to member insurance companies by July 17. **Car insurance claims totaled 23,644**. Member companies set up emergency headquarters at their head offices or local branches in the afflicted prefectures, and started to inspect and collect flood-damaged cars under insurance coverage...
(Daily Automobile (Nikkan Jidosha Shimbun), July 23, 2018)

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

In 2030 in the 2°C Scenario, the number of natural disasters and damage will remain almost present levels.

The scenario assumes that the use of renewables, energy-saving technology, and electric vehicles will steadily progress, (and that, as a result, the 2°C target will be achieved.)

Automobile industry

Efforts towards a carbon-free society (energy-saving facilities/ business transfer)

Conventional market (advanced country-oriented)

Local production will increase

CO2 emissions from factories will be cut 2% per year

Carbon tax 11,000 yen/t-CO2

ZEV regulations will come to effect worldwide

Renewables will account for 22% of all energy supply

Fossil fuel costs will increase 1.5 times

Conventional corporate management

Energy society

Renewables

Decentralized

High demand for fossil fuels

Mitsubishi Motors

Government policy

Stricter policy to a carbon-free society will result in higher carbon tax and stricter regulations.

People's lives

Maas market will expand 16 times

Sales of EVs will increase 10 times

Electrification

Modal shift/MaaS

Natural disasters will slightly increase

Further electrification and modal shift will increase demand for EVs.

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

Changes in social environment Events that can take place in future	Future prediction Choice and combinations of information, story-making	Impacts on business Interpretation of actual impacts	Business impacts Impacts on annual profit
• Changes in customer behaviors • Enhanced carbon tax and ZEV regulations • Progress of next-generation vehicle technology • Drop in battery prices	**Further and quicker spread of EVs** • Changes in consumer behaviors, government policy, and technology progress will increase car sales to a maximum 17.6 million cars per year. (global market)	**Expanded share of EVs** • The share of EV sales will sharply grow. Sales of new cars will decrease under the 4℃ scenario. • Demand will increase chiefly for EV. The average battery capacity will double. • Adoption of alternative resources and sharp increase in battery production will more than halve battery costs. • Capital investment and R&D will increase to meet the increased share of EVs.	
		Government subsidies • Subsidies will be secured for investment in battery development and renewables. Credit incomes will also be secured.	
• Inflated energy prices • Accelerating renewable energy and energy-saving development	**Inflated energy prices** • Increased demand for fossil fuels will raise fuel prices from 2,200 yen to 3,630 yen/barrel. • The share of renewables will increase from 7% to 22% in Japan. Demand for ancillary services will increase, leading to higher electricity rates. • Grid power procurement costs will increase from 14,300 to 16,610 yen/Mwh.	**Increased energy procurement costs** • For CO2 emissions reduction, inexpensive thermal power generation and oil prices will cost more. • Electricity will cost more because of carbon pricing on thermal power generation.	
		Further efforts for energy-saving and renewable energy development • The Company will seek low-cost electricity through third-party PVs and grid power companies.	
• Inflated energy prices • Accelerating renewable energy and energy-saving development • Spread of EVs	**Development of a renewable energy decentralized society** • Increased use of renewables and inflated fossil fuel prices will make the electricity system less stable. This will lead to a decentralized society. More use of V2X and reuse of batteries.	**Entry in energy management business** • Launch of new businesses including sales of reusable batteries • The Company will build a battery supply chain management scheme to minimize costs of used batteries.	
• Changes in customer behaviors	**Accelerating progress of Maas and urban traffic** • Heightened inclination to the environment and shift in preference from ownership to sharing will facilitate development of MaaS and urban traffic.	**Decrease in new car sales** • Development of Maas and urban traffic will reduce new car sales in the global market.	
		Entry in new businesses • Entry in Maas and CASE businesses will help the Company secure profit.	
• More frequent and severe natural disasters	**Natural disasters will cause greater damage to the economy.** • Temperature rises will lead to more frequent and severer natural disasters. In particular, Japan will experience more torrential rains, 0.2 to 0.5 times more per year. • Increased natural disasters will increase car accidents and flood damage cars. This will increase payments for insurance companies.	**Increased damage to supply chains** • More torrential rains will cause physical damage to supply chains, suspension of operations, and worsening of working environments.	
		Enhanced efforts to protect supply chains • The Company will enhance countermeasures against natural disasters to minimize damage.	
		Creation of new value added • The Company will deal more with V2H functions to increase the market share.	

2. Scenario Analysis - Practice Examples

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

	Risk item	Business impact on timber and building material business	Assessment
Transition risk	**Carbon emissions targets/policies**	• **Governments’ forest carbon absorption policy will increase timber procurement costs.**	Large
	Forest protection policy	• **Governments’ adoption of logging tax and charges will increase timber procurement costs.**	
	Renewable energy subsidies	• **Promotion of wood biomass power generation will increase sales. If the government stops subsidies, sales will decrease.**	
	Changes in energy mix	• **If relevant countries incorporate biomass in their sustainability standards, sales will increase.** • **But increased demand will increase fuel costs (timber chips) in the biomass power generation business.**	
	Sluggish economic activities due to stricter climate change regulations	• **If construction itself is suppressed, supply and demand of timber and building materials will become sluggish, and sales will decrease.**	
Physical risk	**Rise in average temperatures**	• **Forest fires and pests will increase timber procurement costs.** • **Higher temperature and increased precipitation will facilitate timber growth, possibly improving productivity and reducing timber procurement costs.**	
	Changes in precipitation and weather patterns	• **Changes in forestation and timer procurement areas will increase timber procurement costs.**	
	Increased severity of extreme weather events	• **Suspension of factory operations will reduce sales. Decreased forest resources will increase timber procurement costs.**	
Others	Fluctuations in key product prices, progress of next-generation technology, changes in reputation among investors, dissemination of renewable and energy-saving technologies	• Adoption of AI and IoT will reduce transport and factory operation costs. • Increased trade of energy-saving products and high-efficiency insulating materials will increase sales of timber and building materials for renewable-oriented markets.	Small to Medium

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

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

	Risk item	Business impact on housing and construction	Assessment
Transitional risk	**National carbon emissions targets/policies**	• **Governments’ forest carbon absorption policy will increase timber procurement costs.**	Large
	Forest protection policy	• **Governments’ adoption of timber tax and charges will increase timber procurement costs.**	
	Building policy	• **Efforts to meet government’s policy will increase investment and reconstruction costs.** • **If the government continues subsidies, monetary incentives will arise. Some policies can impact market competition and sales.**	
	Changes in reputation customers	• **If customers pay more attention to climate change, they will opt for forest certified timber, which will increase procurement costs.**	
Physical risk	**Increased severity of extreme weather events**	• **Severe natural disasters will cause delays in construction. This, together with recovery of facilities, will increase construction costs.** • **More extremely hot days will lower outdoor work efficiency, and cause delay in construction and require more careful health management of workers. All this will increase costs.**	
Others	Subsidy policies or RE, changes in energy mix, changes in reputation investor, fossil fuel subsidies, average temperature rise, etc.	• Subsidies for PV power systems will increase monetary incentives. • Accelerating divestment will be more unfavorable to companies not practicing environment business. • Changes in subsidies will change demand for renewable and other forms of energy, having impacts on operation costs.	Small to Medium

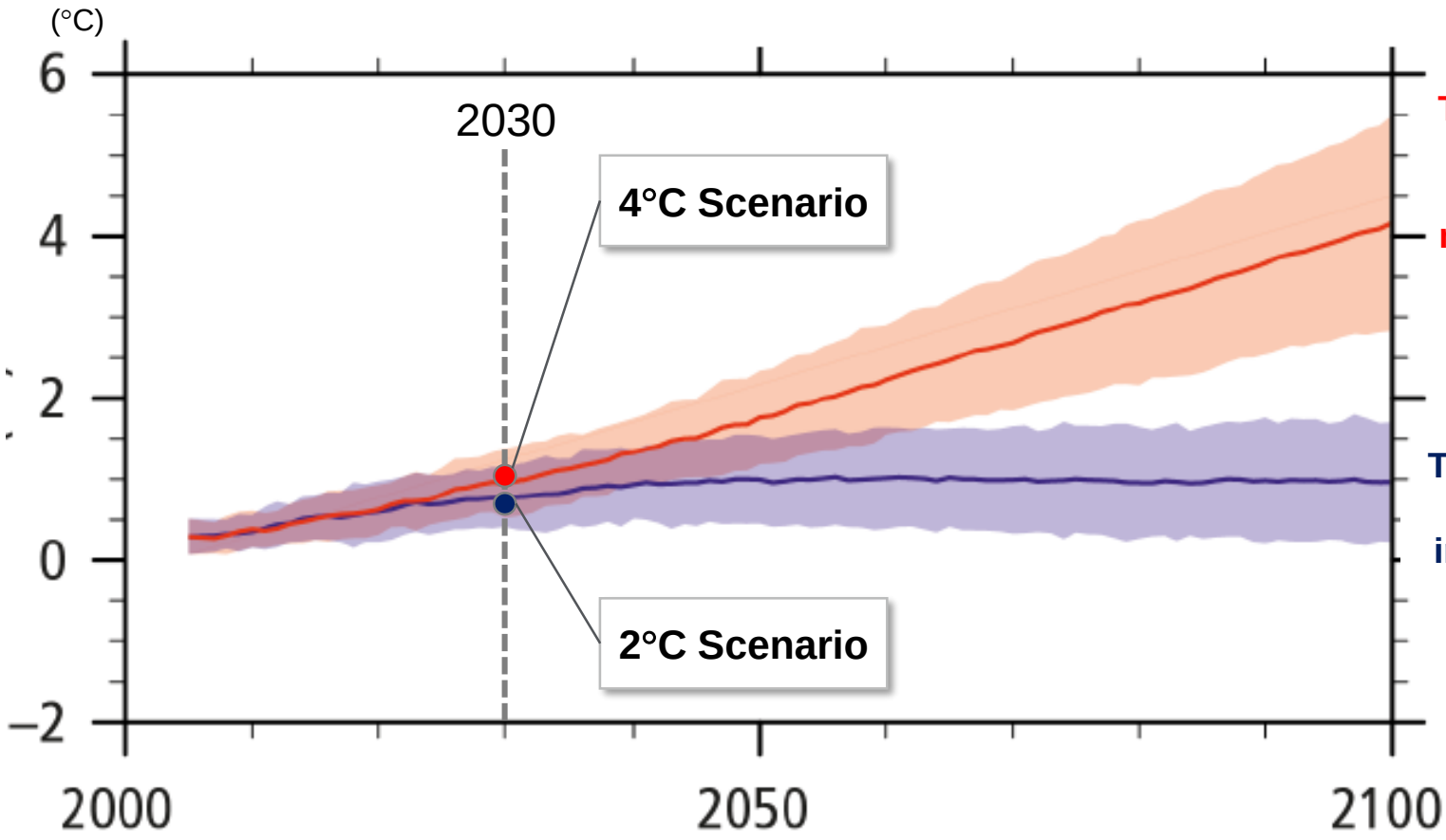
Changes in government policies on forest protection and buildings, as well as severer extreme weather events, will increase costs and have great financial impacts.

STEP3 “Identify and define range of scenario”

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

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

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



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

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

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

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

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

Supplier

Increased forest fires and pests will increase costs.

(region: xxx)

✓ **Increased fires and pests will raise timber prices.**

(region: xxx)

✓ Flooding and soil drainage will **reduce timber supply** and raise timber prices. There will be **risk of suspension of factory operations.**

Action

Secure suppliers with an eye to changes in forestation areas

Prepare disaster prevention measures for forest fire and flooding (Collaboration with suppliers)

New entry

✓ No new entry (No particular action needed)

Timber & building material industry

Industry/Sumitomo Forestry

Further action in light of global warming impacts

✓ **Preparation for possible changes in forestation areas and materials (with an eye to the latter half of the 21st century)**

✓ Governments’ deforestation prevention regulations and policy will change supply change, and raise forest management and logging costs.

Action ***Develop tougher products Review supply chain***

Alternatives

Accelerating shift to alternative materials

✓ Timber will be replaced by metals for building structures (as a result of increased demand for heavy duty materials)

Action ***Change business portfolio***

Customer

Changes in material needs in response to extreme weather events

✓ Frequent extreme weather events will increase demand for heavy duty building materials.

✓ Changes in forestation areas and materials will require the Company to reconsider suppliers and business partners.

Action ***Understand buyers’ needs, and procure materials and develop products to meet the needs***

Other stakeholders

Intensified consumer boycott

✓ NGOs will label logging as unhealthy acts, pushing anti-logging protests and consumer boycotts

Action ***Promote dialogue with NGOs and other environmental groups Participate in initiatives***

Government

Regulations remaining at the present level

(region: xxx)

✓ Government introduce forest protection regulations and policy to achieve NDC target. They may stipulate stricter regulations

(region: xxx)

✓ No regulations on forest absorption in relation to NDC. The government will maintain the present level of operators’ obligations to return emission rights when logging under the emissions trading scheme.

Action ***Gather up-to-date information about government regulations Secure transparency of supply chains***

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

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

Supplier

Stricter regulations will increase timber material costs. Increased forest fires and pests will increase costs

Overall

- ✓ **Stricter regulations** will lead to higher logging tax rates and reduced material productions. This will **increase sales costs and procurement costs.**

(region: xxx)

- ✓ **Forestation areas will shift slightly to north, increased forest fires and pests will raise timber prices.**

Action

Secure suppliers with an eye to higher logging tax rates
Prepare measures for disaster prevention arising from forest fires

New entry

Increased demand from biomass power generation

- ✓ New entries supplying biomass materials and power generation

Action ***Promptly secure promising regions (resilient regions, etc.)***

Timber & building material industry

Industry/Sumitomo Forestry

- ✓ **Preparation for possible changes in forestation areas and materials**
- ✓ **Securing of suppliers with an eye to stricter regulations and inflated prices**
- ✓ Reduction in new housing starts due to ageing society with lower birth rate

Action ***Develop a network contributing to transport cost reductions and suitable for the local production for local consumption model***

Alternatives

More use of carbon-free materials (including wood)

Use of waste materials and new materials (bioplastics, CNF, etc.) in preparation for reduced supply

Action ***Develop new materials and approaches***

Customer

Higher environment consciousness More use of biomass

- ✓ Changes in supply volume will encourage development of materials and new approaches.
- ✓ Increased demand for biomass fuel

Action ***Increase the share and secure domestic materials Supply materials to biomass power generation Promote forest certification and forestation***

Other stakeholders

Changes in investment and financing

- ✓ Investors and financial institutions will change their stance in accordance with the quality of forest management (reforestation, etc.).

Action ***Promote forest certificates and plantation forests***

Government

Much stricter government regulations

Overall

- ✓ **Stricter regulations on natural forest logging**
- ✓ Spread of the idea of “Net Zero Deforestation”

(Region: xxx)

- ✓ The government will set stricter forest protection regulations and policy against logging with the target deforestation rate under 350h/year.

Action ***Gather up-to-date information about government regulations Secure transparency of supply chain***

STEP3 “Identify and define range of scenario”

STEP 2 **3** 4 5 | Scenario **4°C** 2°C | Timber & Building Materials | **Housing and Construction**

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

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

Supplier

Increased forest fires will increase material costs.

- ✓ **Risks of natural disasters will increase material costs.**
- ✓ Procurement of heavy duty materials and timber against natural disasters.

Action

Establish supply chain considering physical risk

Energy business

Inflated grid power rates

- ✓ Grid power rates will increase.
- ✓ Use of heat as renewable energy

Action

Secure non-utility power sources

New entry

Rise in new entries

- ✓ IT businesses and mass home appliance retailers are already in the renovation market.

(No particular action needed)

Housing and construction industry

Industry/ Sumitomo Forestry

Continued efforts for BCP and spread of ZEH

- ✓ Technology development for BCP, energy-saving housing, and HEMS
- ✓ ZEH will increase, but not among large residential houses
- ✓ **Longer construction schedules**

Action

Steadily promote energy-saving and ZEH

Alternatives

- ✓ No alternatives will emerge.

(No particular action needed)

Customer

More efforts for BCP Continued efforts for ZEH

- ✓ Possibly more frequent extreme weather events and slope failures will increase demand for tougher, more **resilient housing**.
- ✓ Global warming will slightly increase air-conditioning demand and costs, and slightly decrease heating demand and costs. If the cooling trend prevails, demand for and costs of heating will increase.
- ✓ Demand for energy-saving and heat-resistant housing will slightly increase.

Action

Continue promoting ZEH Develop highly resilient housing

Government

Continued efforts for net “zero energy houses” (ZEH) Increased subsidies for BCP

- ✓ The government will promote energy-saving houses, and visual control of renewable energy and home energy management systems, HEMS, (through subsidies).
- ✓ The government will encourage the industry to realize ZEH targets (50% of new houses by 2020, and more widespread by 2030).
- ✓ Efforts for carbon pricing will not bear fruit.

Action

Gather up-to-date information about government policy and secure subsidies

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

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

Inflated timber prices
Supplier

- ✓ **Forestry regulations (logging tax, etc.) will raise timber prices.**
- ✓ **Risks of natural disasters will increase material costs.**

Action
Establish supply chains that can accommodate natural disaster risk.
Consider supply chains with an eye to stricter regulations
Promptly secure necessary parts for ZEH

Rise in new entries
New entry

- ✓ Electronics, automobile and IT makers, particularly those with energy-saving and energy storage technology will enter the market.

Action **Business partnerships and M&A**

More sophisticated (high-function) ZEH at lower costs
Customer

- ✓ **The ZEH market will mature and the demand will be polarized (to inexpensive housing and more sophisticated housing).**
- ✓ Higher interest in lower power rates will increase the demand for housing with higher energy efficiency.
- ✓ Increased demand for certificated housing for “fair forestry” and net zero deforestation.

Action
More focus on lower-price housing
More focus on advantageous field (wooden housing)

Promotion of lower-carbon policy for households
Government

- ✓ **The government will set stricter targets than current NDC, and adopt stricter building and housing regulations (including ZEH) and subsidies.**
- ✓ Policy to use surplus power for wider use of PV power generation
- ✓ Promotion of electrification for lower carbon in the household sector (depending on the progress of “Power to Gas” technology)

Action
Work with the government for the spread of advanced ZEH,
Adopt renewable energy, and deal with carbon tax to create emission rights

Housing and construction industry

Increased demand for high-function housing
Industry/ Sumitomo Forestry

- ✓ Reduction in new housing starts due to ageing society with lower birth rate
- ✓ Longer construction schedules
- ✓ **Development of advanced ZEH, efforts for lower pricing**

Action
Develop and apply advanced ZEH and low-price ZEH technologies

More use of renewable energy
Energy business

- ✓ Increased share of renewable energy
- ✓ **Creation of FIT-free and aggregated business**

Action
Secure non-utility power sources and supply from other companies

Increased demand for new materials
Alternatives

- ✓ Inflated prices of steel, cement and other materials will increase demand for bioplastics, CNF and other new materials.

Action **Develop new low-carbon (wooden) materials**

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

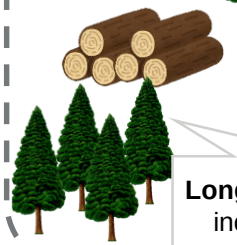
STEP 2 **3** 4 5 | Scenario **4°C** 2°C

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

(Region: xxx)

Forestation areas will slightly shift to north. Procurement costs will increase.

Increased forest fires and pests will increase procurement costs.



Longer growths period can increase logging supply.

Troubles with transport routes due to extreme weather events

Government

Promotion of energy-saving, renewables, and energy storage for housing

The government will promote **energy-saving houses**, and visual control of renewable energy and **HEMS**. The government will encourage the industry to realize **ZEH** targets.

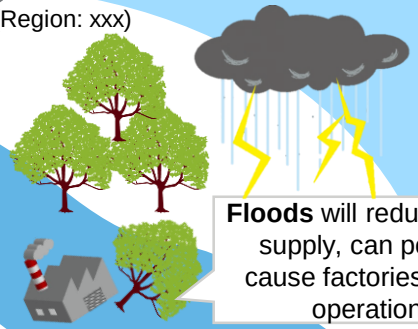
Consumers will have slightly higher interest in **energy-saving housing**, **use of renewables**, and purchase of **ZEH** to cut electricity bills.
Global warming will slightly increase **air-conditioning costs**, and slightly decrease heating costs. Extreme weather events will increase heating costs.
Increased demand for **energy-saving and heat-insulating housing**.

Government

Protect forests against extreme weather events

The government will maintain or possibly enhance **logging tax rates** and regulations **on emission rights in relation to logging.**

(Region: xxx)



Floods will reduce timber supply, can possibly cause factories to stop operations.

Increased demand for **heavy duty construction materials**
Expansion of **sharing economy**
Further urban concentration of population

Technology development for BCP, energy-saving housing, and HEMS

Timber and building materials

Housing and construction

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

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

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

(region: xxx)

Slightly increased **forest fires** and **pests** will slightly increase procurement costs in some regions.

A **longer growth periods** will increase timber supply in some southwestern regions.

Government

Further promotion of low-carbon policy for households
Assistance to technology development

The government will set stricter construction and housing regulations than NDC, and enhance subsidies.
Promotion of **electrification** for lower carbon in the household sector, as well as **carbon tax** and **emissions trading**

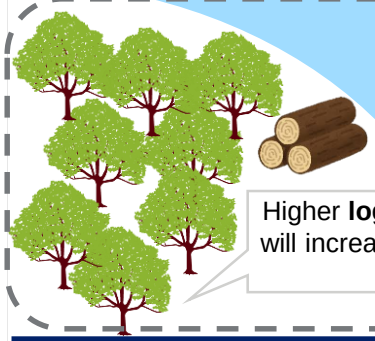
Promotion of **local production for local consumption and domestic timber materials** with an eye to higher LCA

Government

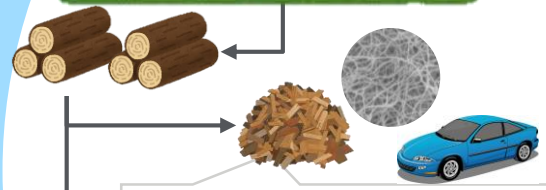
Stricter regulations and policy to protect forest resources

Stricter (natural) forest regulations
Possible higher **logging tax rates** and suspension of exports
Spread of the notion **"Net Zero Deforestation"**
Increased efforts for **emission rights**

(region: xxx)



Higher **logging tax rates** will increase procurement costs.



Use of waste materials and development of **new materials** with an eye to reduced supply
New entries from the housing and material industries

Entries of biomass material suppliers and generators

Promotion of advanced ZEH and lower pricing

Demand will increase for **higher energy-efficiency housing.**
Electronics, automobile and IT makers with energy storage and supply technology will enter the market. Active business operations using surplus power from PV power generation

Timber and building materials

Housing and construction

STEP3 “Identify and define range of scenario”

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

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

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

1

1 [Key indicator: Annual area burned]

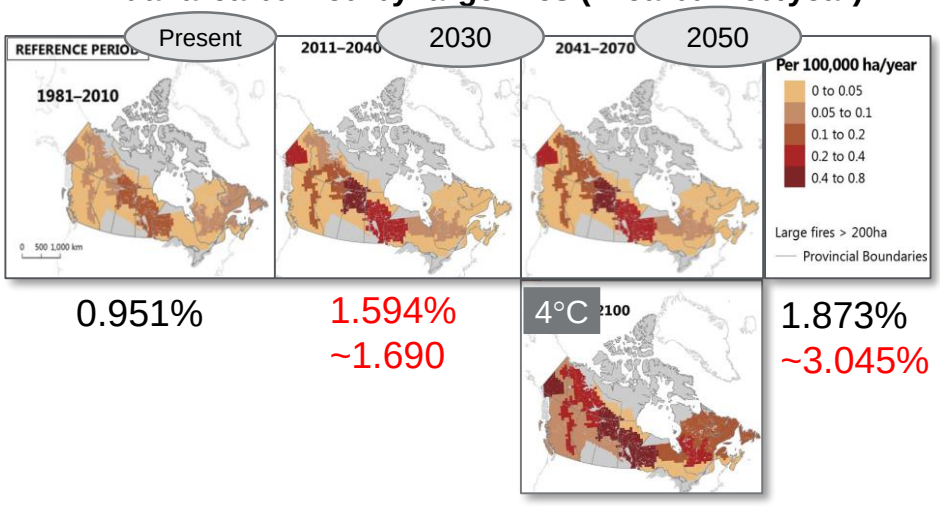
A rise in temperatures will increase the number of large fires, having great impacts both in the 2°C and 4°C scenarios.

Scientific forecasts

Annual area burned by large fires in Canada

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

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



0.951% | 1.594% ~1.690 | 1.873% ~3.045%

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

Recognition of forestry companies

CDP response on climate change risks

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

Forest fire risk recognition among worldwide companies

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

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

Source: CDP response

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

4°C scenario

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

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

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

2°C scenario

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

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

2. Scenario Analysis - Practice Examples

(i) ITOCHU Corporation
(ii) Mitsui O.S.K. Lines, Ltd.
(iii) Japan Airlines Co., Ltd
(iv) MITSUBISHI MOTORS CORPORATION
(v) Sumitomo Forestry Co., Ltd.
(vi) Tokyu Fudosan Holdings Corporation

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

Target business segments and years

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

Assess materiality of climate-related risks
Various factors related to climate change will impact the Company' business

STEP 2 3 4 5 Scenario 4°C 2°C

	Politics	Economy	Society	Technology
Transition Risks (Stricter regulations, etc.)	Great impact • **Carbon pricing** Adoption of carbon tax will incur costs for CO2 emissions. Great impact • **Carbon emissions targets/policies** Expanded coverage of energy-saving laws, enhanced targets of cap and trade programs, and mandatory installation of energy-saving functions will increase technology and facility installation costs. Great impact • **ZEB regulations** Application of ZEB regulations to buildings will increase construction and repair costs.	• Energy prices Increased use of renewable energy and inflated fossil fuel prices will lead to less stable grid systems and increase energy prices. • Trends in energy demand Fluctuating demand for energy as a whole will impact energy procurement costs. • Changes in energy mix Changes in the share of renewable energy will change emission reductions companies need to make.	Great impact • **Changes in consumer behaviors** Increased needs for (i) disaster-resilient and (ii) "green" buildings Great impact • **Changes in reputation among consumers and investors** Any delay to meet the needs for (i) disaster-resilient and (ii) "green" buildings can result in consumer boycott and withdrawal of investors.	Great impact • **Progress of ZEB technology** Rise in advanced materials and technologies will reduce ZEB construction and repair costs. Great impact • **Spread of energy-saving and renewable technology** Progress towards a low-carbon society will facilitate development of energy-saving and renewable technology, and reduce adoption costs.
Physical Risks (climate change, etc.)	Great impact • **Higher average temperatures and sea levels** A rise in average temperatures will cause more heatstroke. It will also lead to more use of air-conditioning, which will increase operation costs. Great impact • **Severer extreme weather events (wind and flood damage)** More frequent typhoons and torrential rains will cause more wind and flood damage to buildings, increase repair costs, and reduce customers.			

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

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

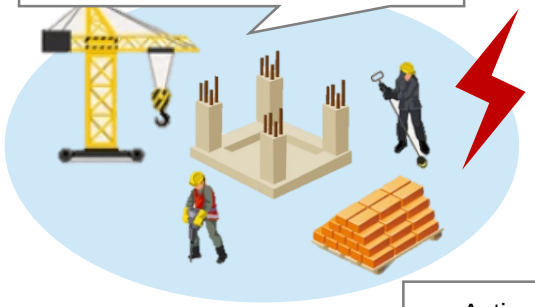
Extreme weather events will be more frequent and shifts to a low-carbon society and renewable energy will not progress.

Urban

Whether companies have BCP or not will be a key factor for investors and customers.

Investor/customer

Competition for land acquisition, disaster preparedness, and enhanced facilities will increase development costs.



Properties vulnerable to flood risks will be low rated.

Active policy and adoption of BCP

CO2 CO2 CO2

Failure to adopt renewable energy will result in large CO2 emissions.

Fossil fuels

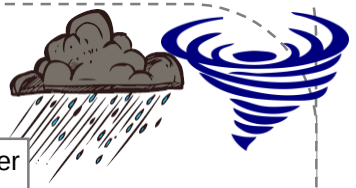
Brown electricity

Disaster preparedness will increase repair costs.

Resort

Low-carbon and remote work policy will basically remain at the present level.

Government

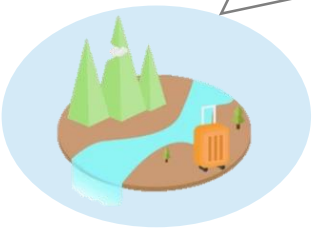


Increased extreme weather events will reduce the number of visitors.

Customers

Heavy rains will cause sediment disasters.

Climate change will lead to lower revenues at ski resorts.



Climate change will increase operating costs.

More employees will wish to work indoors.

Business impacts in the 4°C scenario

STEP 2 3 **4** 5 Scenario **4°C** 2°C

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

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

(Reference) Image of a future society in the 2°C scenario
Extreme weather events will be less frequent than in the 4°C scenario, and adoption of ZEB and renewable energy will progress

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

Urban

Investor/customer

(i) Green building will be a key factor for investors' and customer's decision-making
(ii) Spread of remote work will change criteria for customers for housing rent/purchase.

Carbon tax will increase material costs.

Energy-saving and renewables will reduce costs.

Green energy

Adoption of renewable energy and ZEB with various procurement means

ZEB

ZEB

ZEB

CCS thermal power plant as the main power source

CCS technology

Brown electricity

Disaster preparedness will increase repair costs.

(i) Stricter low-carbon regulations
(ii) Carbon tax
(iii) Subsidies for renewable energy
(iv) Promotion of remote work

Government

New entry

ZEB Green energy

Possible entry of companies with advanced technology

New entry

Resort

Green energy

Energy-saving and renewables will reduce costs.

Increased extreme weather events will reduce the number of visitors.

Customer

Torrential rains and sediment disasters

Climate change will reduce revenues at ski resorts.

Climate change will increase operating costs.

More employees will wish to work indoors.

Business impacts in the 2°C scenario
Interpret that Stricter laws and regulations in the future will have impacts on business to some extent

STEP 2 3 **4** 5 Scenario 4°C **2°C**

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

3. Publicly Available Scenario Analysis

Chapter 3. Publicly Available Scenario Analysis
This chapter presents corporate efforts for scenario analysis in accordance with the steps recommended by the TCFD recommendations.

[Examples of Scenario Analysis]
Not many case studies of scenario analysis are available. This chapter will present selected publicly available scenario analysis

■ **At present, companies listed below have undertaken scenario analysis. Among Japanese companies, INPEX, Mitsubishi Corporation and Toyota Motor are on the list.**

Sector by TCFD definition		Company	Country
Energy	1	Royal Dutch Shell	Netherlands
	2	INPEX	Japan
	3	Mitsubishi Corporation	Japan
Materials (Metals & Mining)	4	BHP	Australia
	5	Glencore	Switzerland
Transportation	6	JetBlue	United States
	7	Aurizon	Australia
	8	TOYOTA MOTOR	Japan
Foods/Consumer Staples	9	Unilever	United Kingdom

Sources: websites, annual reports, and sustainability reports of the companies concerned

[Royal Dutch Shell (Energy) (1/2)]

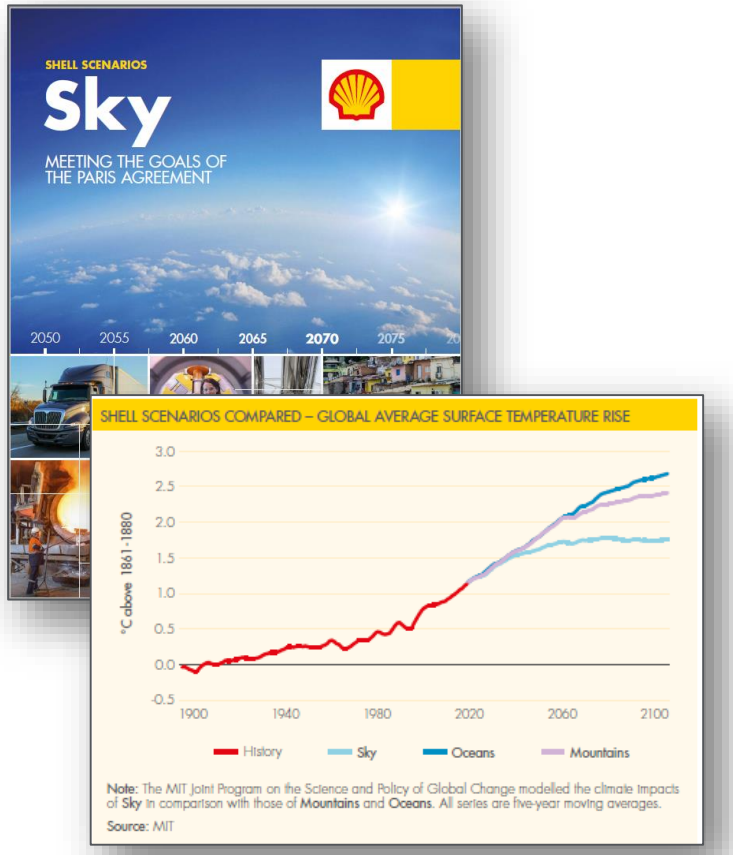
1

The Company sets three scenarios incorporating government policy of different levels. In FY2017, the Company adopted a new scenario “Sky”, “Well below 2°C - The Paris ambition”

Royal Dutch Shell scenario analysis

Features

- Extensive report on scenario analysis comprised 96 pages. Reference to the TCFD recommendations
- In 2013, Shell published its original scenario “New Lens”, a pioneering scenario work.
- The report features comments from CEO/Head of Shell Scenarios on the importance of scenarios.
- The scenarios originally developed were praised by the Massachusetts Institute of Technology (MIT).
- The report makes the most of scenarios and analyzes climate-related impacts on the world and the industry.



Scenario

- **Mountains**
  Governments around the world steadily and gently promote political and economic reforms.
- **Oceans**
  Markets and citizens gain more initiatives, and changes take place at varied paces depending on the speed of deregulation.
- **Sky**
  The scenario complies with the target “below 2℃” of the Paris Agreement. It assumes that carbon emissions from the energy sector will be net-zero by the target year 2070.

2°C Scenario

Source: Royal Dutch Shell, “Shell Scenarios Sky”

1

[Royal Dutch Shell (Energy) (2/2)]

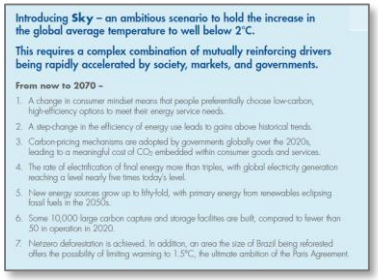
STEP 2 3 4 5

The Company analyses the future world in 2070 and clarifies concerns that could arise when comparing to the present situation.

Royal Dutch Shell scenario analysis

The future world in 2070 in the Sky scenario

- A change in consumer mindset means that people preferentially choose low-carbon, high-efficiency options to meet their energy service needs.
- A step-change in the efficiency of energy use leads to gains above historical trends.
- Carbon-pricing mechanisms are adopted by governments globally over the 2020s, leading to a meaningful cost of CO2 embedded within consumer goods and services.
- The rate of electrification of final energy more than triples, with global electricity generation reaching a level nearly five times today's level.
- New energy sources grow up to fifty-fold, with primary energy from renewables eclipsing fossil fuels in the 2050s.
- Some 10,000 large carbon capture and storage (CCS) facilities are built, compared to fewer than 50 operating in 2020.
- Net-zero deforestation is achieved. In addition, reforesting an area the size of Brazil offers the possibility of limiting warming to 1.5℃.


Introducing Sky – an ambitious scenario to hold the increase in the global average temperature to well below 2°C.

This requires a complex combination of mutually reinforcing drivers being rapidly accelerated by society, markets, and governments.

From now to 2070 –

1. A change in consumer mindset means that people preferentially choose low-carbon, high-efficiency options to meet their energy service needs.
2. A step-change in the efficiency of energy use leads to gains above historical trends.
3. Carbon-pricing mechanisms are adopted by governments globally over the 2020s, leading to a meaningful cost of CO_2 embedded within consumer goods and services.
4. The rate of electrification of final energy more than triples, with global electricity generation reaching a level nearly five times today's level.
5. New energy sources grow up to fifty-fold, with primary energy from renewables eclipsing fossil fuels in the 2050s.
6. Some 10,000 large carbon capture and storage facilities are built, compared to fewer than 50 in operation in 2020.
7. Net-zero deforestation is achieved. In addition, an area the size of Brazil being reforested offers the possibility of limiting warming to 1.5°C, the ultimate ambition of the Paris Agreement.

Challenges for a 21st century scenario

- Energy demand is rising
- Efficiency can have unexpected consequences
- Coal remains popular
- Some parts of the energy system are "stubborn"
- Some technologies are "stalled"
- Systems transformations are unpredictable and take time
- Given the time frame of 2070, there can be no slippage

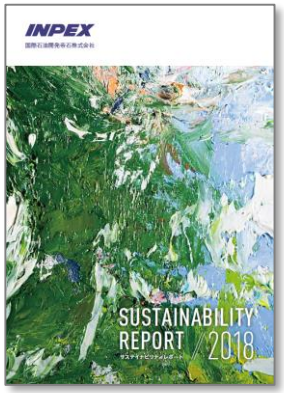
Source: Royal Dutch Shell, "Shell Scenarios Sky"

2

[INPEX (Energy) (1/2)]
The Company sets four climate-change scenarios based on two key factors, “policy” and “technology”.

STEP 2 3 4 5

The Company sets four climate-change scenarios consisting of IEA’s and its own scenarios.



The INPEX Low-carbon Society Scenarios

Scenario (to 2040)	Enhanced policy level	Technological progress level
IEA New Policies Scenario	Preserving actual NDC trends after 2025	Level of actual NDC plus announced technological progress in each country
Technology progress scenario	Preserving actual NDC trends after 2025	Technology of solar, wind and EVs will progress more than those of the IEA New Policies Scenario due to decreasing the cost
Wake-up scenario	Strengthen NDCs greatly enhanced by 2025	Technological progress level : Same as IEA New Policies Scenario through 2025; thereafter the 2°C scenario level
2°C scenario	Strengthen NDCs greatly enhanced by 2020	Energy efficiency improvements and CCS largely contribute to emissions reduction in addition to expansion of solar and wind power, and EVs according to technology development

Low-carbon Transition Plan Based on Scenario Analysis

Medium-term Business Plan 2018–2022

- ✓ Reduce production costs to $5/bbl (excluding royalties) for oil and natural gas upstream businesses
- ✓ Maintain financial and corporate resilience even if the crude oil price drop to US$50/bbl
- ✓ Promote development of natural gas, enhance renewable energy initiatives
- ✓ Manage emissions from operations

Vision 2040

- ✓ Increase our corporate value by conducting operations flexibly
- ✓ Create a global gas value chain
- ✓ Aim for renewable energy projects to account for 10% of its project portfolio in the long term
- ✓ Develop technology for the practical application of CCS

Source: INPEX Corporation, “Sustainability Report 2018”, August 2018.

2

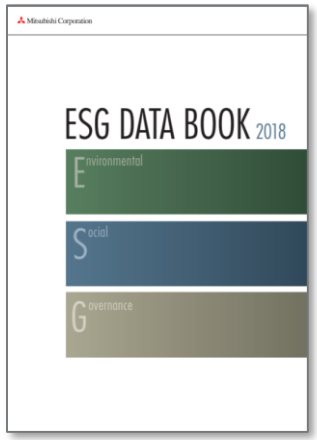
[INPEX (Energy) (2/2)]
The Company evaluates medium and long term transition risks and physical risks

Status of Climate Change Risks and Opportunities: Assessment Coverage Plus Management/Initiatives

Risk/opportunity category		Risks and opportunities covered	Management/initiatives status
Transition risks	Medium-term (to 2022)	• **Reputation risks** related to absolute emissions and emissions intensity • Increased stakeholder **concerns against the industry regarding carbon budgets** and emissions reductions • **Disclosures** regarded as inadequate	• Proper control of **emissions from operations** • **Setting of management targets for company-wide emissions** • **Disclose** climate risk exposure in line with TCFD recommendations
		• Introducing **a carbon pricing policy** in project countries results in higher financial costs	• **Carbon pricing policy trends are monitored** • **Sensitivity analysis being conducted on internal carbon prices** • Practical **use of CCS technology** being strengthened
	Long-term (to 2040)	• A continuing business environment with potential decreased oil demand as **climate policies** are enhanced in each country • A continuing business environment with potential decreased **oil demand** due to technological progress in renewables, EVs, etc. • **Development is difficult for oil/gas projects** with high production costs due to changes in energy choices in the market, resulting in long term demand and pricing impacts	• **Analyzing scenarios in policy, technology, and market trends** • Develop and expand natural gas • Strengthen initiatives on renewable energy • Reducing production costs in upstream oil and natural gas businesses • Maintaining a framework enabling stable operations even if oil prices stay at $50/bbl
Physical risks	Long term (to 2040)	• **Project operations** impacted by increase in abnormal events relating to climate risks • **Project operations** are impacted by increasing average temperatures, changing precipitation patterns, and rising sea levels	• Ichthys LNG Project: Impact of large tropical cyclones on the design of offshore facilities and of rising sea levels on the placement of terrestrial facilities • Erecting a company-wide **framework for assessing and managing physical risks**
Opportunities	Medium-term (to 2022)	• Develop and adopt **low-carbon products and services**	• Develop and expand **natural gas** • Strengthen **renewable energy** projects • **Build a company-wide framework** for assessing and managing opportunities
	Long-term (to 2040)	• Develop and adopt **low-carbon products and services** • Develop **new products and services** through R&D and technology innovation	• Put 10% of project portfolio into **renewable energy projects** • Develop **technology for practical application of CCS** • Continue **R&D in renewable energy technologies** including storage batteries, artificial photosynthesis, and methane reuse using microorganisms

Source: INPEX Corporation, “Sustainability Report 2018”, August 2018.

[Mitsubishi Corporation (Trading Company) (1/3)]
The Company discloses its climate-change risk and opportunity assessment process



Disclosure of the scenario analysis process

The report provides the definition of scenarios used for scenario analysis and the process of assessing climate-related risks that have business impacts.

Process of Assessing Climate Change Risks and Opportunities

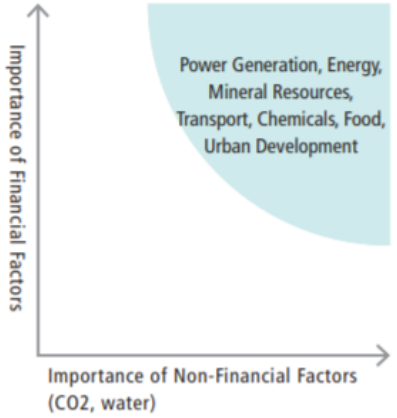
(1) Identification of Climate Change Scenarios

MC will identify scenarios to objectively assess both new opportunities and the resilience of its businesses in cases where climate change causes significant deviations from business as usual (BAU).

Impact of Transition Risks	IEA 2℃ Scenario (WEO SDS Scenario, ETP 2DS Scenario, etc.)
Impact of Physical Risks	IPCC 4℃ Scenario (government panel on climate change RCP8.5 Scenario, etc.)

(2) Identification of Businesses Most Affected by Climate Change

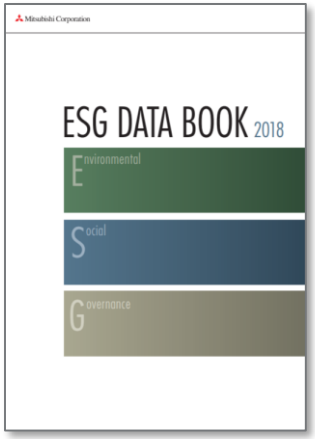
In addition to the industries in which MC is involved where both financial and non-financial factors (CO_2 emissions, water-usage amounts) have significant impacts, MC will specify those most affected by climate change taking into account the TCFD's sector classifications.



Source: Mitsubishi Corporation, "ESG Data Book 2018"

3 [Mitsubishi Corporation (Trading Company) (2/3)] The Company discloses the process of assessing transition opportunities and risks, and physical risks

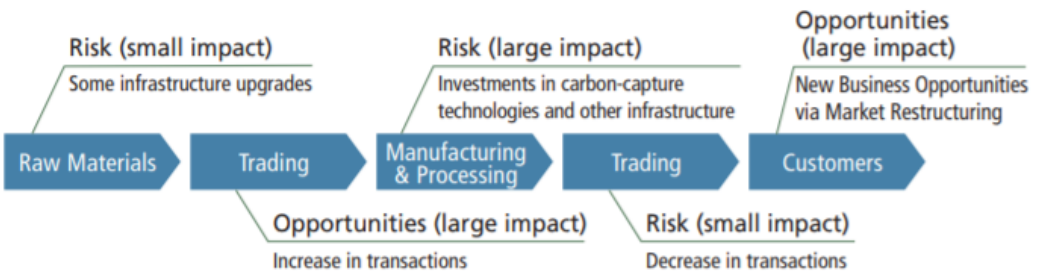
STEP 2 3 **4** 5



(3) Industry Impact Assessments

● Transition Opportunities and Risks

Based on TCFD recommendations, MC is identifying climate-related opportunities and risks under the 2℃ Scenario at each link in its industry-specific value chains. The impact of climate change on each industry is assessed with respect to changing demand under the 2℃ Scenario (impact on demand), the impact on MC's businesses, and new business opportunities (impact on earnings).



Industry Impact Assessment Criteria

Opportunities:
Resource efficiency, energy resources, products, markets, resilience

Transition Risks:
Government policies and laws, technologies, markets, reputation

Physical Risks:
Acute, chronic

● Physical Risks

MC is assessing physical risks (water shortages, landslides, fires, etc.) in each region under the 4℃ Scenario and the impact on businesses at each of its Group companies. With respect to assessing water risk, Aqueduct* and other outside tools are utilized based on information on water withdrawals at those companies.

* Aqueduct: World Resource Institute's water risk mapping tool

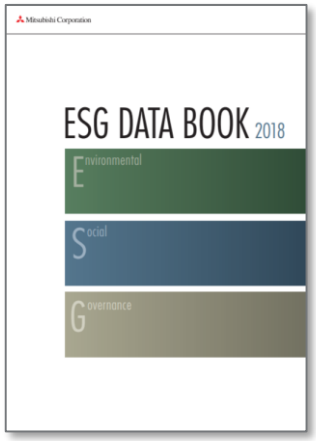
(4) Future Actions

Based on the results of MC's industry impact assessments, we will verify how the identified risks and opportunities are likely to affect our businesses and examine ways to optimize future strategies, risk management, and monitoring (such as by specifying which indicators to use and targets to set).

Source: Mitsubishi Corporation, "ESG Data Book 2018"

3 [Mitsubishi Corporation (Trading Company) (3/3)] The Company discloses business impacts and potential responses in detail under the NDC 2°C scenarios.

STEP 2 3 4 5



Disclosure of scenario analysis in detail

The report provides global demand trajectory and trends for power generation and related businesses, natural gas and LNG, thermal coal, and coking coal at five levels (substantial increase, increase, unchanged, decrease, and substantial decrease) in various scenarios.

NDC Scenario

2°C Scenario

Power Generation and Related Businesses

Awareness of the business environment under the NDC Scenario	Awareness of the business environment under the 2°C Scenario
Thermal power*3 → Renewables	Thermal power*4 → Renewables
*3 Demand trajectory and trends related to thermal power differ depending on fuel type, generation method and country/region.	*4 Based on the Sustainable Development Scenario of the IEA World Energy Outlook 2017.
With the introduction of government subsidies and technological advancements, opportunities are anticipated for businesses such as renewable energy and clean gas-fired power generation. However, given the nature of power generation being produced locally for local consumption, MC feels it is important to continue managing businesses by responding to the policies, etc. of each country and region. For thermal power generation, business opportunities for gas-fired power, which has a lower environmental impact, are also anticipated to increase. The demand from Asia for LNG and demand in North America for natural gas are expected to grow. With regard to renewable energy, as the expansion of renewables progresses together with the proactive deployment of renewable technologies in Europe, with a focus on offshore wind, the grid configuration and supply of power will change. As a result, opportunities are anticipated for energy transmission and businesses that regulate the supply and demand for power such as battery storage and VPP (virtual power plant) businesses.	Under a 2°C Scenario, it is believed that policies to capture renewable energy as a main power source will become mainstream. It will be necessary to promote deregulation and technological innovation to construct an energy system that is not only sound environmentally, but economically and socially as well. Regarding this point, MC understands the need for multifaceted initiatives involving technologies that support the expansion of renewable energy while maintaining safe and stable supplies of power (energy storage, hydrogen, transmission technology and energy trading). Furthermore, MC recognizes that trends towards decentralization of the energy system driven by the spread of renewable energy, batteries and other technologies along with movements around thermal power generation, including next-generation types, may vary greatly in terms of timing and content depending on the status of government regulation and technological innovation, as well as the country or region.

Disclaimer regarding scenarios

Scenarios are based on past data and are not forecasts. Instead, they are virtual models based on possible outcomes for matters with high levels of uncertainty. The scenarios and awareness of business environment written here represent MC's understanding of the main scenarios disclosed by international organizations such as the IEA, and do not represent MC's medium to long-term outlook. Outlooks for possible outcomes in the medium to long-term take into account a number of potential risks, uncertainties and assumptions, and in actuality, may differ significantly from each scenario due to fluctuations of key factors.

Evaluation of business impact on industry

Policies / Initiatives

In line with the expansion of renewable energy and accompanying policies, MC will optimize its portfolio throughout the electric power value chain while taking into account the characteristics of each country and region.

As of the end of September 2018, the total electricity generation capacity worldwide is approximately 5.7 GW, and the length of transmission cables in the power transmission business has reached a cumulative total of roughly 1,000km (with about 5 GW transmission capacity).

In the thermal power generation business, in addition to facilitating collaboration between its gas-fired power generation business, which uses a fuel source with a lower environmental footprint, and its upstream natural gas business, MC is also strengthening its power trading function. Furthermore, in Japan, MC is promoting comprehensive energy-efficient electric power supply businesses (on-site cogeneration business) for local communities and manufacturing plants.

In the renewable energy business, in addition to aiming to achieve at least 20% renewable energy in its power generation business (by 2030, based on generation amount), MC is promoting businesses that support the proliferation of renewable energy, including energy transmission and storage-related businesses.

In Europe, where the active deployment of renewable energy continues to progress, all of MC's power generation activities involve renewable energy, with a focus on offshore wind. Moreover, MC proactively engages in new business opportunities including a virtual power plant (VPP) business that utilizes Lawson convenience stores as well as an off-grid distributed renewable energy project in Africa.

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

Reference: Environmental Business Section- List of Renewable Energy Projects

Policies and Initiatives

Source: Mitsubishi Corporation, "ESG Data Book 2018"

[BHB Billiton (Materials) (1/3)]

The Company has developed four scenarios in terms of the levels of cooperation and technology available at each country. It also adopts a Global Accord scenario towards a 2°C target.

Features of scenario analysis, and scenarios used

Features

- The Company reports on scenario analysis and refers to the TCFD recommendations.
- The report covers various events under four scenarios including the 2°C scenario (Global Accord) recommended by the TCFD recommendations.
- The report assumes a scenario where shock events will prompt a rapid transition to a largely decarbonized world in accordance with Global Accord scenario.
- The report concludes that strict environment regulations and emission costs will impact their commodities, but that BHP Billiton's scenario remains attractive.

Scenarios

- A New Gear: Innovation delivers step-change growth in developed economies
- Closed Doors: National self-interest drives economic policy leading to low growth
- Global Accord: High cooperation and commitment to limit emissions will facilitate technology development. There is a transition to a 2°C world
- Two Giants: U.S. and China-led hubs drive technology-enabled growth

2°C Scenario

Source: BHP Billiton, "Portfolio Analysis 2015"

[BHB Billiton (Materials) (2/3)]
The Company analyzes possible impacts on commodity demand during transition to a 2°C world

Global Accord- Impacts on Long-term Demand

Approach

- Identify critical uncertainties impacting demand for the Company's commodities in a 2°C scenario. (Table 2)
- Construct a central case, where what the Company expects will happen, and analyze the commodities long-term demand under the Global Accord scenario and with the application of shock events. (Figure 6)

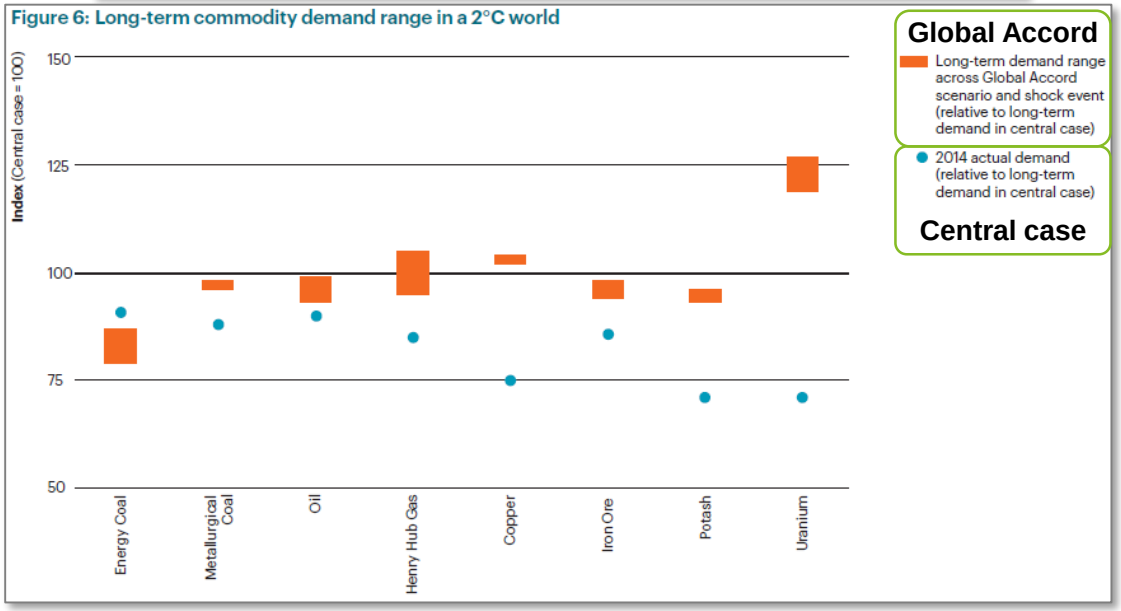
Results

- The Company forecasts growth in long-term demand for most of their commodities in the Global Accord scenario and shock event scenarios.
- Growth will be at a slower pace than in the central case.
- The Company forecasts the share of renewable energy in the power mix to increase by almost 25 per cent in the Global Accord scenario compared with the central case.
- In transport, several trends intensify, including improvements in the fuel economies of new vehicles and the rise in electric vehicles. As a result, energy coal and crude oil are likely to be the most affected in the Global Accord scenario and shock event scenarios.
- In the Global Accord and shock event scenarios, the power and machinery sectors are impacted by tighter environmental constraints and emissions costs.

Table 2: Critical uncertainties impacting demand for BHP Billiton's commodities in a 2°C world

Commodity	Critical uncertainties
Energy Coal	↑ Economic carbon capture and storage solution
	↑ Penalties for lower quality coal supply/minimum quality standards for power generation
	↓ Switch from coal to gas in power generation
	↓ Renewables capacity additions for power generation
Metallurgical Coal	↑ Penalties for lower quality coal supply
	↓ Increased rate of steel scrap collection
	↓ Materials substitution
Copper	↑ Energy efficient machinery
	↑ Renewables capacity additions for power generation
	↑ Increased adoption of electric vehicles
	↓ Increased rate of copper scrap collection
	↓ Materials substitution

Figure 6: Long-term commodity demand range in a 2°C world



Source: BHP Billiton, "Climate Change: Portfolio Analysis"

4 [BHB Billiton (Materials) (3/3)]

Due to portfolio diversification, the Company forecasts that the EBITDA and margins will not be impacted significantly in the scenarios used

Global Accord - Earnings

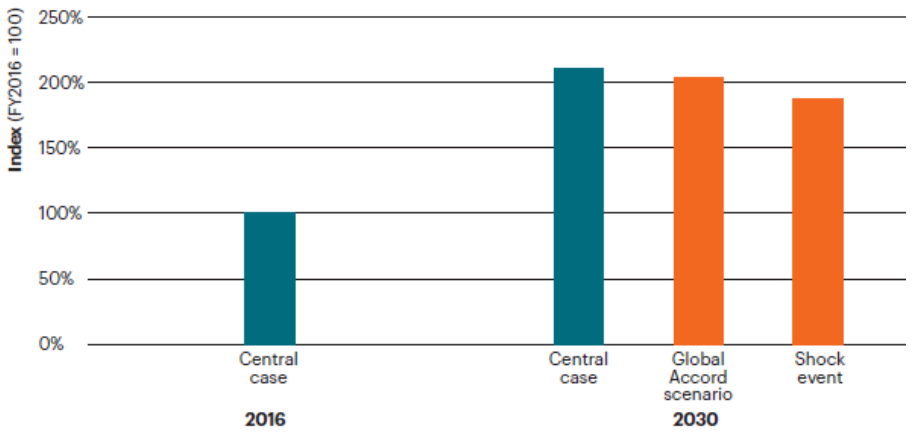
Approach

- The Company analyzes how EBITDA grows in FY2030 relative to FY2016 in the central case (benchmark for business planning), under the Global Accord scenario and the shock event scenario. (Figure 7)

Results

- The EBITDA is expected to double relative to FY2016 both in the Global Accord and the shock event scenarios.
- In the Global Accord scenario, the Company anticipates the impact on the current portfolio value will be minimal. This is due to portfolio diversification and diminishing contribution of fossil fuels as a proportion of portfolio value over time, in comparison with other commodities.

Figure 7: EBITDA

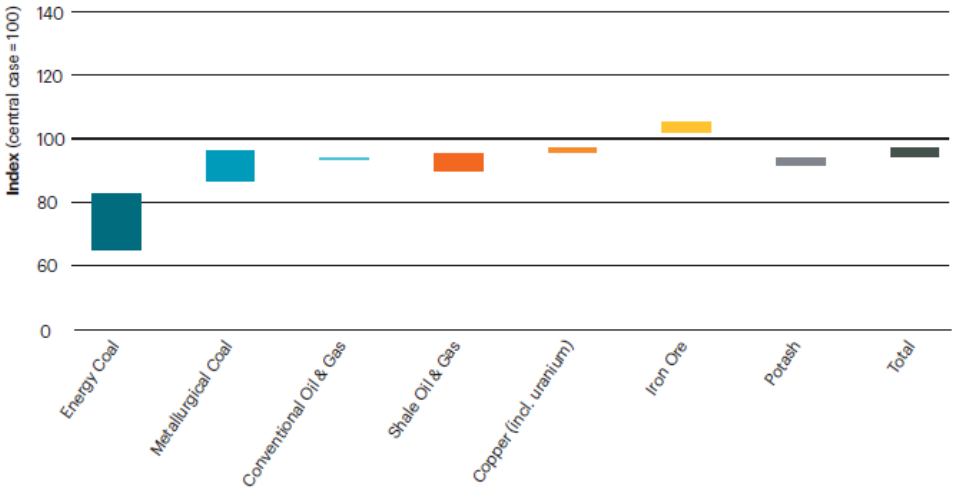


Global Accord - EBITDA margin and commodity supply

Results

- The EBITDA margins will not be impacted significantly both in the Global Accord and the shock event scenarios.
- The Company forecasts that commodities affecting climate change will reduce their proportions in the portfolio, and others will increase their proportions, both in the Global Accord and the shock event scenarios in comparison to central case.

Figure 8: 20-year average EBITDA margin ranges in a 2°C world



Source: BHP Billiton, “Climate Change: Portfolio Analysis”

5 [Glencore (Materials) (1/2)]

The Company makes climate change considerations with three scenarios invented based on IEA's New Policies Scenario in WEO 2016 and the 450 scenario

(i) Delayed Action (Glencore Central Scenario)

- **Based on IEA's New Policies Scenario (4°C) with outcomes reflective of 5-10 year delays**
- Carbon prices: **US $5 to US $25 per tonne CO2e by 2030**, rising to a range of **US $10 to US $40 by 2040 per tonne CO2e**
- Domestic efforts: Many countries do not meet their stated targets or objectives.
- Technology: Fossil fuels continue to be the primary base for electricity generation, especially in Asia with slower introduction of low-carbon technologies.

(ii) Committed Action

- **New policy Scenario, including timely and full implementation of NDCs**
- Carbon prices: **US $10 to US $40 per tonne CO2e by 2030**, rising to a range of **US $20 to US $50 by 2040 per tonne CO2e**
- Domestic efforts: Key countries make efforts to reduce emissions with focused NDC implementation.
- Technology: Moderate growth of renewables and increasing use of high-efficiency technologies. Enhanced energy efficiency and consumption improvements in developed and developing countries

(iii) Ambitious Action

- **450ppm Scenario (consistent with achieving 2°C climate change goal)**
- Carbon prices: **US $75 to US $100 per tonne CO2e by 2030**, rising to a range of **US $125 to US $140 by 2040 per tonne CO2e**
- Domestic efforts: Globally coordinated efforts to reduce emissions accelerated beyond the implementation of existing NDCs. Universal adoption of carbon pricing
- Technology: Rapid development of break-through technologies and investment in renewable energy and CCS

Source: Glencore, "Climate Change Considerations for Our Business 2017"

5

[Glencore (Materials) (2/2)]

Under (ii) the committed action scenario, where NDCs are implemented without delay, the Company's business units remain a positive investment outlook, with the exception of ferroalloys and oils (which account for 5% of the total EBITDA).

STEP 2 3 **4** 5

	Business Unit EBITDA	Scenario	Outlook	Impact under Ambitious Action Scenario
Copper	Copper 31%	Delayed Action Committed Action Ambitious Action	↑ ↑ ↑	**Marketing attractiveness is robust and demand growth improves** as climate action is globally coordinated driving electrification of energy and transport systems,. (…)
Marketing	Marketing 28%	Delayed Action Committed Action Ambitious Action	↑ ↑ ↑	Marketing and trading margins **not impacted by climate initiatives**. **Remains core to Glencore's business model and differentiates** Glencore from its peers.
Zine	Zinc 18%	Delayed Action Committed Action Ambitious Action	↑ ↑ −	**Demand growth** for Zinc based on anti-corrosive properties **and use as an alloy to form materials** that are used in automobiles, (…) **will be supported by ongoing** electrification, industrialization and urbanization.
Seaborne Coal	Seabourne Coal 13%	Delayed Action Committed Action Ambitious Action	↑ ↑ −	Seaborne traded coal differentiated (…) as ongoing investment in low cost coal cased power generation across south east Asia supports seaborne demand. Glencore's competitive portfolio **continues to generate acceptable returns**
Nickel	Nickel 4%	Delayed Action Committed Action Ambitious Action	↑ ↑ −	**Marketing attractiveness is robust and demand growth improves** as climate action is globally coordinated driving electrification of energy and transport systems. (…)
Ferroalloys	Ferroalloys 4%	Delayed Action Committed Action Ambitious Action	− − ↓	**The high cost of carbon** assumed under the (3) Ambitious Action Scenario would potentially **lead to the closure** of some of South Africa's marginal ferrochrome producers, **resulting in major job losses**.
Agriculture	Agriculture 1%	Delayed Action Committed Action Ambitious Action	↑ ↑ ↑	Agriculture **maintains positive investment attractiveness** under each of Glencore's scenarios.
Oil	Oil 1%	Delayed Action Committed Action Ambitious Action	− − −	Oil **has a neutral attractiveness** under each of Glencore's scenarios. We **will continue to monitor any increase in carbon prices** that may provide a driver from investment into reduction options to reduce our overall risk to the business.

Source: Glencore, "Climate Change Considerations for Our Business 2017"

6

[jetBlue (Transportation) (1/2)]
The Company analyzes impacts of climate-change risks and opportunities using a 2°C scenario as part of enterprise risk management (ERM)

STEP 2 3 4 5

jetBlue "A Sustainability Accounting Standards Board (SASB) and Task Force on Climate-related Financial Disclosure (TCFD) Report"

➢ Corporate profile: jetBlue Airways Corporation

A U.S. low-cost airline headquartered in New York City and the sixth-largest airline in the U.S. JetBlue Airways operates some 1,000 flights daily and serves over 100 domestic and international destinations in 17 countries including the Caribbean, Central America and South America.

➢ Purpose of the report:

The report is designed to provide stakeholders with information about the Company's environmental, social, and governance (ESG) performance that helps them understand the issues and trends affecting the Company's business and how they prepare for them. It also aims to disclose information in line with the SASB and TCFD.

Identify risks to the Company

The report gives accounts of ESG risks and specific cases (including a hurricane's devastating impact). The report also explains the management of and resilience to risks and the reasons in the SASB or TCFD framework.
The Company started scenario analysis in FY2017 and expresses its intention to continue the analysis in the coming five years.

Transition Risks	
Policy & Legal	Higher fuel and/or carbon prices
	Additional emissions-reporting obligations
	Mandates on and regulation of existing products and services
Technology	Cost to transition to lower-emissions technology
	Substitute lower-emission options from existing products and services
Market	Increased concerns of stakeholders around lower carbon service offerings
	Increased cost of materials
Reputation	Shifts in consumer preferences between brands and/or modes of transportation for tourism destinations
	Stigmatization of sector
	Increased stakeholder concern or negative stakeholder feedback

Physical Risks	
Acute	More frequent and severe weather events (e.g., hurricanes and snow storms) leading to business interruption and damage across operations and supply chains
Chronic	Long-term shifts in climate patters, possibly resulting in new storm patterns, coastal flooding, and chronic heat waves that potentially affect airports

Why the Company is resilient (examples)

- In 2017, three large hurricanes resulted in more than 2,500 cancelled flights and disrupted normal operations for 30 consecutive days. Property damage was estimated at more than $200 billion, the costliest on record.
- Despite the disruption caused by the multiple hurricanes, only 1.4% of the Company's available seat miles were cancelled in 2017 as a result of these events.
- Even a major hurricane is typically a short-term localized event. The Company was able to mitigate revenue loss from cancelled flights by redeploying flights to other destinations, which were not hit by extreme weather events.
- Due to more accurate hurricane forecasting models, the Company is able to move planes out of storm paths earlier than in the past.

Source: jetBlue, "A Sustainability Accounting Standards Board (SASB) and Task Force on Climate-related Financial Disclosure (TCFD) Report"

6 [jetBlue (Transportation) (2/2)]
The Company presents potential financial risk impacts qualitatively, and explains corporate strategy and mitigation measures.

STEP 2 3 4 5

jetBlue "A Sustainability Accounting Standards Board (SASB) and Task Force on Climate-related Financial Disclosure (TCFD) Report"

Transition Risk

Climate-related Risk	Potential Financial Impact	Strategy and Mitigation Measures
Policy & Legal • Increased climate change related regulation and policies resulting in: ✓ Higher fuel and/or carbon prices ✓ Additional emissions-reporting obligations ✓ Mandates on and regulation of existing products and services	• Higher compliance and mitigation costs	**Preparation for Regulatory Change** • Implementation of monitoring, data aggregation, and calculations required by new regulations before mandated implementation • Reporting in accordance with SASB, TCFD, and other reporting schemes • Proactive emissions offsetting to establish relationships and processes • Engagement with regulations and industry organizations • Cost reduction activities **Enhanced Data Analytics** • Monitor fuel consumption and resulting carbon emissions • Model or forecast carbon-related costs to determine economic impact

Physical Risk

Climate-related Risk	Potential Financial Impact	Strategy and Mitigation Measures
Acute • More frequent and severe weather events(e.g., hurricanes and snow storms) leading to business interruption and damage across operations and supply chain (including aircrafts and/or fuel supply)	• Loss of revenues • Increased costs in the form of operational strain, customer compensation, and crewmember overtime pay	• Established operating procedures that allow us to cancel flights early if we predict that extreme weather will impact safety, inconvenience customers, or disrupt crewmembers' ability to perform • Coastal assessments and management plans

Source: jetBlue, "A Sustainability Accounting Standards Board (SASB) and Task Force on Climate-related Financial Disclosure (TCFD) Report"

7

[Aurizon (Transportation)]
The Company considers the implications of the three policy scenarios of IEA, WEO, and ETP for the coal business

STEP 2 **3** 4 5

Scenario analysis in Sustainability Report

WEO-CPS
(Current Policies Scenario)

The scenario assumes no changes in policies. Partly due to population growth, the demand for fossil fuels will increase.

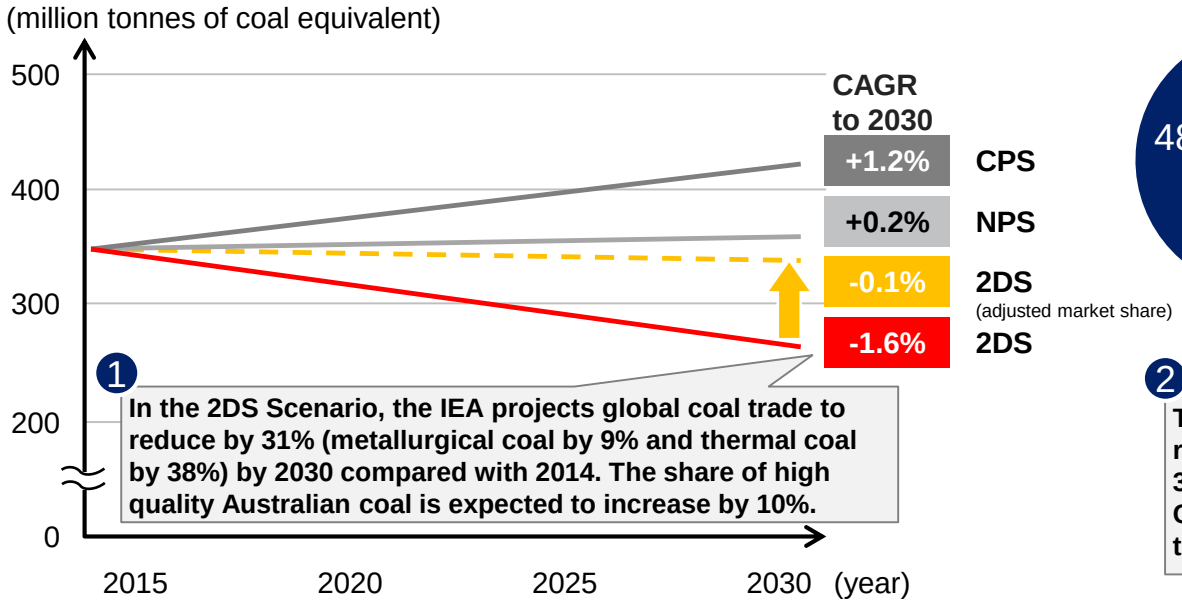
WEO-NPS
(New Policies Scenario)

The scenario takes account of broad policy commitments and plans announced by countries, including national pledges to reduce GHG and plans to phase out fossil-energy subsidies (NDC assumptions).

ETP-2DS
(2 Degree Scenario)

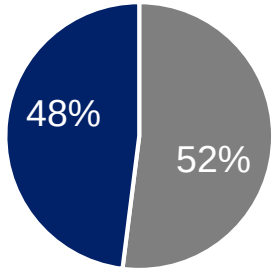
The scenario is consistent with the goal of limiting the global increase in temperature to 2°C. Countries will adopt carbon tax and emissions trading, resulting in a reduction in fossil fuel consumption.

Australia export volumes projected under IEA scenarios (compared with 2014)

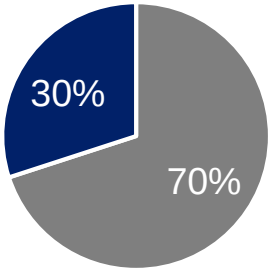


1 **In the 2DS Scenario, the IEA projects global coal trade to reduce by 31% (metallurgical coal by 9% and thermal coal by 38%) by 2030 compared with 2014. The share of high quality Australian coal is expected to increase by 10%.**

Coal-related revenues
(Above Rail)



Coal-related revenues
(Below Rail)



■ Metallurgical coal ■ Thermal coal

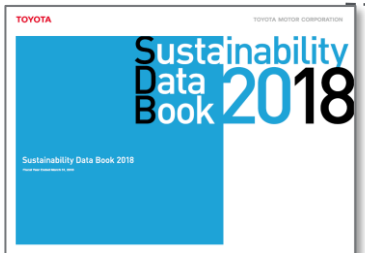
2 **Thermal coal accounts for some 50% of the revenues of the transport business, but for a mere 30% of the revenues of the network business. The Company considers that climate change impacts on the entire business are limited.**

Source: Aurizon, “Sustainability Report 2017”

8

[Toyota Motor (Transportation)]
The Company performs scenario analysis with the ratio of electric vehicles and carbon pricing as two variable parameters

STEP 2 3 4 5

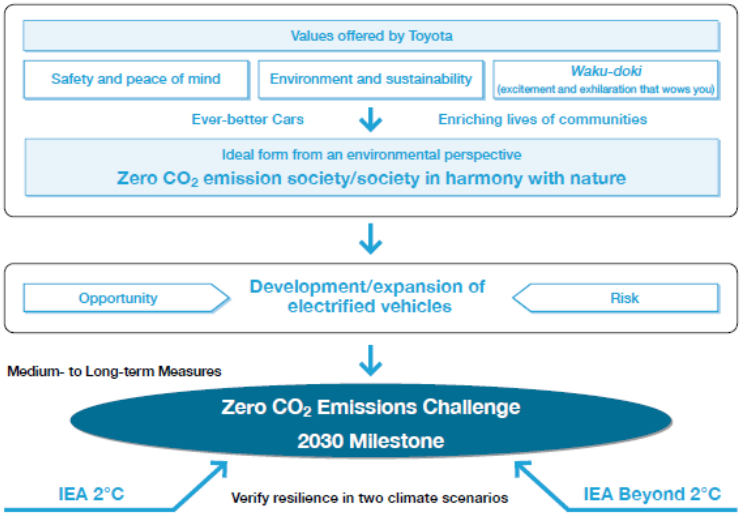


TOYOTA MOTOR CORPORATION
"Sustainability Data Book 2018"
(September, 2018)

Climate-related Scenario Analysis

In order to realize the Toyota Environmental Challenge 2050, the 2030 Milestone was established based on the current situation of Toyota and social trends. In the setting of the Milestone, based on "different climate-related scenarios, including a 2°C or lower scenario," the influence that climate change will have on Toyota was analyzed and resilience of Toyota's medium- to long-term strategy was verified. The climate scenarios mentioned above referred to those equivalent to "2°C" and "Beyond 2°C" in the International Energy Agency (IEA) report, and electrified vehicle sales and production activities at plants were analyzed.

Investigation Process



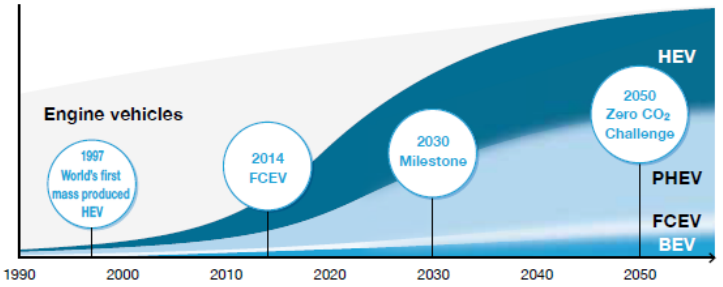
Results of Verification in Two Senarios

■ Electrified vehicle sales

With regard to the ratio of electrified vehicles including hybrid electric vehicles (HEVs), the ratio in the 2030 Milestone exceeds the levels both in the "2°C" and "Beyond 2°C" climate scenarios. On the other hand, although the ZEV* ratio surpasses that in "2°C," it does not reach the level of "Beyond 2°C." However, through the development of HEVs, Toyota has been establishing a mass production base by cultivating the component technologies essential to electrified vehicles. These technologies will also be applicable to ZEV, and Toyota is capable of making flexible and strategic changes to the powertrains and line-ups according to changes in demand. As we look toward "Beyond 2°C," we will make flexible decisions on the necessity to change the line-ups by monitoring various indicators to grasp global trends.

* ZEV (Zero Emission Vehicle): Vehicles with zero CO_2 emissions at the driving phase

Vehicle Electrification Milestones



■ Production activities at plants

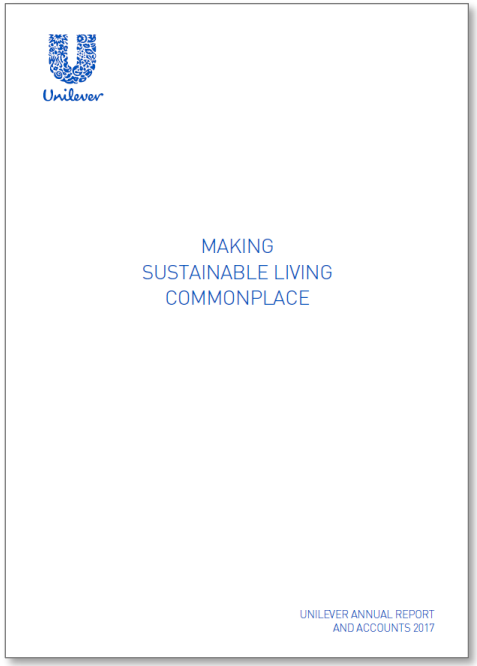
Carbon pricing policies have been in discussion globally toward the achievement of the 2°C target. In terms of the financial risk from this policy, there may be a cost increase due to the carbon price according to CO_2 emissions from energy usage emission. However, Toyota has been globally promoting CO_2 emissions reduction at plants in the Toyota Environmental Challenge 2050 and 2030 Milestone. On this basis, we expect to reduce costs from carbon pricing and energy purchase costs by energy-saving and energy creation. Therefore, measures for the 2030 Milestone can lower the financial impact due to carbon pricing.

Source: Toyota, "Sustainability Data Book 2018", September 2018.

9

[Unilever (Consumer Staples) (1/4)]
The Company presents the findings of its scenario analysis in annual reports

Scenario analysis featured in the annual report



CONTENTS

The scenario analysis is included in the "Risks" section.

Source: Unilever, "Annual Report and Accounts 2017"

9

[Unilever (Consumer Staples) (2/4)]
The report presents assumptions made for the 2°C and 4°C scenarios

Climate change has been identified as a principal risk to Unilever. To further understand the impact that climate change could have on Unilever's business we performed a high level assessment of the impact of **2°C and 4°C global warming scenarios**.

The 2°C and 4°C scenarios are constructed on the basis that average global temperatures will have increased by 2°C and 4°C in the year 2100. Between today and 2100 there will be gradual changes towards these endpoints, and we have **looked at the impact on our business in 2030 assuming we have the same business activities as we do today**. We also made the following simplified assumptions:

- In the 2°C scenario, we assumed **that in the period to 2030 society acts rapidly to limit greenhouse gas emissions and puts in place measures to restrain deforestation and discourage emissions (for example implementing carbon pricing at $75-$100 per tonne, taken from the International Energy Agency's 450 scenario)**. We have assumed that there will be no significant impact to our business from the physical ramifications of climate change by 2030 – i.e. from greater scarcity of water or increased impact of severe weather events. **The scenario assesses the impact on our business from regulatory changes**.

- In the 4°C scenario, we assumed climate policy is less ambitious and emissions remain high so the physical manifestations of climate change are increasingly apparent by 2030. Given this **we have not included impacts from regulatory restrictions but focused on those resulting from physical impacts**.

We identified the material impacts on Unilever's business arising from each of these scenarios based on existing internal and external data. The impacts were assessed **without considering any actions that Unilever might take to mitigate or adapt to the adverse impacts or introducing new products that might offer new sources of revenue as consumers adjust to the new circumstances.**

Source: Unilever, "Annual Report and Accounts 2017"

[Unilever (Consumer Staples) (3/4)]
The report presents the findings of analysis under the 2°C and 4°C scenarios

The main Impacts of the 2°C scenario were as follows:

- Carbon pricing is introduced in key countries and hence there are increases in both manufacturing costs and the costs of raw materials such as dairy ingredients and the metals used in packaging
- Zero net deforestation requirements are introduced and a shift to sustainable agriculture puts pressure on agricultural production, raising the price of certain raw materials

The main impacts of the 4°C scenario were as follows:

- Chronic and acute water stress reduces agricultural productivity in some regions, raising prices of raw materials
- Increased frequency of extreme weather (storms and floods) causes increased incidence of disruption to our manufacturing and distribution networks
- Temperature increase and extreme weather events reduce economic activity, GDP growth and hence sales levels fall

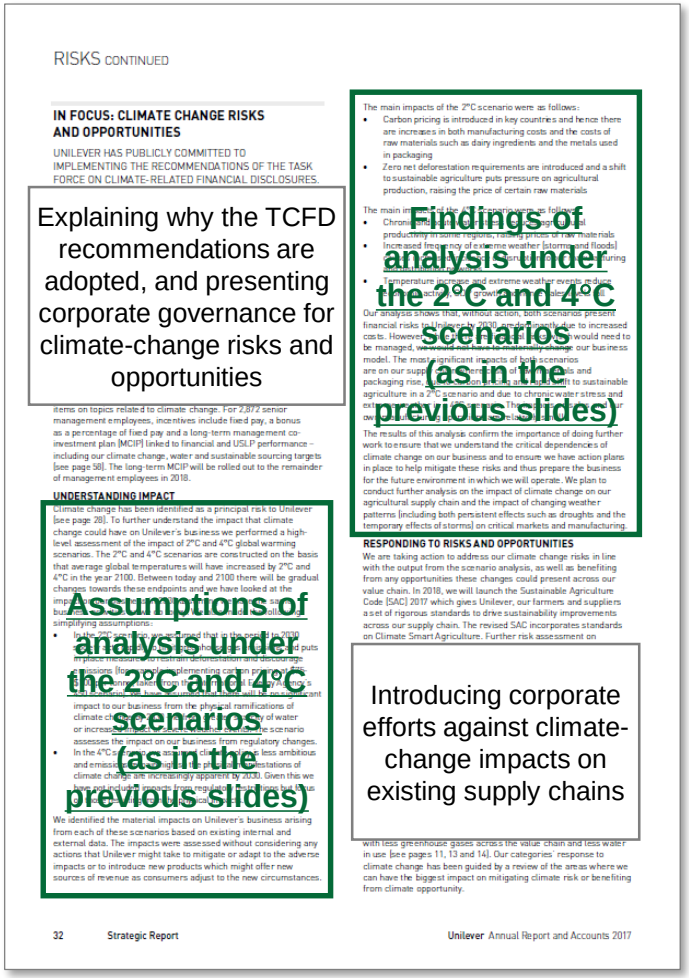
Our analysis shows that, without action, **both scenarios present financial risks to Unilever by 2030, predominantly due to increased costs**. However, while there are financial risks that would need to be managed, **we would not have to materially change our business model.** The most significant impacts of both scenarios are **on our supply chain where costs of raw materials and packaging rise** due to carbon pricing and rapid shift to sustainable agriculture in a 2°C scenario and due to chronic water stress and extreme weather in a 4°C scenario. **The impacts on sales and our own manufacturing operations are relatively small**.

The results of this analysis confirm the importance of doing further work to ensure that we understand the critical dependencies of climate change on our business and to ensure we have action plans in place to help mitigate these risks and thus prepare the business for the future environment in which we will operate. We plan to conduct further analysis on the impact of climate change on our agricultural supply chain and the impact of changing weather patterns (including both persistent effects such as droughts and the temporary effects of storms) on critical markets and manufacturing.

Source: Unilever, “Annual Report and Accounts 2017”

[Unilever (Consumer Staples) (4/4)]
The Company uses scenario analysis to show their present efforts are appropriate

Scenario analysis featured in the annual report



RISKS CONTINUED

IN FOCUS: CLIMATE CHANGE RISKS AND OPPORTUNITIES

UNILEVER HAS PUBLICLY COMMITTED TO IMPLEMENTING THE RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES.

items on topics related to climate change. For 2,872 senior management employees, incentives include fixed pay, a bonus as a percentage of fixed pay and a long-term management co-investment plan (MCIP) linked to financial and USLP performance – including our climate change, water and sustainable sourcing targets (see page 58). The long-term MCIP will be rolled out to the remainder of management employees in 2018.

UNDERSTANDING IMPACT

Climate change has been identified as a principal risk to Unilever (see page 28). To further understand the impact that climate change could have on Unilever's business we performed a high-level assessment of the impact of 2°C and 4°C global warming scenarios. The 2°C and 4°C scenarios are constructed on the basis that average global temperatures will have increased by 2°C and 4°C in the year 2100. Between today and 2100 there will be gradual changes towards these endpoints and we have looked at the

simplifying assumptions:

We identified the material impacts on Unilever's business arising from each of these scenarios based on existing internal and external data. The impacts were assessed without considering any actions that Unilever might take to mitigate or adapt to the adverse impacts or to introduce new products which might offer new sources of revenue as consumers adjust to the new circumstances.

The main impacts of the 2°C scenario were as follows:

- Carbon pricing is introduced in key countries and hence there are increases in both manufacturing costs and the costs of raw materials such as dairy ingredients and the metals used in packaging
- Zero net deforestation requirements are introduced and a shift to sustainable agriculture puts pressure on agricultural production, raising the price of certain raw materials

The main impacts of the 4°C scenario were as follows:

- Chronic physical impacts [changing weather patterns] affect productivity in some regions, raising prices of raw materials
- Increased frequency of extreme weather [storms and floods] [illegible]
- Temperature increases and extreme weather events reduce [illegible]

Our analysis shows that, without action, both scenarios present financial risks to Unilever [illegible] due to increased costs. However, [illegible] would need to be managed, [illegible] our business model. The most significant impacts of both scenarios are on our supply chain [illegible] and packaging rise, [illegible] to sustainable agriculture in a 2°C scenario and due to chronic water stress and [illegible]. The results of this analysis confirm the importance of doing further work to ensure that we understand the critical dependencies of climate change on our business and to ensure we have action plans in place to help mitigate these risks and thus prepare the business for the future environment in which we will operate. We plan to conduct further analysis on the impact of climate change on our agricultural supply chain and the impact of changing weather patterns [including both persistent effects such as droughts and the temporary effects of storms] on critical markets and manufacturing.

RESPONDING TO RISKS AND OPPORTUNITIES

We are taking action to address our climate change risks in line with the output from the scenario analysis, as well as benefiting from any opportunities these changes could present across our value chain. In 2018, we will launch the Sustainable Agriculture Code (SAC) 2017 which gives Unilever, our farmers and suppliers a set of rigorous standards to drive sustainability improvements across our supply chain. The revised SAC incorporates standards on Climate Smart Agriculture. Further risk assessment on

with less greenhouse gases across the value chain and less water in use (see pages 11, 13 and 14). Our categories' response to climate change has been guided by a review of the areas where we can have the biggest impact on mitigating climate risk or benefiting from climate opportunity.

32 Strategic Report

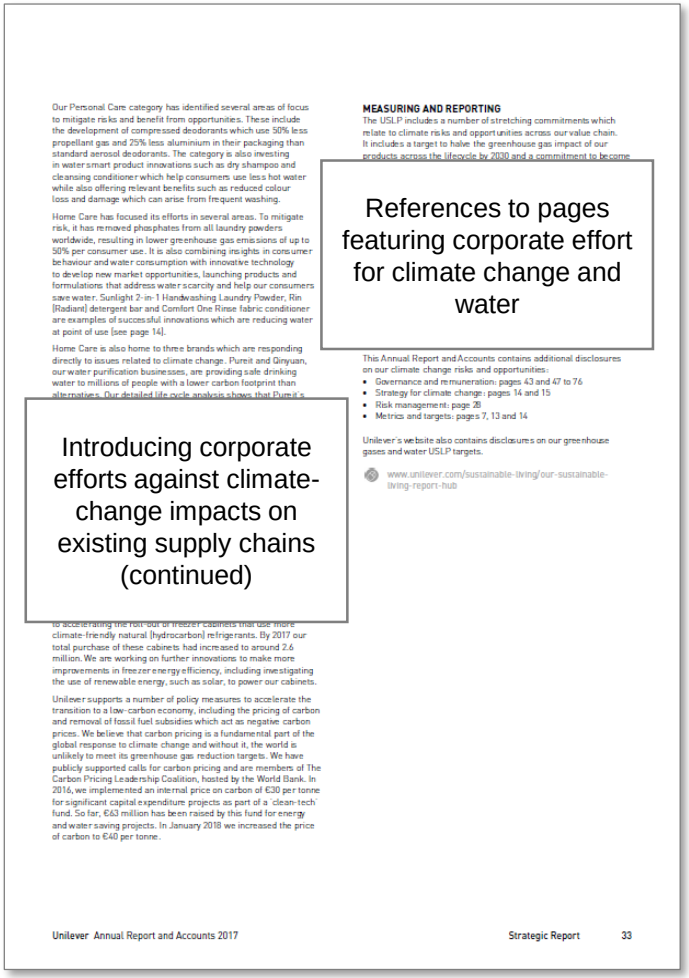
Unilever Annual Report and Accounts 2017

Explaining why the TCFD recommendations are adopted, and presenting corporate governance for climate-change risks and opportunities

Findings of analysis under the 2°C and 4°C scenarios (as in the previous slides)

Assumptions of analysis under the 2°C and 4°C scenarios (as in the previous slides)

Introducing corporate efforts against climate-change impacts on existing supply chains



Our Personal Care category has identified several areas of focus to mitigate risks and benefit from opportunities. These include the development of compressed deodorants which use 50% less propellant gas and 25% less aluminium in their packaging than standard aerosol deodorants. The category is also investing in water smart product innovations such as dry shampoo and cleansing conditioner which help consumers use less hot water while also offering relevant benefits such as reduced colour loss and damage which can arise from frequent washing.

Home Care has focused its efforts in several areas. To mitigate risk, it has removed phosphates from all laundry powders worldwide, resulting in lower greenhouse gas emissions of up to 50% per consumer use. It is also combining insights in consumer behaviour and water consumption with innovative technology to develop new market opportunities, launching products and formulations that address water scarcity and help our consumers save water. Sunlight 2-in-1 Handwashing Laundry Powder, Rin [Radiant] detergent bar and Comfort One Rinse fabric conditioner are examples of successful innovations which are reducing water at point of use (see page 14).

Home Care is also home to three brands which are responding directly to issues related to climate change. Pureit and Qinyuan, our water purification businesses, are providing safe drinking water to millions of people with a lower carbon footprint than alternatives. Our detailed life cycle analysis shows that Pureit's

to accelerating the roll-out of freezer cabinets that use more climate-friendly natural [hydrocarbon] refrigerants. By 2017 our total purchase of these cabinets had increased to around 2.6 million. We are working on further innovations to make more improvements in freezer energy efficiency, including investigating the use of renewable energy, such as solar, to power our cabinets.

Unilever supports a number of policy measures to accelerate the transition to a low-carbon economy, including the pricing of carbon and removal of fossil fuel subsidies which act as negative carbon prices. We believe that carbon pricing is a fundamental part of the global response to climate change and without it, the world is unlikely to meet its greenhouse gas reduction targets. We have publicly supported calls for carbon pricing and are members of The Carbon Pricing Leadership Coalition, hosted by the World Bank. In 2016, we implemented an internal price on carbon of €30 per tonne for significant capital expenditure projects as part of a 'clean-tech' fund. So far, €63 million has been raised by this fund for energy and water saving projects. In January 2018 we increased the price of carbon to €40 per tonne.

MEASURING AND REPORTING

The USLP includes a number of stretching commitments which relate to climate risks and opportunities across our value chain. It includes a target to halve the greenhouse gas impact of our products across the lifecycle by 2030 and a commitment to become

This Annual Report and Accounts contains additional disclosures on our climate change risks and opportunities:

- Governance and remuneration: pages 43 and 47 to 76
- Strategy for climate change: pages 14 and 15
- Risk management: page 28
- Metrics and targets: pages 7, 13 and 14

Unilever's website also contains disclosures on our greenhouse gases and water USLP targets.

www.unilever.com/sustainable-living/our-sustainable-living-report-hub

Unilever Annual Report and Accounts 2017 Strategic Report 33

References to pages featuring corporate effort for climate change and water

Introducing corporate efforts against climate-change impacts on existing supply chains (continued)

Source: Unilever, "Annual Report and Accounts 2017"

4. References on Degree of Risk Importance in Selected Sectors

i. Energy Sector

ii. Transportation Sector (Maritime Transportation, Passenger Air Transportation, Automobiles)

iii. Buildings/Forest Products Sector

Chapter 4 References on Degree of Risk Importance in Selected Sectors

This chapter provides materials for scenario analysis, part of which were used for assessment of the degree of risk importance under the Ministry's support program.

[i. Energy Sector]
List of views by each research report on the importance of risks for the energy sector

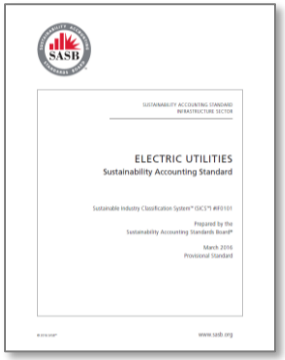
	Major Institutions, etc.	Views
Transition Risks	Sustainability Accounting Standards Board (SASB) 1	GHG emissions and efficient energy use are especially important as indicators of climate change risk analysis.
Transition Risks	2°C Investing Initiative (2ii) 2	Electric power consumption, alternative energies, and technological innovations among others are assumed to be important transitional risks unique to the electric power (generation) industry
Physical Risks	Companies' CDP Disclosure 3	Transition risks from changes in emission/fuel regulations and customer needs, physical risks from variability in precipitation/weather patterns and others are mostly recognized by companies
Physical Risks	European Bank for Reconstruction and Development (EBRD) 4	The energy sector is susceptible to a wide range of physical risks, including storms, cyclones, extreme rainfall and flood, extreme heat, variability in temperatures, sea-level rise and melting of permafrost

	Other Institutions	Views
Transition Risks	CDP Research Report 5	Climate change risks of the electric power generation business are evaluated from the ratio of power generation by fossil fuels, CO2 emissions, carbon costs, and use of water related to power generation equipment, among others.
Physical Risks	International Investors Group on Climate Change(IIGCC) 6	For the electric power generation business, transition risks related to GHG emission regulations, changes in demand for electric power, technological innovations and reputation are substantial, and physical risks for long-term assets are substantial as well
Physical Risks	Kepler Cheuvreux Transition Research 7	Highly important physical risks in the electric power generation business are water risk (drought) and rise of external temperatures
Physical Risks	EON UK Report 8	The energy sector is susceptible to a wide range of physical risks, including storms, cyclones, extreme rainfall and flood, extreme heat, variability in temperatures, sea-level rise and melting of permafrost

1

[i. Energy Sector]
Sustainability disclosure standards required by SASB

GHG emissions and efficient use of energy are especially important as indicators for climate change risk analysis



(Reference) Standards by SASB for each industry in disclosing sustainability information for investors

- Overview of the institution: SASB(Sustainability Accounting Standard Board)
  A non-profit body to promote the disclosure of information on sustainability to meet the needs of investors
- Summary of the report:
  - ✓ Formulated and disclosed sustainability accounting standards by industry type for the disclosure of financial information
  - ✓ Regarding the sustainability disclosure items (environment, community impact, labor safety, end use efficiency, crisis management, grid resilience, and statutory regulation-related), presented items unique to the electric power utility industry, and prepared disclosure indicators as sustainability standards

As an important disclosure item for the electric power utility industry, establish indicators for "GHG and air pollution materials, community impact, efficiency and grid" for the environmental aspect

GHG/air pollution material emissions, and grid resilience/efficiency, to be subject to statutory regulations, are important issues for the electric power utility industry

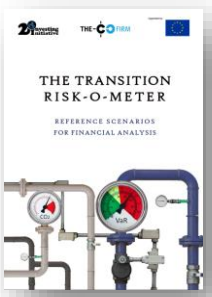
- ✓ Statutory regulations have been strengthened for electric power utilities which are major sources of emitting GHG and air pollution materials
- ✓ If emission regulations become stricter including GHG to make businesses using certain power generation facilities unprofitable, there will be stranded assets.
- ✓ Since GHG emission reduction not only by power generation but also by use are deemed important, initiatives such as smart grid and demand response are also required.
- ✓ In addition, climate change has also increased the risk of physical damage to the power distribution networks.

Climate-related Disclose Topics	Items and Accounting Indicators Required to be Disclosed for the Electric Power Utility Industry (Excerpt)
GHG Emissions & Energy Resource Planning	(1) Gross global Scope 1 emissions, (2) percentage covered under emissions limiting regulations, and (3) percentage covered under emissions-reporting regulations
Air Quality	Air emissions of the following pollutants: NOx (excluding N2O), SOx, particulate matter (PM10), Pb, and Hg; percentage of each in or near areas of dense population
Community Impacts of Project Siting	Number of projects requiring environmental or social modification, percentage of modifications resulting from formal public interventions or protests
	Discussion of community engagement processes to identify and mitigate concerns regarding project environmental and community impacts
End-Use Efficiency & Demand	Percentage of electric load served by smart grid technology
	Customer electricity savings from efficiency measures by market
Grid Resiliency	Number of incidents of non-compliance with North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards
	(1) System Average Interruption Duration Index (SAIDI), (2) System Average Interruption Frequency Index (SAIFI), and (3) Customer Average Interruption Duration Index (CAIDI), inclusive of major event days
Management of the Legal & Regulatory Environment	Discussion of positions on the regulatory and political environment related to environmental and social factors and description of efforts to manage risks and opportunities presented

Source: SASB, Electric Utilities Sustainability Accounting Standard、Industry Brief

[i. Energy Sector]
Transition Risk Scenarios by 2ii

Electric power consumption, alternative fuels, and technological innovations among others are important transition risks unique to the electric power (generation) industry



(Reference) Transition risk scenario by 2°C investing initiative for companies responding to TCFD recommendations

- Overview of the institution: 2°C investing initiative
  A think tank developing climate change risk indicators and policy options in the financial markets
- Purpose of the report:
  - ✓ To present transition scenarios in line with TCFD recommendations, which companies can refer to when conducting financial risk analysis and scenario analysis (ACT (ambitious climate transition) assuming +2°C world and LCT (limited climate transition) with +3-4°C)
  - ✓ To establish important parameters for each of 8 sectors with large energy consumption, such as the electric power industry and automobile industry, and consider how parameters should be based on the existing scenarios such as IEA.

Deriving 5 risk analysis parameters based on the expected trend of the electric power (generation) industry toward low carbonization

Trends	Background
Consumption is expected to increase globally	Demand changes will respond mainly to efficiency measures, and macroeconomic and demographic factors. These factors imply that dynamics in developed and developing economies will be different, with the demand in the latter increasing at a higher pace In some countries.
Fuel Switch	The shift from fossil fuels to renewable energy-based power is going to be driven by three main forces: The increase of thermal coal, gas and CO2 prices, the support from policymakers for the development of new low-carbon technologies and the decreasing marginal costs of renewable power production. Under both the LCT and the ACT scenarios, the total share of fossil fuels will decrease. Under the ACT the share of renewables need to surpass that of fossil fuels to achieve the 2°C target.
Policy- and market induced technology change	Incentives from policymakers will enable the transition from a fossil fuel-based economy to a renewable based one. Policy instruments such as subsidies, taxes and levies can be put in place to enable this transition. Most of the countries under scope have already started to incentivize renewables and/or disincentivize fossil fuels-based power generation as part of their strategy to achieve their long-term renewables share targets. In addition to policies, changes in the relative economics of renewable technologies versus fossil fuels are similarly expected to drive fuel switching.

Category	Parameters
Production & Technology	#1 Electricity production (TWh) #2 Electricity capacity (GW)
Market pricing	#3 Levelised costs of electricity (EUR/Mwh)
Policy Mandates, Incentives & Taxes	#4 Subsidies (EUR/Mwh) #5 Effective carbon rates (EUR/tCO2)

Source: 2ii.& The CO-Firm. "*The Transition Risk-O-Meter*". 2017.

[i. Energy Sector]
Companies' Replies to CDP

Transition risk by emission/fuel regulations is recognized by the largest number of companies (1/2)

CDP Question

Please answer details of **risks from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Uncertainty about New Regulations	5	• Low-Med • Med • Med-High	• Higher operational cost • Higher asset cost • Lower demand	Short- to long-term	Direct	Likely-Virtually certain	If the Japanese government adds/strengthens regulations to reduce CO2 emissions, the cost of power generation will rise, which will raise the selling price of electricity, possibly affecting demand and sales.
Fuel/Energy Regulations	3	• Low-Med • Med-High	• Higher operational cost • Lower production	Less than 3 years	Direct/ Indirect	Unlikely-Virtually certain	Since a lot of energy is used in the process of manufacturing oil products from crude oil, excessive taxation on fuel and mandatory regulations will restrain production activities. Restrained production activities will lower the operating ratio of devices, making efficient management difficult.
Product Efficiency Regulations and Standards	3	• Med • Med-High	• Higher operational cost • Lower production • Lower demand	3 years or more	Direct/ Indirect	Likely	Strengthened regulations on the efficient use of energy, etc. could cause an unexpected decrease in demand for energy. There are energy-saving related directives issued in Europe, which may affect sales.
Carbon Tax	2	• Med-High • High	• Higher operational cost	1-6 years	Direct	Unlikely/ Likely	There are various risks, including uncertainty about reduction of total emissions, possible changes in carbon prices depending on political decisions, decrease in demand and market share due to the increased cost of using fossil fuels, and risk of inflexible carbon prices at the time of recession.
Cap-and-Trade	2	• Med	• Higher operational cost • Higher asset cost	1-3 years	Direct	Likely/ Very likely	Since we have not been given flow quotas under EU's ETS system since 2013, we are purchasing quotas for almost all emissions. With the price of quotas as well as energy prices changing, lack of liquidity makes risk hedge difficult.

Source: Companies' Replies to CDP

[i. Energy Sector]
Companies' Replies to CDP

Transition risk by emission/fuel regulations is recognized by the largest number of companies (2/2)

CDP Question

Please answer details of **risks from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Environmental regulations in general (incl. plans)	2	• Med • Med-High	• Higher operational cost • Social detriment	3-6 years	Direct	Likely	Various laws for pollution and environmental problems are applied to the oil industry, which bears the cost of complying with such regulations. If measures for environmental problems are further strengthened, we will be hard pressed financially by bearing the cost of improving and updating equipment.
Obligation to report emissions	1	• Med-High	• Lower stock price (market value)	3-6 years	Direct	Very likely	If additional reporting obligations for emissions are imposed, there will be a risk of not being able to meet the reporting standards of EU' ETS and regulatory authorities for the gas and electric power markets.
Restriction on air pollution	1	• Med	• Higher operational cost	6 years or more	Direct	Likely	With stricter regulations on the restraint of air pollution including an EU Directive to be implemented in 2020, French regulations implemented in 2017 and an IED Directive recently added, there may be issues for technologies, competition, and updates of power generation facilities owned.
International agreement	1	• High	• Lower demand	1-3 years	Direct	More likely than not	International agreements pose substantial uncertainty. Electric power companies in Europe may lose competitiveness due to the commitment under the Paris Agreement and emission trading in EU among others. It could raise the selling price of electricity to reduce the demand.
Renewable energy	1	• Low-Med	• Lower production	6 years or more	Direct	More likely than not	If there is a regulatory reform without sufficient development in Germany causing an excessive rise of the price in the fixed price purchase system, there may be a risk of reducing energy production. Moreover, if companies in real estate business, etc. are allowed to enter into distributed energy production and energy-saving services, there will be more competition in the market.

Source: Companies' Replies to CDP

[i. Energy Sector]
Companies' Replies to CDP

Physical risks from variability in precipitation/weather patterns are recognized by the largest number of companies (1/2)

CDP Question

Please answer details of **physical risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Variability in precipitation	4	• High	• Higher asset cost • Lower production capacity	6 years or more	Direct	More likely than not/ Likely/ Very likely	Changes in precipitation patterns due to the amount of precipitation and seasons increase/decrease the amount of water in rivers. If the amount of precipitation decreases causing water shortage, there will be a risk of a lower operation rate of hydroelectric power stations.
Tropical cyclone (typhoon/ hurricane)	3	• Low-Med • Med-High	• Higher operational cost • Lower production capacity	Less than 1 year/6 years or more	Direct	Unlikely/ Likely	If a large typhoon directly hits the Kanto region, there will be a risk of power failure or unstable electric power supply for a long period of time due to high tides and river floods in addition to rainstorms. Moreover, it will incur costs for restorations. With the influence of these, there is a risk for business performance and finance.
Higher average temperature	2	• Med-High	• Higher operational cost	6 years or more	Direct	More likely than not/ Virtually certain	With the rise in the average temperature, demand for electricity will be less predictable especially due to the use of air-conditioner in summer.
Snow accumulation and ice	2	• Med-High • High	• Higher operational cost • Lower production capacity	6 years or more	Direct	More likely than not/ Likely	Accumulated snow may affect the energy supply and service provision. Since disruption of energy supply entails huge costs, risks due to accumulated snow and ice should be carefully considered.
Higher sea levels	2	• Low-Med • Med-High	• Higher operational cost • Social detriment	6 years or more	Direct	Very likely/ Virtually certain	While not an immediate issue, power stations on the coast may be affected by higher sea levels. If higher sea levels increase water flowing into power stations, seaweed may enter into stations. Moreover, damage by floods and the like because of extraordinary weather affects equipment as well.
Other climate change-related physical risks	2	• Med-High • High	• Lower production capacity • Higher asset cost	Less than 1 year/6 years or more	Direct/ Indirect	Likely	There are already influences of climate change, with a rainstorm having suspended wind power generation. It lowers electric power generation, with a risk of damaging assets. Moreover, there is also a risk of damaging the power grid with forests blown away by heavy snow, hailstones, or rainstorms.

Source: Companies' Replies to CDP

[i. Energy Sector]
Companies' Replies to CDP

Physical risks from variability in precipitation/weather patterns are recognized by the largest number of companies (2/2)

CDP Question

Please answer details of **physical risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Average temperature	1	Unanswered	• Lower production capacity	Un-answered	Un-answered	Un-answered	In France, a rise of temperature by 1°C will decrease the production capacity by 2,400MW. Moreover, a rise in water temperature in the river during summer will affect the cooling of fossil fuels and nuclear power generation. As there is also regulation on waste water temperatures after it's used for cooling because there is a risk of losing electric power due to higher water temperatures.
Impact on natural resources	1	• Med-High	• Lower production capacity	6 years or more	Direct	Very likely	Availability of natural resources may change. For example, hydraulic power generation, the cooling system of thermal power generation, efficiency of thermal power generation, and resilience of power grids will be affected. Moreover, bio-diversity around power stations may also be affected.
Uncertainty about physical risks	1	• Med-High	• Lower production capacity	Unknown	Direct	Likely	For asset planning, long-term climate change should be taken into account. Since new power stations will be used for the coming several decades, they should be verified as to whether resilient to changes going forward. However, there are a lot of uncertainties about the long-term influence of climate change and what influence will be incurred for suppliers.

Source: Companies' Replies to CDP

3

[i. Energy Sector]
Companies' Replies to CDP

Change in customers' needs is also recognized as a climate change risk by many companies

CDP Question

Please answer details of **other risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Other Risks (see Companies' Replies to CDP)

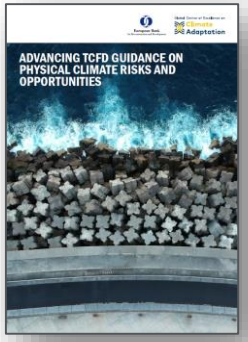
Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Change in customer behaviors	4	• Med • Med-High	• Lower demand	1 year or more	Direct Indirect	More likely than not/ Very likely	We are mainly engaged in the "Oil business," "Petrochemical business" and "Oil development business" of which the oil business accounted for more than 90% of net sales in FY2016. If many consumers become to choose hybrid cars and electric vehicles considering the environmental loading of oil products, we will have no choice but to reduce business activities.
Reputation	3	• Low-Med • Med	• Lower demand • Lower estimated brand value	1 year or more	Direct	Unlikely/ Likely	Since the domestic electric power industry accounts for 30% of CO2 emissions, emission reduction goals cannot be achieved without improving efficiency responding to climate change, including highly efficient power generation equipment and energy-saving. This has a large impact on consumers; and failure to meet consumer expectations will present a risk of lowering enterprise value.
Uncertainty about market signs	2	• Med-High	• Lower demand • Higher operational cost	1 year or more	Indirect	More likely than not/ Likely	Various changes will appear in the market due to climate change, requiring responses to them, and demand for products and services related to energy efficiency may become higher while demand for energy supply may become lower. Integration of electricity, mobility and heating sectors may bring about fundamental change to businesses going forward.

Source: Companies' Replies to CDP

4

[i. Energy Sector]
Physical Risks and Opportunities by EBRD

The energy sector is subject to a wide-range of physical risks including storms, cyclones, heavy rains, extreme flood and hot weather, temperature changes, higher sea levels, and melting of permafrost



(Reference) **Assessment Guidance for Physical Risks and Opportunities from TCFD Recommended Initiatives**

➢ Overview of the institution

- EBRD (European Bank for Reconstruction and Development): Established after the end of Cold War to develop market economies in central and eastern European countries. It also advocates to promote the “environment-friendly sustainable development” and aggressively makes investments related to climate change.
- GCECA (Global Centre of Excellence on Climate Adaptation):An organization established by the United Nations and governments of countries including the Netherlands. Having partnerships with NGOs, financial institutions and others, it aims to promote adaptation to climate through the sharing of knowledge and development of assessment methods, among others.

➢ Summary of the report:

✓ A guidance compiling points to note and indicators for reference when companies assess physical risks and opportunities, taking into account TCFD recommendations. It was prepared after discussions in the working group combining financial institutions and companies, among others.

✓ It requires information disclosure and assessment of influence on assets based on analysis by value chain and geography.

In the electric power industry and public utility, storms, cyclones, extreme rainfall and flood, extreme heat, variability in temperatures, sea-level rise and melting of permafrost are deemed to be highly influential physical risks

Acute ← → Chronic

GICS industry group	Storms and cyclones	rainfall and flood	Extreme heat	Variability in precipitation	Variability temperature	stress	ea-level rise	Other climate hazards
Energy	High	High	High	Medium	High	Medium	High	Icemelt, permafrost melt
Utilities	High	High	High	High	High	High	High	Wildfires

*Excerpt

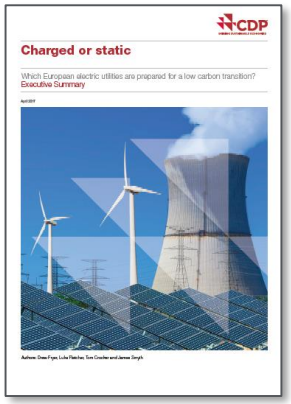
Risk Type	Physical Risks	Influence (electric power)	Influence (public utility)
Acute	Storms and cyclones	High	High
Acute	Extreme rainfall and flood	High	High
Acute	Extreme heat	High	High
Chronic	Variability in precipitation	Medium	High
Chronic	Variability in temperature	High	High
Chronic	Water Stress	Medium	High
Chronic	Sea-level rise	High	High

Source: “Advancing TCFD guidance on physical climate risks and opportunities”, Global research institute “Measuring physical climate risk in equity portfolios”

5

[i. Energy Sector]
CDP Report “Charged or static”

Climate change risk in the power generation business is assessed by the ratio of power generation using fossil fuels, CO2 emissions, carbon cost and water use related to power station equipment



(Reference) Summary results of the survey by CDP on measures for low carbonization by 14 major European electric power companies

- Overview of the institution: CDP
  An international NGO tackling the environmental area, such as climate change. From the perspective of management risk that climate change poses to companies, it does ratings by conducting surveys in a questionnaire format covering major companies around the world.
- Purpose of the report:
  To update CDP’s League Table (rating table), publishing the analysis method and the result of surveying the measures for low carbonization by 14 power generation companies in Europe

4 important assessment categories and items used for assessing the League Table

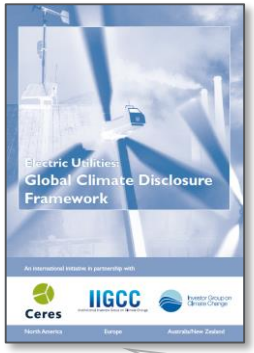
Category	Assessment Items and Methods
Transition risks	CDP assesses companies’ current **share of generation from fossil fuels**, **their emissions profiles and current carbon costs under the EU ETS**, and introduces a model to measure locked-in emissions between 2015-2050 from current fossil fuel assets against companies’ implied carbon budgets to achieve a 2°C transition
Physical risks	CDP maps facility-specific **water stress risks** for today and for 2030 using WRI’s Aqueduct Water Risk Atlas and compares this with companies’ water risk management measures
Transition opportunities	CDP assesses companies’ progress and strategy **in shifting towards renewable energy assets**, as well as **smart energy solutions**, and assess their **CAPEX plans and capital flexibility**
Climate governance and strategy	CDP assesses emissions reduction targets, identifies alignment of governance and remuneration structures with low carbon objectives, and actions taken in supporting or opposing policies to achieve a low carbon transition

Source: “CDP - Charged or static”

6

[i. Energy Sector]
International Investors Group on Climate Change(IIGCC)

For the electric power generation business, transition risks related to GHG emission regulations, changes in demand for electric power, technological innovations and reputation are substantial, and physical risks for long-term assets are substantial as well



(Reference) Disclosure information items related to climate change in demand from investors, by IIGCC and others

About IIGCC (International Investors Group on Climate Change):
IIGCC is the leading group for collaboration among institutional investors in Europe focused on addressing investment risks and opportunities presented by climate change

Purpose of the report:

- ✓ To formulate a reporting framework that meets investors' demand for disclosure to power generation business, and promote the disclosure of information that enables investors to recognize financial decisions due to climate change
- ✓ To prepare a framework that takes into account the climate change issues most relevant to the power generation business, in cooperation with Ceres (U.S.) representing an investors' network for climate change risks and, IGC, an investors' group for climate change (Australia and New Zealand)

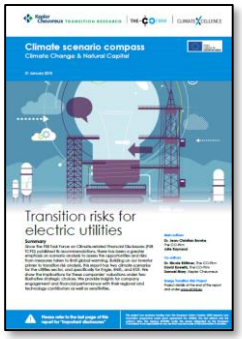
Category	Specific Examples of Risks and Opportunities	Disclosed Contents
Risk	• Compliance costs as a **result of regulatory constraints on greenhouse gas emissions, in particular emissions of carbon dioxide** • Changing demand for energy/electricity. For example, energy and electricity demand will be influenced in some markets by targets to improve **energy efficiency** and **increase renewable energy**, as well as other associated policies, and **technology developments** to address climate change, e.g. energy storage and building standards • Impacts on generating assets **and hence on electricity generation due to changing weather conditions** • **Reputational risks**	**Climate change strategy:** • Companies are requested to provide a brief overview of their climate change strategy and their processes for managing climate change risks and opportunities **Quantitative data related to exposure to climate change:** • Generation mix • Electricity production • Carbon dioxide (CO_2) emissions • Emissions allowances and other forms of credits (e.g., EU-ETS)
Opportunity	• **Reputational opportunities** • New business opportunities in areas such as **emissions trading, energy efficiency and renewable energy**	

Source: "Global Climate Disclosure Framework For Electric Utilities"

7

[i. Energy Sector]
Kepler Cheuvreux Transition Research

Financial impact of transition risks for power generation business companies are measured by indicators related to regulations on CO2 emissions, technological innovations such as renewable energies, and market changes.



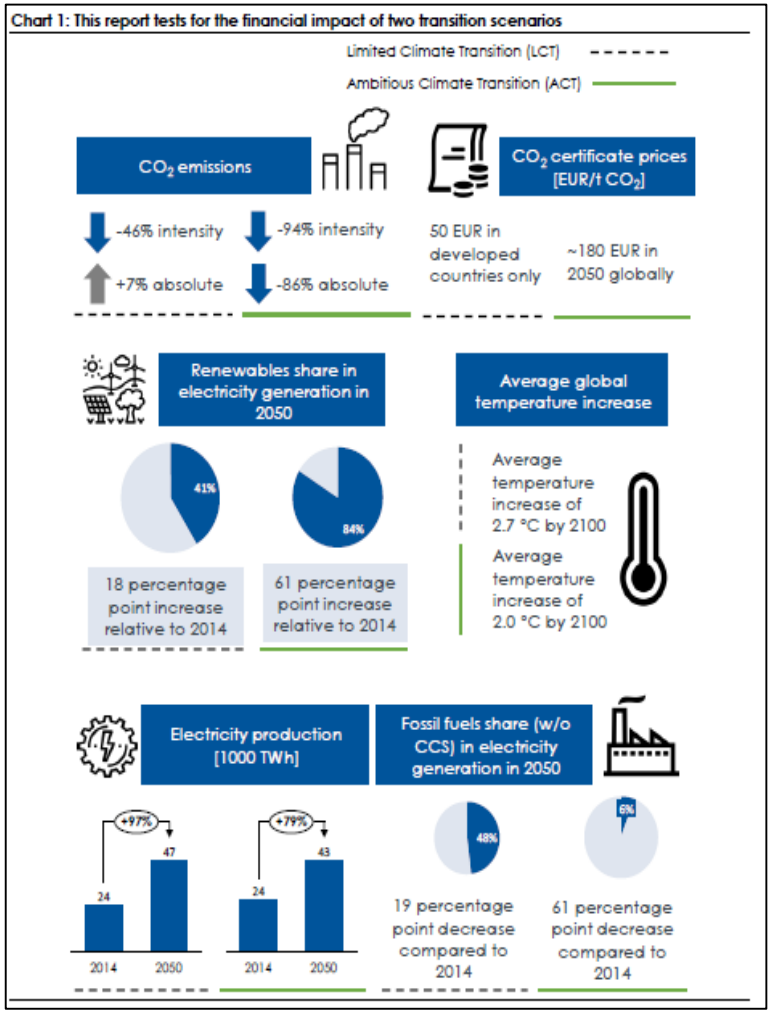
(Reference)
Transition risk scenario analysis of electric power companies conducted as part of the Energy Transition Project composed by Kepler Cheuvreux Transition Research (Research group under an independent financial service organization in Europe) and others

- Summary of the project: Energy Transition Project (Kepler Cheuvreux Transition Research, The CO-Firm, ClimateXcellence)
  A project formed to encourage the energy sector to respond to transition risks and opportunities of climate change

- Purpose of the report:
  - ✓ To analyze the financial impact of transition risks related to climate change on power generation companies, analyzing 3 major electric power companies in Europe using 2 IEA scenarios (RTS and 2DS) and publishing its methods and results.

Measured items for the impact of transition risks related to climate change on finance (right figure)
ACT (targeting 2°C or less) and LCT (targeting 2.7°C) are applied to measure using the following 6 indicators related to **regulations**, **technological innovations** and **market changes**:

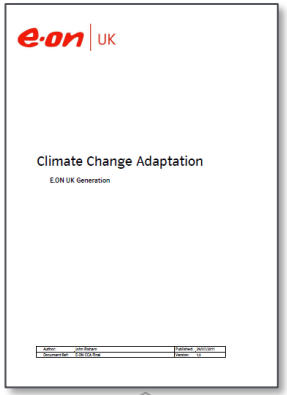
- CO2 emissions (intensity/absolute)
- CO2 certificate prices
- Renewables share in electricity generation in 2050
- Average global temperature increase
- Electricity production
- Fossil fuels share (w/o CCS) in electricity generation in 2050



Source: “ET Risk consortium - Climate Scenario Compass”

[i. Energy Sector]
Physical Risk Analysis by EON UK

Highly important physical risks in the power generation business are water risk (drought) and external temperature increase



(Reference) This report presents E.ON"s assessment of the impact of climate change on its UK Generation business and its proposals for adaptation.

- Overview of the company: E.ON UK
  UK branch of E.ON, a major European energy company headquartered in Germany supplying electricity and gas.
- Purpose of the report:
  To assess the consequence of physical risks related to climate change, analyze the importance of risks by 2 axes of "Likelihood" and "Consequence" and disclose the result

Analyzing the importance of physical risks from their likelihood and consequence:

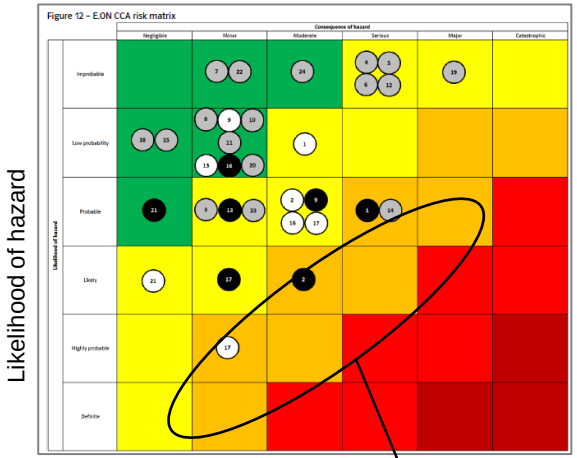
i. Table of consequence of physical risks at the company level (current and future)
→ Larger the number of consequence, the larger the consequence

ii. Matrix of importance
Matrix of importance analyzed by 2 axes of likelihood and consequence

Most important physical risk

Water risk (drought) and external temperature increase

ii. E.ON CCA risk matrix



i. Table of consequence of physical risks at the company level (current and future)

Impact	Sub-impact		Ref	Current	Future
Drought	Low river flow impact on station cooling / operation		C1	20.2	35.0
	Low river flow impact on compliance		C2	25.0	35.0
	Restricted supply of Towns water		C3	20.1	20.9
Flood	Extreme high river levels		C4	21.0	27.4
	Coastal flooding		C5	23.5	28.7
	High precipitation	Flooding within site boundary	C6	23.0	27.4
		Impact on oil interceptors	C7	11.8	12.2
	Flood / high precipitation in the catchment surrounding the site	Debris at water inlet	C8	17.8	18.1
		Impact on water quality	C9	19.5	26.2
	Flooding of access routes to site	Impact on critical commodity access	C10	17.1	19.7
		Impact on staff access	C11	15.8	17.5
High temperature	High ambient temperature causing station trip		C12	23.3	23.5
	High air / water temperature impact on compliance		C13	19.1	21.1
	High temperature impact on performance		C14	33.2	33.3
	High temperature impact on occupational health		C15	12.0	12.0
Low temperature	Freezing of water-containing equipment		C16	23.7	18.0
	Anti icing impact on performance		C17	36.0	28.0
	Low temperature impact upon compliance		C18	15.0	12.0
Extreme winds	Impact on operator safety		C19	24.8	24.8
Heavy snowfall	Impact on access of critical commodities		C20	19.6	17.5
	Impact on access of staff		C21	22.9	18.3
Lightning			C22	12.0	12.0
Meteorological conditions leading to cooling tower visible plume grounding			C23	21.0	21.0
Subsidence / landslide			C24	13.6	15.5

Source: "E.ON UK - Climate Change Adaption"

4. References on Degree of Risk Importance in Selected Sectors

i. Energy Sector

ii. Transportation Sector (Maritime Transportation, Passenger Air Transportation, Automobiles)

iii. Buildings/Forest Products Sector

Chapter 4 Reference on Degree of Risk Importance in Selected Sectors

This chapter provides materials for scenario analysis, part of which were used for assessment of the degree of risk importance under the Ministry's support program

[ii. Transportation Sector (Maritime transportation)]
List of views by each research report on the importance of risks for the transportation sector (maritime transportation)

	Major Institution, etc.	View
Transition Risks	Sustainability Accounting Standards Board (SASB) 1	An indicator to measure the “Environmental Footprint of Fuel Use” is useful as an important accounting indicator for disclosure
Transition Risks	2°C Investing Initiative (2ii) 2	We will add “Shipping Transport demand,” “Fuel efficiency” and “Alternative fuel penetration (%)” among others as indicators unique to the maritime industry.
Physical Risks	Companies’ CDP Disclosure 3	Three maritime companies recognize international agreements, tropical cyclones and North Sea route as risks/opportunities.
Physical Risks	European Bank for Reconstruction and Development (EBRD) 4	Transportation industry is likely to be affected by the melting of permafrost

	Other Institution	View
Transition Risks	The International Council on Clean Transportation (ICCT) 5	Possibility of introducing next generation technologies, such as hydrogen and fuel cells, in the maritime transportation industry

1

[ii. Transportation Sector (Maritime transportation)]
SASB Information Disclosure Standards for Sustainability

An indicator to measure the “Environmental Footprint of Fuel Use” is useful as an important accounting indicator for disclosure

(Reference) **Standards by SASB for each industry concerning information disclosure to investors on sustainability**

- Overview of the institution
  - ✓ SASB (Sustainability Accounting Standard Board)
    A non-profit body to promote the disclosure of information on sustainability to meet the needs of investors
- Summary of the report
  - ✓ Formulating and publishing sustainability accounting standards of each industry for the disclosure of financial information
  - ✓ For the two environmental disclosure items (Environment, Leadership and Governance), presenting items unique to the maritime industry and preparing disclosure indicators as standards for sustainability

As important disclosure items for the maritime industry, 5 indicators were established for the “Environmental Footprint of Fuel Use”

Disclosure Topics	Important Disclosure Items for the Maritime Industry
Environment	Environmental Footprint of Fuel Use
	Ecological Impacts
Leadership and Governance	Business Ethics
	Accidents & Safety Management

Topic	Accounting Metric
Environmental Footprint of Fuel Use	Gross global Scope 1 emissions
	Description of strategy of plan to manage emissions, emissions reduction targets, and an analysis of performance against those targets
	Total energy consumed, percentage from heavy fuel oil, percentage from renewables
	Air emissions for the pollutants
	Energy Efficiency Design Index(EEDI)* for new ships

- Since the maritime industry depends on heavy oil, fuel cost increase and GHG/air pollution materials, regulations are matters of grave concern
- Use of fuel-efficient engines and fuel other than heavy oil is required.

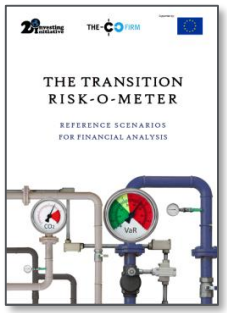
*Indicators referred to in TCFD Guidance

Source: SASB. ”*Marine Transportation Research Brief*”, “*Marine Transportation Sustainability Accounting Standard*”. 2014.

2

[ii. Transportation Sector (Maritime transportation)]
2ii Views on the Importance of Risks (1/2)

We will add "Maritime demand," "Energy efficiency" and "Alternative energy usage ratio" among others as indicators unique to the maritime industry.



(Reference) **Transition risk scenario by 2°C investing initiative /The CO-Firm for companies responding to TCFD recommendations**

- Overview of the institution
  - ✓ 2°C Investing initiative (2°Cii): A think tank developing climate change risk indicators and policy options in the financial markets
  - ✓ The CO-Firm: A German boutique consultant limited company specializing in climate change and energy strategy
- Purpose of the report
  - ✓ To present transition scenarios in line with TCFD recommendations, which companies can refer to when conducting financial risk analysis and scenario analysis (ACT (ambitious climate transition) assuming +2°C world and LCT (limited climate transition) with +3-4°C)
  - ✓ To establish important parameters for 8 sectors with large energy consumption, and consider how indicators should be based on the existing scenarios such as the one by IEA

Five indicators are derived based on the trends in the maritime transportation industry towards low carbonization, in addition to risk analysis indicators related to cross sectors

Trends	Background
Demand increase	The increasing relevance of global supply chains and the expansion of trade routes will likely drive the increase of the sector's demand.
Energy efficiency improvements	Efficiency improvements will come from the implementation of technologies for fuel control, instrumentation and navigation, as well as from operational changes. Efficiency measures will be pushed by the industry itself and by market standards. Both have the potential to reduce 40% of the sector's emissions by 2040.
Increase in the emissions control areas and gases in scope	Currently areas with emission controls are set up in the North and Baltic sea, U.S., Canada and some regions in China. The International Maritime Organization (IMO) is not only looking towards the increase of control areas and the maximum gas limits allowed but as well as extending global requirements. Abiding by regulations will thus require manufacturers to implement new reduced pollutant technologies

Category	Parameters	
Production & Technology	**#1 Shipping Transport Demand(G tonne-km/year)**	
	#2 Fuel Efficiency(kJ/tonne-km)	
	#3 Alternative Fuel Penetration (%)	
Market pricing	Oil Price (USD/bbl)	Coal Price (USD/ton)
	Natural Gas Price(USD/MBtu)	Electricity Charge (2015 EUR/MWh)
	#4 Marine Fuel prices(USD/GJ)	
Policy Mandates, Incentives & Taxes	Carbon Tax(2015 USD/T-Coeq)	
	#5 Efficiency Design Standards	

Source: 2ii.& The CO-Firm. "*The Transition Risk-O-Meter*". 2017.

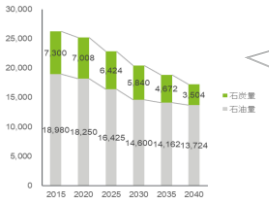
2

[ii. Transportation Sector (Maritime transportation)]
2ii Views on the Importance of Risks (2/2)

Indicators unique to the maritime transportation industry and future forecast

#1 Shipping Transport demand(G tonne-km/year)

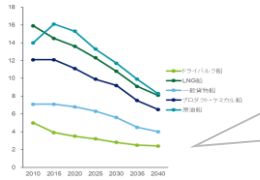
"Under the ACT, demand for oil and coal transport is expected to reach its peak in 2018 and decline to 2000 levels by 2050. Demand for fossil liquid-bulk will decline by 28% through 2040 compare to 2015 levels. Likewise, bulk coal transport will decline by 52% through 2040 from 2015."



Demand for oil and coal will peak in 2018 and decrease to the level of 2000 in 2050

#2 Fuel efficiency(kJ/tonne-km)

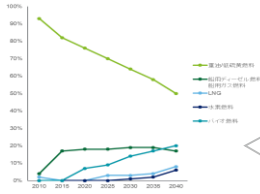
"The ACT sees the maximum reduction in fuel consumption for the dry-bulk segment with an average sector abatement of 52% by 2040 from 2010 levels."



In 2040, fuel consumption for the dry-bulk segment will decrease by 52% of that in 2010.

#3 Alternative fuel penetration (%)

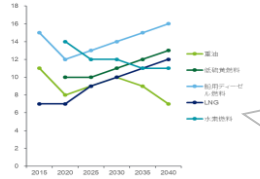
"In the ACT scenario, technological advancements and bio-availability allow the penetration of biofuels starting in 2020 and reaching a share of 20% by 2040. Hydrogen will be used starting in 2030 occupying a share of 6% by 2040 in the ACT."



The penetration of biofuels will start in 2020 to reach a 20% share by 2040, while hydrogen will be used starting in 2030 occupying a 6% share by 2040

#4 Marine Fuel Prices(USD/GJ)

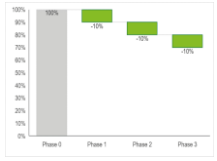
"HFO will remain as the lowest cost option, but from 2020, its use alongside with emission abatement technologies will be required to comply with emissions regulations."



Although heavy oil will be cheap even in 2040, emission abatement technologies will need to be introduced under regulations from 2020.

#5 Efficiency Standards

"EEDI compliance at current values is not sufficient to be aligned in with the ACT or the LCT. Additional carbon intensity reduction mechanisms are needed (i.e. technical measures, alternative fuels, carbon offsets)."



Whereas EEDI will gradually impose stricter reduction rates, additional regulations and methods will be needed to achieve emission reduction targets.

Source: 2ii.& The CO-Firm. "*The Transition Risk-O-Meter*". 2017.

3

[ii. Transportation Sector (Maritime transportation)] Study the Recognition of Transition/Physical Risks by Companies Based on Companies' Replies to CDP

Three maritime companies recognize international agreements, tropical cyclones and North Sea route as risks/opportunities.

Category	Risk Item	Contents*	Company A	Company B	Company C	Influence	Potential Impact	Period	Direct-ness	Likeli-hood	Comments (excerpt)
Transition Risks /Opportunities	International agreement	• EEDI • SEEMP • MBMs	○	○	○	High	• Demand increase/ decrease	3-6 years-	Direct	High	If IMO DCS (a system to collect and report verified data such as fuel consumption) is introduced, it will increase operational costs.
	Product Efficiency Regulations and Standards	• Energy-saving Law	○			Med	• Operational cost increase/ decrease	1-3 years	Direct	Med	Operational cost reduction due to energy-saving
Physical Risks/Opportunities	Tropical Cyclones	• Route change, accidents	○	○	○	High	• Operational/ capital cost increase/ decrease	3-6 years	Direct	Med	Fuel costs will increase as transportation will be delayed or routes will be changed to avoid cargo damage and accidents
	Changes in Heavy Rains and Drought	• Transaction volume decrease	○	○		Med	• Demand increase/ decrease	6 years -	Direct Indirect	Low	Risk of damaging cargo for dry-bulk business Indirect impacts on clients
	Higher sea levels	• Terminal, port facilities		○		Low	• Operational cost increase/ decrease	3-6 years	Indirect	Low	As there is a possibility of closing facilities, we will consider alternative routes such as transition to air transportation (indirect impact on supply chain)
	Precipitation Changes	• Delay	○		○	Med	• Demand increase/ decrease	6 years -	Direct	Med	By becoming able to respond to weather changes, we can expect to obtain customers.
	Snow and Ice	• North Sea Route	○	○	○	High	• Operational cost increase/ decrease	3-6 years-	Direct	Med	Melting of the North Sea ices will connect Europe and the northern part of Asia, reducing fuel costs and decreasing the risk of pirate attacks around the Indian Ocean.
Other Risks /Opportunities	Reputation	• Investors • Shippers	○	○	○	Med	• Demand increase/ decrease	1-3 years	Direct	Med	Getting excellent assessment from investors and shippers, etc., by actively disclosing information through CDP, etc., will increase transportation business revenue.
	Changes in customer behaviors	• Environment-friendly products	○	○	○	High	• Demand increase/ decrease	3-6 years	Direct	Med	With higher needs for environmental conservation, we will need capital investment for deploying energy-efficient ships.

Source: Companies' Replies to CDP

*Additions. Other items are derived from the average of 3 companies.

4 [ii. Transportation Sector (Maritime transportation)] Physical Risk Assessment on Each Industry by EBRD/GCECA

Transportation industry is likely to be affected by the melting of permafrost

(Reference) **Assessment Guidance for Physical Risks and Opportunities by Initiatives Receiving TCFD Recommendations**

- Overview of the institution
  - ✓ EBRD (European Bank for Reconstruction and Development): Established after the end of Cold War to develop market economies in central and eastern European countries. It also advocates promotion of "environment-friendly sustainable development" and aggressively makes investments related to climate change.
  - ✓ GCECA (Global Centre of Excellence on Climate Adaptation): An organization established by the United Nations and governments of countries including the Netherlands. Having partnerships with NGOs, financial institutions and others, it aims to promote adaptation to climate through the sharing of knowledge and development of assessment methods, among others.
- Summary of the report
  - ✓ A guidance compiling points to note and indicators for reference when companies assess physical risks and opportunities, taking into account TCFD recommendations. It was prepared after discussions in the working group combining financial institutions and companies, among others.
  - ✓ It requires information disclosure and assessment of influence on assets based on analysis by value chain and geography.

Transportation industry is affected by permafrost melt in addition to the common physical risks with other sectors

Acute ← → Chronic

GICS sector	GICS industry group	Storms and cyclones	Extreme rainfall and flood	Extreme heat	Variability in precipitation	Variability in temperature	Water stress	Sea-level rise	Other climate hazards
	Diversified financials	High	High	Low	Low	Low	Low	High	
	Insurance	High	High	Medium	Medium	Medium	Medium	High	Hail storms, landslides, wildfires
Industrials	Capital goods	High	High	High	High	Medium	High	High	
	Commercial and professional services	High	High	Low	Low	Low	Low	High	
	Transport	High	High	Medium	Low	Low	Low	High	Permafrost melt, ice melt
Information technology	Semi-conductors	High	High	High	Low	High	Medium	High	
	Software and Services	High	High	Low	Low	Low	Low	High	
	Technology hardware and equipment	High	High	High	Low	High	Medium	High	
Materials	Materials	High	High	High	High	High	High	High	
Real estate	Real estate	High	High	Low	Low	Low	Low	High	

Permafrost melt, ice melt

- When assessing the influence of physical risks on companies, influence and other risks are examined depending on each business model, process and location.
- Specific influences given by physical risks
  Examples:
  - Rise in energy cost and burden on workers due to higher temperatures
  - Water shortages and higher operational costs due to water stress
  - Asset damage and transfer costs due to cyclones and others
  - Route change due to permafrost melt

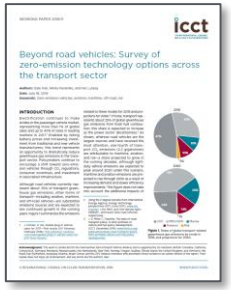
*Table is an excerpt from the report.

Source: EBRD. & GCECA. "*Advancing TCFD Guidance on Physical Climate Risks and Opportunities*". 2018.

5

[ii. Transportation Sector (Maritime transportation)] Assessment of Next-Generation Technologies by ICCT

Possibility of introducing next generation technologies, such as hydrogen and fuel cells, in the maritime transportation industry



(Reference) **A report assessing next-generation technologies in land/maritime/air transportation from the perspective of climate change**

- Overview of the institution
  - ✓ The International Council on Clean Transportation (ICCT): Established aiming to provide research/technologies/scientific analyses on environmental issues from a neutral position. It aims to improve the environmental performance and energy efficiency of land/maritime/air transportation to mitigate climate change.
- Summary of the report
  - ✓ Examining the possibility of zero emission technologies for each transportation industry such as air, maritime, off-road and railway, assessing risks and opportunities of introducing technologies, and considering the significance of policies. The government requires the industry to have improvement measures to mitigate climate change and improve air pollution, and recommends the promotion of research and demonstrations of effective measures
  - ✓ While zero emission technologies are introduced in the transportation industries, the speed of penetration differs for each industry.

Maritime transportation industry is considering the introduction of next-generation technologies such as hydrogen and fuel cells.

Technology	Vessel or project	Capacity	Route length (km)	Region	Entry into service	Status
Battery-electric ferry (solar)	*Aditya*	75 passengers	2.5	Kerala, India	2017	Operational
Battery-electric cargo ship	Guangzhou Shipyard	2,000 tonnes	80	Guangzhou, China	2017	Operational
Hydrogen ferry (combustion)	*Hydroville*	16 passengers	~6.5	Antwerp, Belgium	2017	Operational
Battery-electric cargo ship	*Yara Birkeland*	2,880 tons	56	Norway	2019	Under construction
Plug-in sailing ship	*Statsraad Lehmkuhl*	190 passengers		Norway	2019	In retrofit
Hybrid hydrogen electric ferry	Fiskerstrand PILOT-E	80 vehicles	~4	Norway	2020	In development
Hydrogen fuel cell cruise ship	Viking Cruises	1,400 passengers and crew	—	Norway	N/A	In development

	Battery electric			Hydrogen			Ammonia		
	Readiness/ feasibility	Cost	Emissions	Readiness/ feasibility	Cost	Emissions	Readiness/ feasibility	Cost	Emissions
Ferries and harborcraft	4	4	5	3	2	3	2	2	2
Inland and short-sea shipping	3	3	4	3	2	3	2	2	2
Transoceanic container ships	1	1	4	2	2	3	2	3	2

- In the maritime transportation industry, fuel cell ships are already used for ferries and short-distance transportation, use by large ships used for long distance is under development.
- Fuel cell ships are difficult to use for large ships despite their effectiveness for reducing emissions, while hydrogen ships need substantial fiscal support in the short and medium-tem.

High
↑
Technical assessment
↓
Low

Score	Technological readiness and feasibility	Cost	Greenhouse gas emission reduction potential
5	Currently in widespread use	Least expensive option available	Lifecycle zero-emission using widely available fuel pathways
4	Appears poised for commercial introduction	Cost-competitive with conventional alternative	>50% emissions reduction from fossil fuel baseline
3	Early demonstration, but not yet ready for commercial deployment	Lower upfront or fuel cost, but uncertain or somewhat negative total cost of ownership	1 to 50% emissions reduction from fossil fuel baseline
2	Not yet built, but appears possible with near-term technology	Would require substantial financial support in the short to medium term	Approximately even with fossil fuel baseline using widely available fuel pathways
1	Faces extreme difficulties using near-term technology, or not logistically feasible to implement	Prohibitively expensive	Higher emissions than fossil fuel baseline under most circumstances

*Top-left table is an excerpt from the report

Source: ICCT. "*Beyond Road Vehicles: Survey of Zero-emission Technology Options Across the Transport Sector*".2018.

[ii. Transportation Sector (Passenger Air Transportation)]
List of views by each research report on the importance of risks for the transportation sector (passenger air transportation)

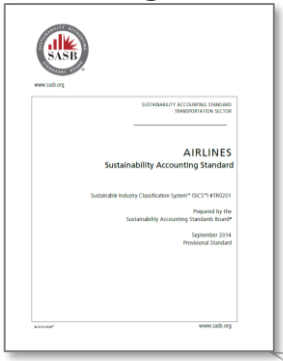
	Major Institution, etc.	View
Transition Risks	Sustainability Accounting Standards Board (SASB) 1	Fuel use and GHG emissions are especially important as indicators for climate change risk analysis
Transition Risks	2°Investing Initiative (2ii) 2	Fuel efficiency, alternative fuels, and fuel prices among others are important transition risks unique to the passenger air transportation sector.
Transition Risks	Companies' CDP Disclosure 3	Transition risks from carbon emission/fuel efficiency regulations, physical risks from variability in precipitation/weather patterns, and changes in customer needs, among others are recognized by companies.
Physical Risks	European Bank for Reconstruction and Development (EBRD) 4	Physical risks deemed highly influential in the transportation industry are four: Storms, cyclones and heavy rains; extreme flood; sea-level rise; and permafrost melt.

	Other Institution	View
Transition Risks	International Air Transport Associations (IATA) 5	For the passenger air transportation sector, climate change-related risks with the highest business impact and uncertainty include alternative fuels, extraordinary weather, international regulations on CO2 emissions, oil prices, and environmentalist actions.
Transition Risks	Marsh & McLennan Companies (major US insurance company) report 6	As transition risk from GHG emission regulation is high for the passenger air transportation sector, it will be important to actively make early investment in renewable energies and fuel efficiency.

1

[ii. Transportation Sector (Passenger Air Transportation)] Sustainability Disclosure Standards Requested by SASB

Fuel use and GHG emissions are especially important as indicators for climate change risk analysis



(Reference) **Standards by SASB for each industry concerning information disclosure to investors on sustainability**

- Overview of the institution: SASB (Sustainability Accounting Standard Board)
  A non-profit body to promote the disclosure of information on sustainability to meet the needs of investors
- Summary of the report:
  - ✓ Formulating and publishing sustainability accounting standards of each industry for the disclosure of financial information
  - ✓ Regarding sustainability disclosure items (environment, labor-management relations, competition, safety, supply chain), presenting items unique to the passenger air transportation sector and preparing disclosure indicators as sustainability standards.

As an important disclosure item for the air transportation (passenger/cargo) industry, establish indicators for "emissions and reduction plan for Scope 1, fuel consumption and the ratio of renewable energies, and emissions of air pollution materials" for the environmental aspect

Fuel use and GHG emissions are important issues for the air transportation sector

- ✓ Reponses to sustainability issues including fuel efficiency improvement for airframes and reduction of GHG and harmful materials will improve the competitiveness of the air transportation sector.
- ✓ Since fuel is a major expenditure in the air transportation sector (estimated by SASB at about 30% of operational costs), fuel efficiency and use of alternative fuels will not only reduce costs but also become counter-measures against rises in unstable fuel oil prices.
- ✓ Accounting for 13% of global GHG emissions, the air transportation sector is especially susceptible to the strengthening of regulations. In recent years, their impact has been expanding with the increase in climate change-related regulations.

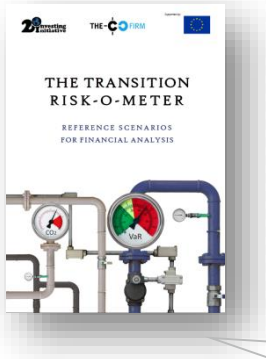
Disclosure Topic	Important Disclosure Items in Air Transportation Sector	Accounting Indicators to be Disclosed
Environmental Footprint of Fuel Use	Greenhouse Gas	Gross global Scope 1 emissions
	Strategy or plan	Description strategy or plan to manage Scope 1 emissions, emissions reduction targets, and an analysis of performance against those targets
	Fuel Use	Total fuel consumed, percentage renewable
	Air pollution	Air emissions for the following pollutants: NOx, SOx, and particulate matter (PM)
Supply Chain Management	Complete greenhouse gas footprint across transport modes	Metric tons CO2-e per ton-kilometer

Source: SASB, Airlines & Air Freight Logistics Sustainability Accounting Standard、Industry Brief

2

[ii. Transportation Sector (Passenger Air Transportation)]
2ii Views on the Importance of Risks

Fuel efficiency, alternative fuels, and fuel prices among others are important transition risks unique to the passenger air transportation sector.



(Reference) **Transition risk scenario by 2°C investing initiative for companies responding to TCFD recommendations**

- Overview of the institution: 2°C investing initiative
  A think tank developing climate change risk indicators and policy options in the financial markets
- Purpose of the report:
  - ✓ To present transition scenarios in line with TCFD recommendations, which companies can refer to when conducting financial risk analysis and scenario analysis (ACT (ambitious climate transition) assuming +2°C world and LCT (limited climate transition) with +3-4°C)
  - ✓ To establish important parameters for each of 8 sectors with large energy consumption such as the passenger air transportation sector and automobile industry, and consider how parameters should be based on the existing scenarios such as IEA

Six risk analysis parameters are derived based on the trends in the passenger air transportation industry towards low carbonization

Trends	Background
Changes in volume	Demand for international flights is expected to grow on average 4%-5% annually in the coming decades (ICAO 2016a). In contrast, a 2°C transition would be associated with a low-demand scenario for air travel as consumers switch to rail, information technology, and local travel.
Scaling of alternative fuels	The scale up of alternative fuels will respond to evolving market standards, development of country-specific policy goals and further extension of international organizations and coalition targets.
Efficiency gains	Fuel efficiency gains will come from two main sources: Technological improvements related to the airplane itself and more sophisticated traffic management and infrastructure use. The International Civil Aviation Organization (ICAO) has set a medium-term goal to improve fleet-fuel efficiency by 2% per year through 2020.

Category	Parameters
Production & Technology	#1 Demand (passenger-kilometers) #2 Fuel efficiency (g fuel/revenue passenger km) #3 Biofuel Penetration (%)
Market pricing	#4 Jet fuel prices (USD / gallon)
Policy mandates, Incentives & Taxes	#5 Carbon credit mandates (# and Euro / tCO2) #6 Fuel efficiency standards (kg/km)

Source: 2° ii.& The CO-Firm. "*The Transition Risk-O-Meter*". 2017.

3

[ii. Transportation Sector (Passenger Air Transportation)]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Transition risks from carbon emissions/fuel efficiency regulations are recognized by many companies.

CDP Question

Please answer details of **risks from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Cap-and-Trade	5	Low-High	• Higher operational cost • Lower liquidity	Less than 1 year or 3-6 years	Direct	Very likely-Virtually certain	There may be a negative impact on finances in relation to the EU Emission Trading Scheme. Since emissions exceeding the upper limit need to be offset, a negative impact on finance is expected with the future rise in the carbon prices.
International agreement	4	Med-High	• Higher operational cost	Medium- to Long term	Direct	Very likely-Virtually certain	With the establishment of CORSIA, there will be an upper limit on CO2 emissions of international flights after 2021, and emissions exceeding it will need to be offset. In addition, 2% fuel efficiency improvement by 2050, introduction of carbon tax, or the like, may affect operational costs.
Product Efficiency Regulations and Standards	3	Un-known/ Low-Med	• Higher operational cost	Short- to long-term	Direct	Likely	There will be costs to acquire airframes that are in compliance with ICAO's CO2 standards.
Carbon Tax	1	Med-High	• Higher operational cost	3-6 years	Direct	Likely	By complying with different rules, there will be distortions in the competitive environment and a risk of double taxation (because carbon tax systems differ substantially between reginal units and the EU zone, and they are not corresponding to each other).
Fuel/Energy Regulations	1	Med-High	• Lower demand	Less than 1 year	Direct	Virtually certain	With the strengthening of fuel/energy regulations, operational costs will increase. Moreover, such regulations are unique to this country, which could make the competitive environment less favorable to that of airline companies originating from other countries.
Uncertainty about New Regulations	1	Un-known	• Higher operational cost	6 years or more	Direct	Likely	There will be costs to make biofuels in compliance with sustainability standards.
Lack of regulations	1	Un-known	• Lower demand	6 years or more	Indirect	More likely than not	There are differences in the use of bio-mass fuels by industry. While bio-mass fuels are recommended in the road transportation industry, regulations to ensure the use of bio-mass are not currently developed in the air transportation sector where alternative fuels cannot be used.

Source: Companies' Replies to CDP

3

[ii. Transportation Sector (Passenger Air Transportation)] Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Physical risk from variability in precipitation/weather patterns is recognized by the largest number of companies (1/2)

CDP Question

Please answer details of **physical risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Extreme variability in temperature	4	Low-Med	• Lower production capacity • Higher operational cost	6 years or more	Direct Indirect	More likely than not-Likely	Operational costs may rise because of the increase in the use of air-conditioners in airports and flights due to the extreme changes in temperatures. Moreover, even if temperatures become extremely low, similar events may occur, possibly decreasing sales. Due to the increase in extraordinary weather including hurricanes, gusts, and heavy snow, there may be such consequences as cancellations/delays of flights, and serious damage to airport facilities. Moreover, we will need to invest in establishing reserve facilities in order to mitigate the effect of climate change in accordance with ICAO policies.
Other climate change-related physical risks	2	Low-Med	• Higher operational cost	6 years or more	Direct	About as likely as not	Change in the direction jet streams pointed out by ICAO is a risk. This is because airplanes flying between continents will have to navigate in strong winds and therefore increase fuel consumption, possibly being forced to make unscheduled temporary landings to refuel.
Tropical cyclone (typhoon/ hurricane)	1	Low-Med	• Unfulfilled business	6 years or more	Direct	Virtually certain	Flights may not be operated as scheduled due to direct hits by typhoons. In particular, it is difficult to forecast weather in Japan because of its geography, while there have been an increasing number of typhoons directly hitting it in the last ten years. This should be taken into account.

Source: Companies' Replies to CDP

3

[ii. Transportation Sector (Passenger Air Transportation)] Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Physical risk from variability in precipitation/weather patterns is recognized by the largest number of companies (2/2)

CDP Question

Please answer details of **physical risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Snow and ice	1	Med	• Lower production capacity	Less than 1 year	Direct	About as likely as not	Since there will be more delays and cancellations of flights due to the increase in weather conditions where snow and ice cannot be forecast, scheduled flights, customer satisfaction, and subsequent flights will be affected.
Higher sea levels	1	Low	• Higher capital cost	6 years or more	Indirect	More likely than not	The sea-level rise may affect major markets for our services such as coastal regions and islands. We may be pressed to respond to changes in customers' moving patterns by securing the development of airports and runaways that are not affected by sea-level rise.
Extreme variability in precipitation	1	Low	• Lower production capacity	Unknown	Indirect	More likely than not	If production and refining facilities are temporarily closed due to extraordinary weather, fuel required for our services may not be supplied.

Source: Companies' Replies to CDP

3

[ii. Transportation Sector (Passenger Air Transportation)]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Change in customer needs are also recognized as a climate change risk by many companies

CDP Question

Please answer details of **other risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Other Risks (see Companies' Replies to CDP)

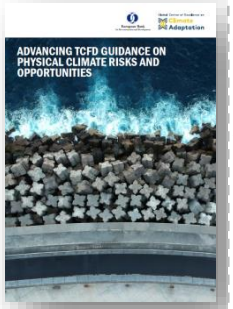
Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Comments (excerpt)
Reputation	4	Low-Med	• Lower demand	6 years or more	Direct Indirect	Unknown	If there are delays and cancellations of flights due to climate change, customers' trust in our company will decline, possibly lowering the preference for air transportation itself. Unless we respond to environmental issues appropriately, the reputation of our company, and ultimately the air transportation sector as a whole, will deteriorate, possibly decreasing demand from changes in customers' behaviors.
Change in customer behaviors	2	Med-High	• Lower demand	Medium-to Long term	Direct Indirect	Likely or Unknown	Led by corporate clients, customers' behaviors are changing to consider CO2 emissions. Since Japan is not an advanced country in terms of biofuel development with the air transportation sector being an industry with substantial CO2 emissions, change to consumer behaviors more considerate about CO2 emissions may lead to the reconsideration of the use of air transportation. Cargo transportation may also be changed to transportation methods with less CO2 emissions than air transportation .
Induction of changes in social environment	1	Un-known	• Lower demand	Un-known	Indirect	Unknown	Due to climate change, population may decrease in coastal areas where our markets exist, or economic situations may change in regions, countries and the world. As a result, there may be uncertain impacts on customers' moving patterns.

Source: Companies' Replies to CDP

4

[ii. Transportation Sector (Passenger Air Transportation)] Physical Risk Assessment on Each Industry by EBRD and Others

Physical risks deemed highly influential in the transportation industry are four: Storms, cyclones and heavy rains; extreme flood; sea-level rise; and permafrost melt.



(Reference) **Assessment Guidance for Physical Risks and Opportunities from TCFD Recommendations**

➢ Overview of the institution

- EBRD (European Bank for Reconstruction and Development): Established after the end of Cold War to develop market economies in central and eastern European countries. It also advocates to promote the "environment-friendly sustainable development" and aggressively makes investments related to climate change.
- GCECA (Global Centre of Excellence on Climate Adaptation): An organization established by the United Nations and governments of countries including the Netherlands. Having partnerships with NGOs, financial institutions and others, it aims to promote adaptation to climate through the sharing of knowledge and development of assessment methods, among others.

➢ Summary of the report:

✓ A guidance compiling points to note and indicators for reference when companies assess physical risks and opportunities, taking into account TCFD recommendations. It was prepared after discussions in the working group combining financial institutions and companies, among others.

✓ It requires information disclosure and assessment of influence on assets based on analysis by value chain and geography.

In the transportation industry, storms, cyclones, heavy rains, extreme flood, sea-level rise, and permafrost melt are deemed highly influential physical risks.

GICS industry group	Acute: Storms and cyclones	Acute: rainfall and flood	Acute: Extreme heat	Chronic: Variability in precipitation	Chronic: Variability temperature	Chronic: stress	Chronic: ea-level rise	Other climate hazards
Transport	High	High	Medium	Low	Low	Low	High	Permafrost melt, ice melt
Capital goods	High	High	High	High	Medium	High	High	
Commercial and professional services	High	High	Low	Low	Low	Low	High	
Automobiles and components	High	High	High	Medium	High	Medium	High	Degraded air quality
Energy	High	High	High	Medium	High	Medium	High	Iceme[illegible], permafrost melt
Banks	High	High	Low	Low	Low	Low	High	
Technology hardware and equipment	High	High	High	Low	High	Medium	High	

*Excerpt

Type	Physical Risks	Influence
Acute	Storms and cyclones	High
Acute	Extreme rainfall and flood	High
Acute	Extreme heat	Medium
Chronic	Variability in precipitation	Low
Chronic	Variability in temperature	Low
Chronic	Water Stress	Low
Chronic	Sea-level rise	High

➢ Influences given by physical risks differ depending on business characteristics such as water and energy consumption

➢ Examples of specific influences given by physical risks:

- Rise in energy cost and burden on workers due to higher temperatures
- Water shortages and higher operational costs due to water stress
- Asset damage and transfer costs due to cyclones and others

Source: "Advancing TCFD guidance on physical climate risks and opportunities", Global research institute "Measuring physical climate risk in equity portfolios"

5

[ii. Transportation Sector (Passenger Air Transportation)] Future Forecast for Air Transportation Sector in 2035 by IATA

For the passenger air transportation sector, climate change-related risks with the highest business impact and uncertainty include alternative fuels, extraordinary weather, international regulations on CO2 emissions, oil prices, and environmental activism.

(Reference) Future of the Airline Industry 2035 by IATA (International Air Transport Associations)

- Overview of the institution: IATA
  The International Air Transport Association (IATA) is the trade association for the world's airlines, representing some 265 airlines or 83% of total air traffic. IATA supports many areas of aviation activity and help formulate industry policy on critical aviation issues.
- Purpose of the report:
  - ✓ To forecast opportunities and challenges the industry may face and take measures that can be done from now.
  - ✓ To engage in the same discussion at individual airlines and their partners
  - ✓ To develop partnerships with governments to lay foundations for promoting sustainable horizontal links in the air transportation sector. It will be ideal if a national strategy for air transportation is formulated.

Analyzing changing factors to have substantial impact on the air transportation sector in 2035

Among 13 changing factors identified by IATA, the following are deemed to be risks of climate change:

■ **Environmental activism**
Environmental activism may come from many directions, the public, the workforce, or even shareholders and governments. Generational and societal shifts may lead to new tools while technology and cyber activism provide new opportunities and threats

■ **Alternative fuels and energy sources**
Alternative fuels and energy sources have the potential to disrupt the geopolitical balance of power, as well as to affect how businesses and the public consume energy.

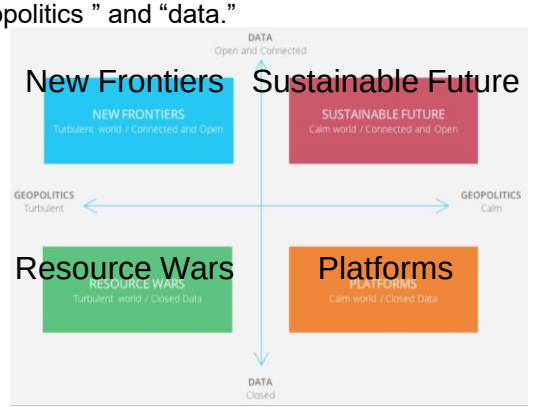
■ **Extreme weather events**
Extreme weather events are expected to increase in both frequency and severity, driven by climate change

■ **Price of oil**
After remaining unusually stable in the three years prior, crude oil prices fell precipitously in 2014 and the future outlook is uncertain

■ **Infectious disease and pandemics**
In the 1960s many infectious diseases were thought to be under control, but the emergence of new threats such as HIV, SARS, Zika virus as well as animal diseases such as BSE have reacquainted the world with the risks

■ **International regulation of emissions and noise pollution**
The airline industry contribution to overall CO2 emissions is relatively low compared to other transport sectors, although forecasts to 2050 vary in optimism

Formulating the materiality matrix from changing factors with the criteria of influence and uncertainty to prepare four scenarios with the two axes of "geopolitics " and "data."

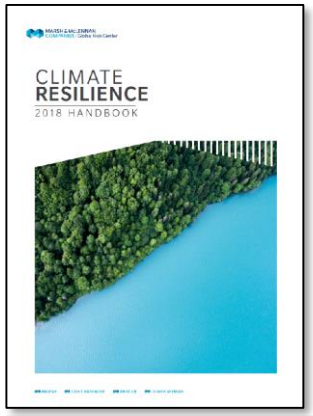


→Predict futures with eleven themes along with each scenario

 Source: IATA "Future of the airline industry 2035"

[ii. Transportation Sector (Passenger Air Transportation)]
Measures by US Insurance Company to Increase Resilience to Climate Change

As transition risk from GHG emission regulation is high for the passenger air transportation sector, it will be important to actively make early investment in renewable energies and fuel efficiency.

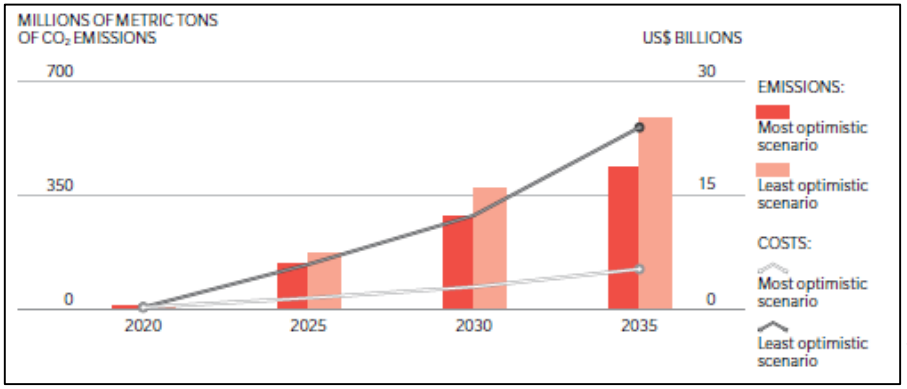


(Reference) Climate change resilience handbook by a major U.S. insurance company Marsh & McLennan

- Overview of the company:Marsh & McLennan
  A major insurance group company headquartered in New York, U.S., providing advisory and solutions in the areas of risk, strategy and human capital.
- Purpose of the report:
  - ✓ It states measures, with case studies, for business strategy, financial strategy, and risk management to increase resilience to climate change risks
  - ✓ It states strategic issues for climate change risks in each industry of retail supermarkets, electric power, airlines and energy industries.

Explaining risks and opportunities of emission regulations for the air transportation sector

Risks: GHG emissions are expected to increase in proportion to demand for airlines, which will be about double the current level by 2035. As emission regulations are planned to be in place within several years, it is required to further move to renewable energies. In addition, emission cost to be offset by CORSIA scheme* is expected to be lower than variable cost of energy.



Opportunities: With the promotion of expanded use of renewable jet fuels by regulations, early strategic actions will create opportunities.

Measures to implement opportunities (examples)

- Gradually expand the use of bio-refinery renewable jet fuels to reduce fuel cost and increase their availability.
- Collaborate with airports and airframe manufacturers to develop airframes and structures capable of efficient fuel transportation, while meeting manufacturing requirements of engines.
- Use government funds to allocate resources actively to R&D in sustainable renewable fuels

*Carbon Offsetting and Reduction Scheme for International Aviation:

 Source: “Climate Resilience 2018 Handbook ”

[ii. Transportation Sector (Automobiles)]
List of views by each research report on the importance of risks for the transportation sector (automobiles)

	Major Institution, etc.	View
Transition Risks	Sustainability Accounting Standards Board(SASB) 1	Power train ratio and fuel efficiency/emissions are especially important as indicators of climate change risk analysis
Transition Risks	2°C Investing Initiative(2ii) 2	As risk analysis parameters of the automobile industry, sale, carbon fibers, battery price, fuel efficiency standard and CO2 ratio are established for each power train
Transition Risks	Companies' CDP Disclosure 3	Transition risk from fuel efficiency regulation is recognized by the largest number of companies.
Physical Risks	European Bank for Reconstruction and Development (EBRD) 4	Almost all physical risks are assumed to substantially affect the automobile industry

	Other Institution	View
Transition Risks	Kepler Cheuvreux Transition Research 5	As items related to the trends, demand by region, global total number of vehicles, ownership ratio of automobiles, power train ratio, emission intensity by power train, WTWCO2 emission ratio, and policy developments are assumed.
Transition Risks	International Investors Group on Climate Change(IIGCC) 6	CO2 emissions and sales numbers are basic disclosure data related to climate change.

1

[ii. Transportation Sector (Automobiles)] Sustainability Disclosure Standards Requested by SASB

Power train ratio and fuel efficiency/emissions are especially important as indicators of climate change risk analysis

(Reference) **Standards by SASB for each industry concerning information disclosure to investors on sustainability**

- Overview of the institution: SASB (Sustainability Accounting Standard Board)
  A non-profit body to promote the disclosure of information on sustainability to meet the needs of investors
- Summary of the report:
  - ✓ Formulating and publishing sustainability accounting standards of each industry for the disclosure of financial information
  - ✓ Regarding five environmental disclosure items (environment, social impacts, human resources, business models and innovations, leadership and governance), presenting items unique to the automobile industry and preparing disclosure indicators as sustainability standards.

Regarding GHG emissions as an important disclosure item for the automobile industry, two indicators related to "fuel efficiency and emissions" are established

- For other environment-related items, "Material efficiency and recycle" arising from the scarcity of resources are established as disclosure items.
- Disclosure items for parts and the rental sector are also published, in addition to the automobile sector. For both, disclosure is required for items related to material efficiency and recycle, and fuel efficiency.

Disclosure Topics	Important Disclosure Items for Automobile Industry
Environment	Materials Efficiency & Recycling
Social Capital	Product Safety
Human Capital	Labor Relations
Business Model & Innovation	Fuel Economy & Use-phase Emissions
Leadership and Governance	Materials Sourcing

Topics	Accounting Indicators Required to be Disclosed
Fuel Economy & Use-phase Emissions	Sales-weighted average passenger fleet fuel economy, consumption, or emissions, by region
	Number of (1) zero emission vehicles (ZEV) sold, (2) hybrid vehicles sold, and (3) plug-in hybrid vehicles sold

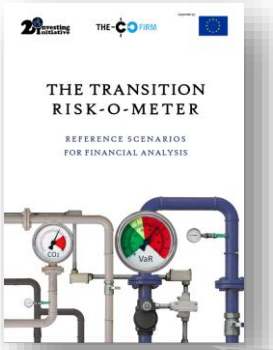
Response to GHG emissions is an important issue for the automobile industry

- ✓ Accumulation of GHG emitted by automobiles will have a substantial effect on climate change on a global scale
- ✓ To reduce the risk of decreasing competitiveness and demand, it is necessary to meet fuel and emission standards required by the society.
- ✓ In fact, regulations on emissions and fuel efficiency for vehicles are increasingly becoming stricter globally.

Source: SASB, "Automobiles Sustainability Accounting Standard"、Industry Brief(2014)

2 [ii. Transportation Sector (Automobiles)]
Transition Risk Scenario by 2°C investing initiative for Companies Responding to TCFD recommendations

As risk analysis parameters of the automobile industry, sales, carbon fibers, battery prices, fuel efficiency standards and CO2 ratios are established for each power train

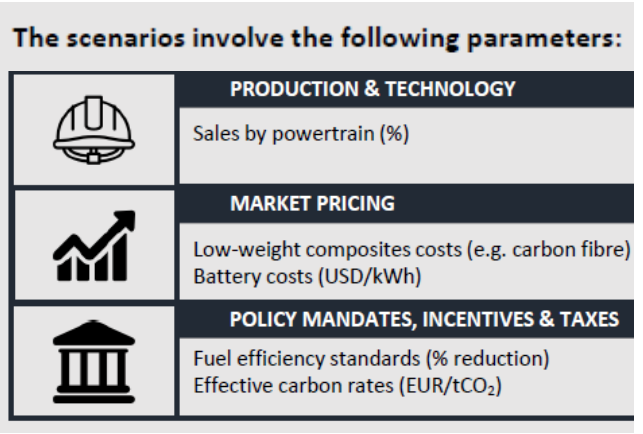


(Reference) **Transition risk scenario by 2°C investing initiative for companies responding to TCFD recommendations**

- Overview of the institution:2°C investing initiative
  A think tank developing climate change risk indicators and policy options in the financial markets
- Purpose of the report:
  - ✓ To present transition scenarios in line with TCFD recommendations, which companies can refer to when conducting financial risk analysis and scenario analysis (ACT (ambitious climate transition) assuming +2°C world and LCT (limited climate transition) with +3-4°C)
  - ✓ To establish important parameters for 8 sectors with large energy consumption, such as the automobile industry, and consider how parameters should be based on the existing scenarios such as the one by IEA

Five risk analysis parameters are derived based on the trend of automobile industry towards low carbonization

Trends	Background
The switch to zero-carbon powertrains	There are **differences in the penetration of various types of vehicles** under IEA 2°C and 4°C scenarios. (The IEA estimates that Internal Combustion Engine (ICE) powered cars (e.g. petrol, diesel) will only account for around 10% of total car sales in 2050 under the 2°C scenario, with a rise in electric and fuel cell alternatives. Zero-carbon powertrains are similarly set to grow under a 4°C transition, albeit at a less rapid pace.)
Changing economics around car production	Manufacturing chains may benefit or be damaged due to **the influence of developments of other actors** such as battery manufacturing.
Increasing fuel efficiency standards	In relation to oil prices, many customers have become to pay more **attention to fuel efficiency at the time of purchase**.
A broader context of changing consumption patterns and technology changes	Beyond the perspective of low carbonization, there have been **structural changes** in the usage of vehicles such as sharing.



 Source: 2ii.& The CO-Firm. "*The Transition Risk-O-Meter*". 2017.

3

[ii. Transportation Sector (Automobiles)]

Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Transition risk from fuel efficiency regulation is recognized by the largest number of companies.

CDP Question

Please answer details of **risks from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**.

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Product Efficiency Regulations and Standards	11	Med-High	• Higher capital cost • Higher R&D cost • Lower production capacity • Higher operational cost • Lower demand • Financial penalties	Short- to long-term	Direct	Unlikely-Virtually certain	• R&D • Production • Sale	As initiatives for climate change, strengthening of CO2 emission regulations on vehicles are accelerating globally. Countries have regulations on their own. They not only have financial impacts but also affect reputation of companies on the environment.
Restriction on Air Pollution	3	Med-Somewhat High	• Lower demand	1-6 years	Direct	Unlikely -Likely	• R&D • Sale	If automobiles do not meet the level, there will be a risk of decreasing demand and lowering sales. It is important to respond to regulations and customer demand.
Environmental Regulations	2	Somewhat High	• Lower production capacity • Lower demand	3 years or less	Direct	Very likely -Virtually certain	• Sale	We are required to submit a medium to long term plan and a report on periodic energy consumption to authorities: Insufficient improvements will lead to a reputation risk.
Product Labelling Regulations and Standards	2	Somewhat Low-High	• Lower demand	1-6 years	Direct Indirect	Unlikely-More likely than not	• Sale	Differences in labeling regulations for products in countries will encourage the improvement in standard performance.
Cap-and-Trade	1	Somewhat Low	• Higher operational cost	3-6 years	Direct	Virtually certain	• Production	Since 2013, new Directives for ETS have further increased their impact on plants in Europe.
Carbon Tax	1	Somewhat High	• Higher operational cost	3-6 years	Indirect	More likely than not	• Procurement • Production	Carbon tax may add huge costs to our business by directly taxing the Company or through the taxation on our suppliers.
Fuel/Energy Regulations	1	Somewhat High	• Higher capital cost	1-3 years	Direct	Virtually certain	• R&D • Sale	Since the commercial market will change from diesel cars to gasoline cars due to fuel regulations, automobile manufacturers will need to change their industry structure. Substantial capital investment will be required for the rethinking and adaptation of industrial processes.
International Agreement	1	High	• Other	3-6 years	Direct	Very likely	• Overall	The Paris Agreement has turned out to require costly changes to long-term technological strategies.

Source: Companies' Replies to CDP

3

[ii. Transportation Sector (Automobiles)]

Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Transition risk from fuel efficiency regulation is recognized by the largest number of companies.

CDP Question

Please answer details of **risk from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure**

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Changes in Heavy Rains and Drought	9	Low-High	• Lower production capacity	Short-to long-term	Direct Indirect	Unlikely-Very likely	•Procurement • Production • Sale	Typhoons, floods and droughts among others cause substantial damage to operations. We are currently operating in regions with extreme climate risks including India and Thailand, while having suffered a considerable loss due to a cyclone in the past.
Changes in Natural Resources	3	Low-Med	• Higher operational cost	1-3 years	Direct Indirect	About as likely as not-More likely than not	• Procurement • Production	We may see the shortage of water, metal resources and the like, possibly leading to unstable supply. Due to the spread of supply chains all over the world, there will be a still higher risk of natural resources shortage.
Extreme variability in temperature	3	Low-Med	• Lower production capacity • Lower demand	Short-to long-term	Direct Indirect	Likely -More likely than not	• Procurement • Production • Sale	Extreme temperatures and weather phenomena will occur due to climate change. Such extreme changes could incur damage to production sites and transportation infrastructure among others.
Changes in Precipitation Patterns	2	Somewhat Low-Somewhat High	• Lower production capacity	Short-to long-term	Direct Indirect	Likely	•Procurement •Production	There are extraordinary weather conditions all over the world that seem to have been caused by climate change. In particular, if facilities of main suppliers are affected by typhoons and floods with the effect of heavy rains, delivery may be delayed and operating ratio may be decreased and possibly making it impossible to maintain stable operations.
Tropical cyclone (typhoon/ hurricane)	1	High	• Lower production capacity	1 year or less	Indirect	Likely	• Procurement • Production	As climate change continues to raise the sea surface temperatures, strong tropical storms will increase in the Asian region, leading to floods of rivers, possibly putting our operations and supply chains in danger.

Source: Companies' Replies to CDP

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[ii. Transportation Sector (Automobiles)]

Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Transition risk from fuel efficiency regulation is recognized by the largest number of companies.

CDP Question

Please answer details of **risk from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

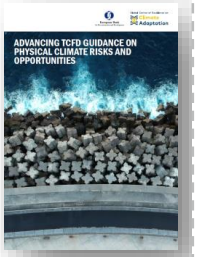
Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Change in customer behaviors	7	Med-Somewhat High	• Lower demand	Short- to long-term	Direct Indirect	About as likely as not-Very likely	• R&D • Sale	Changes in consumer behaviors will decrease the share in the market and profit. For example, fuel prices and tax incentives are thought to affect customer behaviors.
Reputation	3	Somewhat High	• Lower demand	1-6 years	Direct Indirect	Likely-Very likely	• Sale	Consumers are concerned about climate change, and companies unable to respond to it will invite the decline of their trust and brand, possibly decreasing the number of cars sold and damaging company capital.
Changes in Socio-economic Conditions	1	Med	• Lower demand	3-6 years	Direct	Likely	• Sale	Due to the decrease in purchasing power, consumers tend to hesitate to buy new cars, and rather seek new mobility services to optimize the use of individual cars.
Uncertainty of Market Signals	1	Somewhat High	• Response to regulations	1 year or less	Direct	Likely	• Sale	When gasoline prices are high, consumers may choose trains and other transportation means rather than automobiles.

Source: Companies' Replies to CDP

4 [ii. Transportation Sector (Automobiles)] EBRD Assessment Guidance on Physical Risks and Opportunities

Almost all physical risks are assumed to substantially affect the automobile industry



(Reference) **Assessment Guidance for Physical Risks and Opportunities by Initiatives Receiving TCFD recommendations**

➢ Overview of the institution:

- EBRD (European Bank for Reconstruction and Development): Established after the end of Cold War to develop market economies in central and eastern European countries. It also advocates promotion of the "environment-friendly sustainable development" and aggressively makes investments related to climate change.
- GCECA (Global Centre of Excellence on Climate Adaptation): An organization established by the United Nations and governments of countries including the Netherlands. Having partnerships with NGOs, financial institutions and others, it aims to promote adaptation to climate through the sharing of knowledge and development of assessment methods, among others.

➢ Summary of the report:

✓ A guidance compiling points to note and indicators for reference when companies assess physical risks and opportunities, taking into account TCFD recommendations. It was prepared after discussions in the working group combining financial institutions and companies, among others.

✓ It requires information disclosure and assessment of influence on assets based on analysis by value chain and geography.

The number of items of physical risks that have substantial effects on the automobile industry is next to those of the material industry, the public infrastructure industry, and the food production industry.

	Acute			Chronic				
GICS industry group	Storms and cyclones	Extreme rainfall and flood	Extreme heat	Variability in precipitation	Variability in temperature	Water stress	Sea-level rise	Other climate hazards
Automobiles and components	High	High	High	Medium	High	Medium	High	Degraded air quality
Food, beverage and tobacco	High	High	Medium	High	High	High	High	Soil degradation, ocean acidification
Banks	High	High	Low	Low	Low	Low	High	
Transport	High	High	Medium	Low	Low	Low	High	Permafrost melt, ice melt
Software and Services	High	High	Low	Low	Low	Low	High	
Materials	High	High	High	High	High	High	High	
Utilities	High	High	High	High	High	High	High	Wildfires

➢ **Influences** from physical risks **differ depending on business characteristics** such as water and energy consumption

➢ Examples of specific influences given by physical risks:

- Rise in energy cost and burden on workers due to higher temperatures
- Water shortage and higher operational cost due to water stress
- Asset damage and transfer costs due to cyclones and others

*Table on the left is an excerpt.

Source: EBRE, "Advancing TCFD guidance on physical climate risks and opportunities"(2018), Global research institute "Measuring physical climate risk in equity portfolios"(2017)

5

[ii. Transportation Sector (Automobiles)]
Financial Impact Assessment of Transition Risks in European OEM

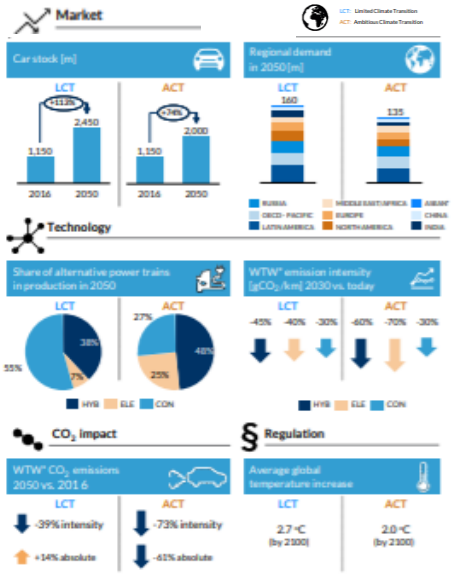
As items related to trends, demand by region, global total number of vehicles, ownership ratio of automobiles, power train ratio, emission intensity by power train, WTWCO2 emission ratio, and policy developments are assumed.

(Reference) Analysis of financial effects that transition risks have on European OEM, by a financial research company

- Overview of the institution: Kepler Cheurveux
  A European financial service company providing intermediation and advice to the investment industry. It also conducts survey research on the environment and governance by its ESG team.
- Purpose of the report:
  - ✓ As part of the ET project, Kepler Cheuvreux independently analyzed financial effects brought up by transition risks for BMW, Daimler and VW. As analysis scenarios, transition risk scenarios prepared by 2°C investing initiative (above) were used.
  - ✓ What is ET Risk Project (Energy Transition Risk Project)?:
    A project aiming to provide assessment tools for financial risks and opportunities due to the transaction to a low carbon society under the collaboration of institutions and research institutes, etc., including 2°C investing initiative and Carbon Tracker.

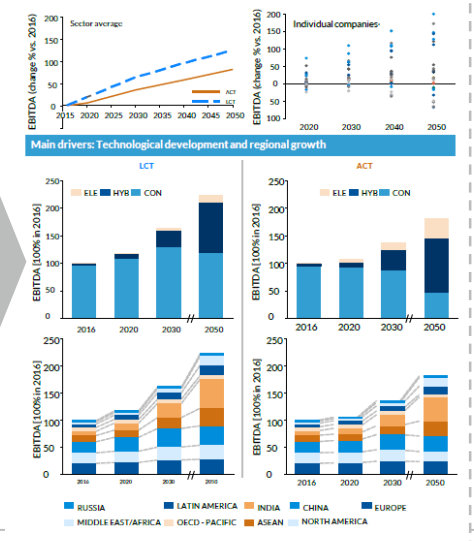
Major trends in the transition to a low carbon society, which have an especially large financial impact, are assumed.

- The following events are assumed as examples of trends:
  - **Demand for products** will increase under both scenarios due to the **development of emerging markets**
  - **The global total number of vehicles** will be more under LCT.
  - **Car ownership ratio** will decrease more under ACT than under LCT due to the changes in transportation means such as **the development of compact cities**.
  - **The market share of EV** is larger under ACT than under LCT.
  - **Automobile tax and abolition of fossil fuel subsidies** will help the achievement of targets for climate change



Trend-related Items
Demand by region
Global total number of vehicles
Car ownership ratio
Power train ratio
Emission intensity by power train
WTWCO2 emission increase/decrease ratio (from the present)
Policy developments (fossil fuel subsidies, automobile tax)

EBITDA analysis was conducted with the main drivers of **technological developments and development by region**



144 Source: Kepler Chervreux, “Transition risks in the automotive sector”(2018)

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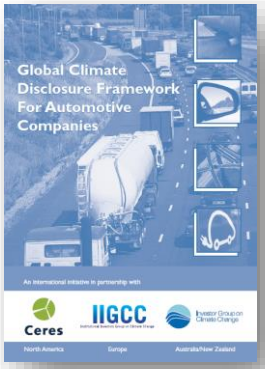
[ii. Transportation Sector (Automobiles)] Formulation by IIGCC of Climate Change-related Disclosure Information Required by Investors

CO2 emissions and sales numbers are basic disclosure data related to climate change.



(Reference) Formulation by IIGCC and others of climate change-related disclosure information required by investors

- Overview of the institution: IIGCC (International Investors Group on Climate Change)
  IIGCC is the leading group for collaboration among institutional investors in Europe focused on addressing investment risks and opportunities presented by climate change
- Purpose of the report:
  - ✓ To formulate a reporting framework in accordance with investors' demand for disclosure to the automobile industry, and thereby promote the disclosure of information, which enables investors to recognize financial decisions due to climate change.
  - ✓ To prepare a framework taking into account the most relevant climate change matters for the automobile industry with Ceres (US) representing the investor network for climate change risks and IGC (Australia and New Zealand) an investor group for climate change.
  - ✓ Such framework has been **integrated in CDP questionnaires** since 2009.

To formulate the disclosure information required to assess climate change-related risks and opportunities automobile companies face

- Request quantitative data on the number of cars sold, emissions, and clean technologies as the disclosure data to appropriately assess climate change risks and opportunities each company is facing individually
- Data on clean technologies is added for the purpose of overcoming the situation in 2009 where the business strategy and prospects of technological development for each company's emission reduction were not clear to investors.

Disclosure Data	Data Granularity
Sales volumes	• Should provide an overview of sales volumes by fuel type / engine technology and, if possible, by region/segment
CO2 emissions of vehicles sold	• Should provide sales volumes by fuel type / engine technology
Clean technologies (Ratio and number of new technology installed cars)	• Should provide the details about sales of different types of clean technologies

Source: "Global Climate Disclosure Framework For Automotive Companies "

4. References on Degree of Risk Importance in Selected Sectors

i. Energy Sector

ii. Transportation Sector (Maritime Transportation, Passenger Air Transportation, Automobiles)

iii. Buildings/Forest Products Sector

Chapter 4 References on Degree of Risk Importance in Selected Sectors

This chapter provides materials for scenario analysis, part of which were used for assessment of the degree of risk importance under the Ministry's support program

[iii. Buildings/ Forest Products Sector]
List of views by each research report on the importance of risks for the buildings/forest products sector

	Major Institution, etc.	View
Transition Risks	Sustainability Accounting Standards Board(SASB) 1	Indicators to measure “Sustainable services“ are useful as important disclosure accounting
Transition Risks	2° Investing Initiative(2ii) 2	(No report on the sector)
Transition Risks	Companies' CDP Disclosure 3	Many companies recognize regulations of product efficiency, etc., heavy rains and droughts, and reputation among others as risks and opportunities.
Physical Risks	European Bank for Reconstruction and Development (EBRD) 4	In the real estate industry, storms, floods, and sea-level rise are expected to be significant risks

	Other Institution	View
Transition Risks	Risk analysis report on the real estate industry by IIGCC 5	Buildings with low energy efficiency will face transition risks including higher costs and lower asset value, while the real estate industry will have various physical risks with higher costs and lower asset value.
Physical Risks	Research report by ACCLIMATISE 6	Climate change risks will bring about lower asset values, higher costs and lower demand.

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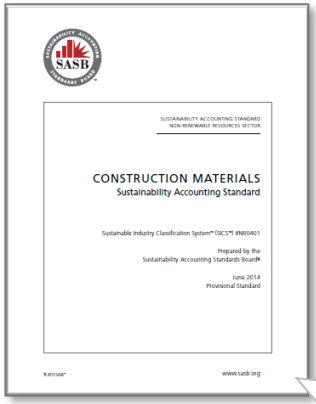
[iii. Buildings/Forest Products Sector]
Sustainability Disclosure Standards Requested by SASB

Indicators to measure “Sustainable services“ are useful as important disclosure accounting



(Reference) **Standards by SASB for each industry concerning information disclosure to investors on sustainability**

- Overview of the institution: SASB(Sustainability Accounting Standard Board)
  A non-profit body to promote the disclosure of information on sustainability to meet the needs of investors
- Summary of the report:
  - ✓ Formulating and publishing sustainability accounting standards of each industry for the disclosure of financial information
  - ✓ Regarding two environmental disclosure items (business models and innovations, and leadership and governance), presenting items unique to the construction material industry and preparing disclosure indicators as sustainability standards.

As an important disclosure item in the construction material industry, establishing two indicators for “Product innovations.”

Disclosure Topics	Important Disclosure Item in the Construction Material Industry
Business Model & Innovation	Sustainability Services
Leadership and Governance	Transparent Information & Management of Conflict of Interest

Topics	Accounting Indicators Required to be Disclosed
Product Innovation	Percentage of products that can be used for credits in sustainable building design and construction certifications
	Total addressable market and share of market for products that reduce energy, water, and/or material impacts during usage and/or production

- Consumer and regulatory trends are largely driving adoption of sustainable building materials and processes that are more resource efficient and lower health impacts of buildings throughout their lifecycle.
- Sustainable construction materials, therefore, are likely to drive a company’s long-term growth and competitiveness

Source: SASB, ”Automobiles Sustainability Accounting Standard”

3

[iii. Buildings/ Forest Products Sector]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Many companies recognize regulations of product efficiency, etc., as risks (1/2)

CDP Question

Please answer details of **risks from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Product Efficiency Regulations and Standards	16	Low-High	• Higher capital cost • Lower stock prices • Higher operational cost • Lower demand	Short- to long-term	Direct Indirect	Likely -Virtually certain	• Planning • Sale/ lease • Mainte-nance	EU government has introduced various energy efficiency requirements, which are strict toward various sectors including the real estate sector. If the latest requirements are not met, market position may be lost, possibly decreasing equity prices.
Fuel/Energy Taxation	11	Low-High	• Higher operational cost • Higher capital cost	6 years or less	Direct Indirect	Unlikely -Virtually certain	• Sale/ lease • Mainte-nance	If energy efficiency measures are not sufficient, our operational costs may increase due to the renewable energy standards, energy tax and regulations.
Carbon Tax	6	Somewhat Low-Med	• Higher operational cost • Higher capital cost	6 years or less	Direct Indirect	Unlikely -Virtually certain	• Sale/ lease • Mainte-nance	Considering uncertainties about nuclear power generation, we may need to increase fossil fuels to supplement the shortage while increasing costs.
General Environmental regulations including plans	6	Low-Med	• Higher operational cost • Higher capital cost • Operational suspension	Short- to long-term	Direct	About as likely as not-Virtually certain	• Overall	As a real estate business operator, we will be affected by the UK government's MEES regulation effective on April 1, 2018. Due to this regulation, leasing properties/units with EPC rating below E will not be allowed.
Cap and Trade	5	Low-Somewhat High	• Higher operational cost	1-6 years	Direct	About as likely as not-Virtually certain	• Planning • Developm ent • Sale/ lease • Mainte-nance	UK participation in the EU scheme is uncertain. If a new scheme is established, other sites in the portfolio will need to participate, possibly increasing carbon prices considerably.

Source: Companies' Replies to CDP

3

[iii. Buildings/ Forest Products Sector]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Many companies recognize regulations of product efficiency, etc., as risks (2/2)

CDP Question

Please answer details of **risks from regulations** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Obligation to Report Emissions	5	Low-Somewhat High	• Higher operational cost	3 years or less	Direct	About as likely as not-Virtually certain	• Maintenance	Various emission regulations are implemented in many parts of the world. If reporting obligations continue to increase, it may increase our operational costs.
International Agreement	3	Somewhat Low-Somewhat High	• Higher operational cost	3 years or more	Direct	About as likely as not-Very likely	• Planning • Maintenance	If the UK is excluded from the EU scheme, energy imports from the EU will be restricted, incurring a risk of building closures and the suspension of customer businesses.
Uncertainties Surrounding New Regulations	3	High	• Operational suspension	Short-to long-term	Direct	About as likely as not-Likely	• Planning • Sale/lease	It will lead to an additional risk as to how governments will change their policies for the generation of renewable energies and the nation's carbon emission reduction in accordance with the Paris Agreement.
Restriction on Air Pollution	1	Low	• Higher capital cost	1 year or less	Direct	More likely than not	• Planning • Sale/lease	Laws regulating air pollution may affect plants and other facilities in the Company's real estate.
Product Labelling Regulations and Standards	1	Somewhat Low	• Lower demand • Assets becoming obsolete	3-6 years	Direct	About as likely as not	• Planning • Sale/lease	Energy certificates such as LEED and ENERGY STAR stipulate the minimum permissible energy rating.

Source: Companies' Replies to CDP

3

[iii. Buildings/ Forest Products Sector]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

In companies' replies to CDP, many of them recognize heavy rains and droughts as risks. (1/2)

CDP Question

Please answer details of **physical risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Changes in Heavy Rains and Drought	9	Low-High	• Lower production capacity • Higher operational cost • Operational suspension • Higher capital cost	Short- to long-term	Direct	More likely than not-Virtually certain	• Development • Planning • Sale/lease • Maintenance	Extreme climate events will cause damage to properties, confuse staff's work and customers' purchases, and cause an increase in operational costs and disruption of businesses.
Higher sea levels	8	Low-High	• Lower demand • Higher operational cost • Operational suspension • Higher capital cost	Short- to long-term	Direct Indirect	Likely-Very likely	• Development • Maintenance	We own properties along the coasts of the U.S. and UK. Sea-level rise may incur damage or loss of properties.
Tropical Cyclones (Hurricanes and Typhoons)	6	Low-Somewhat High	• Higher operational cost • Expansion of social defects • Operational suspension • Higher capital cost	Short- to long-term	Direct Indirect	About as likely as not-Very likely	• Sale/lease • Maintenance	Typhoons occur very frequently along the coastal lines in the eastern part of China. We have spent substantial financial resources to repair and maintain buildings there.
Extreme variability in temperature	5	Low-High	• Higher capital cost • Lower demand • Higher operational cost	1 year or more	Direct Indirect	Likely-More likely than not	• Planning • Maintenance	If external temperatures change extremely, it may increase costs to maintain the internal temperatures in buildings.

Source: Companies' Replies to CDP

3

[iii. Buildings/ Forest Products Sector]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

In companies' replies to CDP, many of them recognize heavy rains and droughts as risks. (2/2)

CDP Question

Please answer details of **physical risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Increase in Average Precipitation	4	Low-High	• Higher operational cost • Higher capital cost • Lower asset values	Short- to long-term	Direct Indirect	Unlikely-About as likely as not	• Planning • Sale/ lease • Maintenance	Financial risks from floods are two; increase in claims from tenants due to the inability to do business; and increase in costs of corrective measures to repair damage from floods
Rise of Average Temperatures	4	Low-Somewhat High	• Higher operational cost • Higher capital cost	Short- to long-term	Direct Indirect	Likely-More likely than not	• Sale/ lease • Maintenance	Variability in the average temperature may invite an increase in cooling/warming costs and a rise in costs due to extreme weather events.
Snow and Ice	4	Somewhat Low-High	• Lower production capacity • Higher operational cost • Lower demand • Higher capital cost	Short- to long-term	Direct	More likely than not-Virtually certain	• Sale/lease • Maintenance	Accumulation of snow and ice may invite an increase in operational costs and insurance-related costs, increase in maintenance and repair costs of damaged enclosure parts, and disruption of services.
Changes in Natural Resources	3	Med-High	• Higher operational cost • Expansion of social defects • Higher capital cost	6 years or more	Indirect	More likely than not Very likely	• Planning • Maintenance	Changes in natural resources may affect the ability of suppliers to procure materials and products for operations, such as food
Changes in Precipitation Patterns	2	NA	• Higher capital cost • Lower production capacity	NA	Direct	NA	• Sale/ lease • Maintenance	Variability in temperatures, precipitation patterns and extreme weather patterns may increase damage at some of our properties.
Uncertainty about physical risks	1	NA	• Impact on the whole business	NA	Direct	NA	• Planning	If a building is not designed to respond to changes, it will entail risks

Source: Companies' Replies to CDP

3

[iii. Buildings/ Forest Products Sector]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

In companies' replies to CDP, they recognize reputation as other risks.

CDP Question

Please answer details of **other risks** among the current or future potential **climate change risks** that may **affect your company's business activities, revenue and expenditure.**

Recognition by Companies on Other Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Reputation	13	Low-High	• Operational suspension • Lower availability of capital	6 years or less	Direct Indirect	About as likely as not-Very likely	• Overall	In the scope where concerns about climate change-related issues are spread, if response to the market demand is insufficient, there will be a reputation risk for business and may potentially incur disadvantages for competition.
Change in customer behaviors	8	Med-Somewhat High	• Higher capital cost • Lower demand • Lower asset values	Short-to long-term	Direct Indirect	About as likely as not-Virtually certain	• Planning • Sale/ Lease	In the French real estate market, certified buildings are becoming the market standards. Real estate companies need to ensure a high level of energy efficiency for buildings in order to remain competitive in the market: Companies not doing so may see their market share decline.
Changes in Socio-economic Conditions	2	Somewhat Low-Somewhat High	• Higher operational cost • Lower demand	1 year or more	Direct	Virtually certain	• Development • Sale/ Lease	Energy costs linked to oil prices may pose a substantial risk for petroleum materials such as asphalt and transportation cost.
Uncertainty of Market Signals	2	Somewhat Low-Somewhat High	• Lower demand • Higher operational cost	1 year or more	Direct	Likely-More likely than not	• Land acquisition • Maintenance	Extreme weather events and other climate change risks may have negative effects on our company in the U.S. and major markets. In the short run, rise in the cost of fuel, energies, and merchandise are the most direct risks.
Change of people and cultural environment	1	High	• Higher operational cost	6 years or more	Direct	Likely	• Maintenance	When climate change starts, many people move to city centers seeking properties for rent. Therefore, the existing commercial spaces are required to be converted to more profitable residential spaces for developers and house owners. This will lead to an increase in rents for commercial properties.

Source: Companies' Replies to CDP

3

(Reference)[iii. Buildings/ Forest Products Sector (Residence)]
Study on the recognition of transition/physical risks by companies based on companies' replies to CDP

Three housing/building business companies recognize regulations of product efficiency and fuel regulations as transition risks.

Recognition by Companies on Risks from Regulations (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Product Efficiency Regulations and Standards	2	Med-High	• Operational costs • Lower demand	1-6 years	Direct Indirect	Likely-Very likely	• Production • Sale	There are laws stipulating standards for thermal insulation performance and facility efficiency for buildings of certain sizes; if such standards are raised, buildings will need to be improved to respond.
Cap-and-Trade	1	Med	• Higher capital cost • Higher operational cost	Short- to long-term	Direct Indirect	Virtually certain	• Production	Emission trading systems are beginning to be introduced in countries like New Zealand and China where we are doing business. If target businesses are expanded in the future, we may become a mandatory participant in some cases. Moreover, depending on international trends, changes in domestic systems may affect business activities and costs.
Carbon Tax	1	Med	• Higher operational cost	3-6 years	Direct	More likely than not	• Sale	As it is pointed out that the tax rate of "Global warming countermeasure tax" introduced in Japan is low, the rate may be raised as a "carbon tax" going forward.
Fuel/Energy Regulations	1	Some-what high	• Higher operational cost	3-6 years	Direct	Very likely	• Material procure-ment	If regulations, etc., are introduced for wood procurement to achieve the target of the Paris Agreement, there will be a risk of not being able to secure enough wood procurement or increasing costs.
Emission Reporting Regulations	1	Low	• Lower demand	3-6 years	Direct	More likely than not	• Overall	If penalties, etc., are reinforced for failed reductions in the system, which requires businesses with large GHG emissions to calculate/report emissions, there will be a risk of lower evaluations by stakeholders.

Source: Companies' Replies to CDP

3

(Reference)[iii. Buildings/ Forest Products Sector (Residence)]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Three housing/building companies recognize natural disasters and natural capital changes as physical risks.

Recognition by Companies on Physical Risks (see Companies' Replies to CDP)

Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Tropical Cyclones (Hurricanes/Typhoons)	2	Low - Somewhat low	• Higher operational cost • Lower production capacity	3 years-	Direct Indirect	Most Likely than not – Unlikely	• R&D • Production	Due to extraordinary weather caused by global warming, it may become necessary to make additional investment in research and development as well as production processes to strengthen disaster-prevention functions such as typhoon-resistant housing properties. If the maximum wind velocity increases resulting in more storms, buildings already built or under construction may be damaged.
Extreme variability in temperature	1	Low	• Lower production capacity	1-3 years	Indirect	More likely than not	• Production	If temperatures rise to substantially raising the highest temperature during the summer, there is a possibility that a risk of heat attack will be higher for construction workers, prolonging construction periods, among other issues.
Variability in precipitation	1	Low〜Med	• Lower production capacity	3-6 years	Direct	Likely	• Production	Due to the variability in precipitation, there is a risk of lower water levels at dams, disrupting the transmission of electricity from hydroelectric generation stations, and thereby suspending the operation of factories.
Forest Fires/ Wood Loss	1	Some-what high	• Lower production capacity	-1 year	Direct	Very Likely	• Overall	In the case of forest loss due to fire in company-owned forests and in/outside of plantations, or fire in a managed area, there will be a risk of damage claims.
Natural Disasters	1	High	• Higher operational cost	-1 year	Direct	Virtually certain	• Product use	There is a risk of incurring damage to houses due to natural disasters such as large typhoons and tornados and heavy snow caused by climate change.
Changes in Natural Capital	1	High	• Lower production capacity	6 years-	Direct	Likely	• Material procure-ment	There is a risk that we will have to change suppliers of raw materials in the case of depletion of wood resources, changes in habitats and harvesting, and accompanying regulations due to climate change.

Source: Companies' Replies to CDP

3

(Reference)[iii. Buildings/ Forest Products Sector (Residence)]
Study the recognition of transition/physical risks by companies based on companies' replies to CDP

Three housing and building companies recognize assessments and reputation of customer behaviors as risks

Recognition by Companies on Other Risks (see Companies' Replies to CDP)

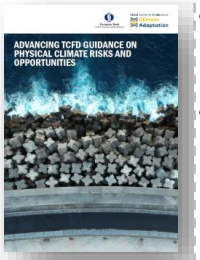
Risk Item	No. of Replies	Influence	Potential Impact	Period	Direct-ness	Feasibility	Impact on VC	Comments (excerpt)
Change in customer behaviors	2	Some-what High-High	• Higher operational cost • Lower demand	1 year-	Direct Indirect	Likely-Very likely	• Material procure-ment • Sale • Product use	There is a possibility of a rise in procurement costs and securing of procurement sources if concerns about increases in CO2 emissions by environmentally-damaging development of forest resources are heightened, and consumers become inclined to use forest-certified wood. If demand for life cycle carbon negative houses rises so much that we cannot deal with them, there is a risk of losing share to other companies. Moreover, there is a risk of increasing costs due to requests for making houses resilient and after-sale services in preparation for climate change.
Reputation	1	High	• Lower demand	1-3 years	Indirect	Likely	• Sale	Initiatives against illegal logging has been strengthened not only in developed countries but also in emerging countries. If our counterparties for wood fail to comply with these regulations, it will affect our company as the handling trading company with a risk of a decrease, etc., in sales and others by the decline of the brand.

Source: Companies' Replies to CDP

4

[iii. Buildings/Forest Products Sector]
Physical Risk Assessment on Each Industry by EBRD and Others

In the real estate industry, storms, floods and sea-level rise are expected to be risks that will have substantial impacts.



(Reference) **Assessment Guidance for Physical Risks and Opportunities by Initiatives Receiving TCFD recommendations**

- Overview of the institution
  - EBRD (European Bank for Reconstruction and Development): Established after the end of Cold War to develop market economies in central and eastern European countries. It also advocates promotion of the "environment-friendly sustainable development" and aggressively makes investments related to climate change.
  - GCECA (Global Centre of Excellence on Climate Adaptation): An organization established by the United Nations and governments of countries including the Netherlands. Having partnerships with NGOs, financial institutions and others, it aims to promote adaptation to climate through the sharing of knowledge and development of assessment methods, among others.
- Summary of the report:
  - ✓ A guidance compiling points to note and indicators for reference when companies assess physical risks and opportunities, taking into account TCFD recommendations. It was prepared after discussions in the working group combining financial institutions and companies, among others.
  - ✓ It requires information disclosure and assessment of influence on assets based on analysis by value chain and geography.

Cyclones, floods and sea-level rise are listed as physical risks surrounding the real estate industry.

	Acute			Chronic				
GICS industry group	Storms and cyclones	Extreme rainfall and flood	Extreme heat	Variability in precipitation	Variability in temperature	Water stress	Sea-level rise	Other climate hazards
Automobiles and components	High	High	High	Medium	High	Medium	High	Degraded air quality
Food, beverage and tobacco	High	High	Medium	High	High	High	High	Soil degradation, ocean acidification
Banks	High	High	Low	Low	Low	Low	High	
Transport	High	High	Medium	Low	Low	Low	High	Permafrost melt, ice melt
Software and Services	High	High	Low	Low	Low	Low	High	
Real estate	High	High	Low	Low	Low	Low	High	
Utilities	High	High	High	High	High	High	High	Wildfires

- **Influences** caused by physical risks **differ depending on business characteristics** such as water and energy consumption
- Examples of specific influences given by physical risks:
  - Rise in energy cost and burden on workers due to higher temperatures
  - Water shortage and higher operational costs due to water stress
  - Asset damage and transfer costs due to cyclones and others

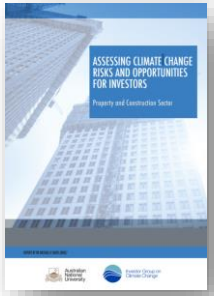
*Table on the left is an excerpt

Source: "Advancing TCFD guidance on physical climate risks and opportunities", Global research institute "Measuring physical climate risk in equity portfolios"

5

[iii. Buildings/ Forest Products Sector]
IIGCC Risk Analysis Report on the Real Estate Industry (1/2)

Buildings with low energy efficiency will face transition risks including higher costs and lower asset values



(Reference) **Analysis of physical risks and transition risks in the real estate industry by an investor group in Australia and New Zealand**

- Overview of the institution: IIGCC (International Investors Group on Climate Change)
  Collaboration of investors in Australia and New Zealand. It focuses on the impact of climate change on financial values of investment.
- Purpose of the report:
  - ✓ To provide information to assist investors in assessing climate risks and opportunities in the property and building sectors
  - ✓ To analyze risks and corresponding strategies, and identify opportunities for each physical risk and transition risk

[Transition Risks]
In Australia, assets not complying with a low carbon society entail more than one transition risks.

Risk	Background and Impact of Risk
Higher Electricity/ Water Charges	• The average price of electricity in Australia is expected to rise due to investment in electric power infrastructure and rise in carbon prices. • Higher electricity/water charges will present opportunities for improving efficiency to real estate companies.
Loss of Premium Prices	• Energy-efficient offices will be rated highly, receive premium prices and become advantageous for the contract as premium tenants being resilient to extreme weather. • Due to such tendencies, energy saving by tenants will improve, bringing benefits to real estate companies.
Higher Vacancy Ratios/ Lower Asset values	• Given that energy-efficiency of leasing and purchasing properties is required to be disclosed by law, properties with low assessment have difficulty finding tenants or purchasers . • Energy-efficient buildings can acquire higher asset values due to low vacancy rates, rise of rents and decrease in maintenance costs
Higher Material Costs	• Manufacturing costs will increase due to the rise in carbon prices and increase in construction materials prices (glass, cement, and others)
Stricter Compliance Levels	• With low carbon regulations for architecture becoming stricter globally, stricter levels will also be required when repairing buildings

Source: IIGCC ”Assessing Climate Change Risks and Opportunities for Investors” (2013)

5

[iii. Buildings/ Forest Products Sector]
IIGCC Risk Analysis Report on the Real Estate Industry (2/2)

The real estate industry faces various physical risks with higher costs and lower asset values

[Physical Risks] <u>In Australia, physical risks bring linear impacts on the construction stage and real estate</u>

➢ Analyzing impacts by sector based on the future forecasts of weather conditions

Physical Risks	Impacts on Construction	Impacts on Real Estate
Mega-Cyclones/Floods	• Delays in construction • Increases in construction costs and insurance premiums due to the countermeasures against floods	• Damage to assets • Suspension of business • Increase in insurance premiums
Occurrence of Frequent Hail/Floods		
Heavy Rains		
Decrease in Water Resources	• Higher costs due to the rise in water prices • Higher electricity prices due to the decrease in hydro-power generation caused by drought	N/A
Rise of Average Temperatures	• Higher prices due to the sharp increase in demand for electricity during the summer • Power failures and risks of construction cancellations • Lower productivity from fatigue and increased risks of accidents due to heat	(←Same as written on the left)
Increase in Extremely Hot Days (Northern Australia)		
Forest Fires	• Restrictions in vulnerable regions	• Damage to assets • Suspension of business • Disruption of electric power supply • Increases in insurance premiums
Sea-level Rise	• Restrictions on construction permits • Increased costs and delayed construction in lands of low altitude relative to sea level	• Flood damage • Investment costs for countermeasures against floods • Suspension of business • Decrease in land values

Source: IIGCC ”Assessing Climate Change Risks and Opportunities for Investors” (2013)

6

[iii. Buildings/ Forest Products Sector]
Survey Report by ACCLIMATISE

Climate change risks bring about lower asset values, higher costs, and lower demand, among others

(Reference) **Analysis of Physical Risks in the UK Real Estate Industry by A Climate Change Risk Analysis Institution**

- Overview of the institution: ACCLIMATISE
  An advisory institution specializing in climate change risk management. It provides climate change risk analysis and adaptive strategies to private and public institutions
- Purpose of the report:
  - ✓ To report on linear and indirect impacts of climate change risks on the industry, intending to develop discussions among companies, investors and government.
  - ✓ To analyze climate change risks and adapting strategies in the U.K. commercial real estate industry

The UK real estate industry will be affected in terms of profits, capital values, evaluations and regulations due to transition risks and physical risks

Risks	Impact from Risks	Overview
Higher Temperatures	• **Higher maintenance costs** • **Lower property values** • **Degradation of materials**	• Maintenance costs will rise because it will be necessary to have exterior coating to prevent damage to buildings by ultraviolet rays • Lower value for properties with low energy efficiency • Progress in degradation of materials such as asphalt
Variability in Precipitation Patterns	• **Higher costs of supplying water** • **Lower asset values and higher insurance premiums** • **Higher maintenance costs** • **Land subsidence risk**	• Higher costs of supplying water due to drought • Lower asset values and higher insurance premiums in areas with the risk of floods • Maintenance costs will rise because it will be necessary to have exterior walls resistant to heavy rains • There will be a higher risk of land subsidence as soils will change due to the variability in precipitation patterns
Storms	• **Higher maintenance costs**	• Maintenance costs will rise with a higher risk of structural damage to buildings
Extraordinary Weather in General	• **Delays in constructions** • **Substantial rise in construction costs**	• Delays in construction will occur due to extraordinary weather • Construction costs will rise due to the decrease in available working hours
Policy Trends	• **Increase in demand for energy-efficient assets** • **Stricter building standards**	• Demand for energy-efficient assets will increase by the implementation of “Green Procurement“ by the government • Renewable energy ratio of energies consumed and building standards for emissions such as energy-efficiency of buildings will rise, with a possibility of non-compliance

Source: ACCLIMATISE ”UK commercial property Understanding the investment implications of adapting to climate change” (2009)

Contact Us

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