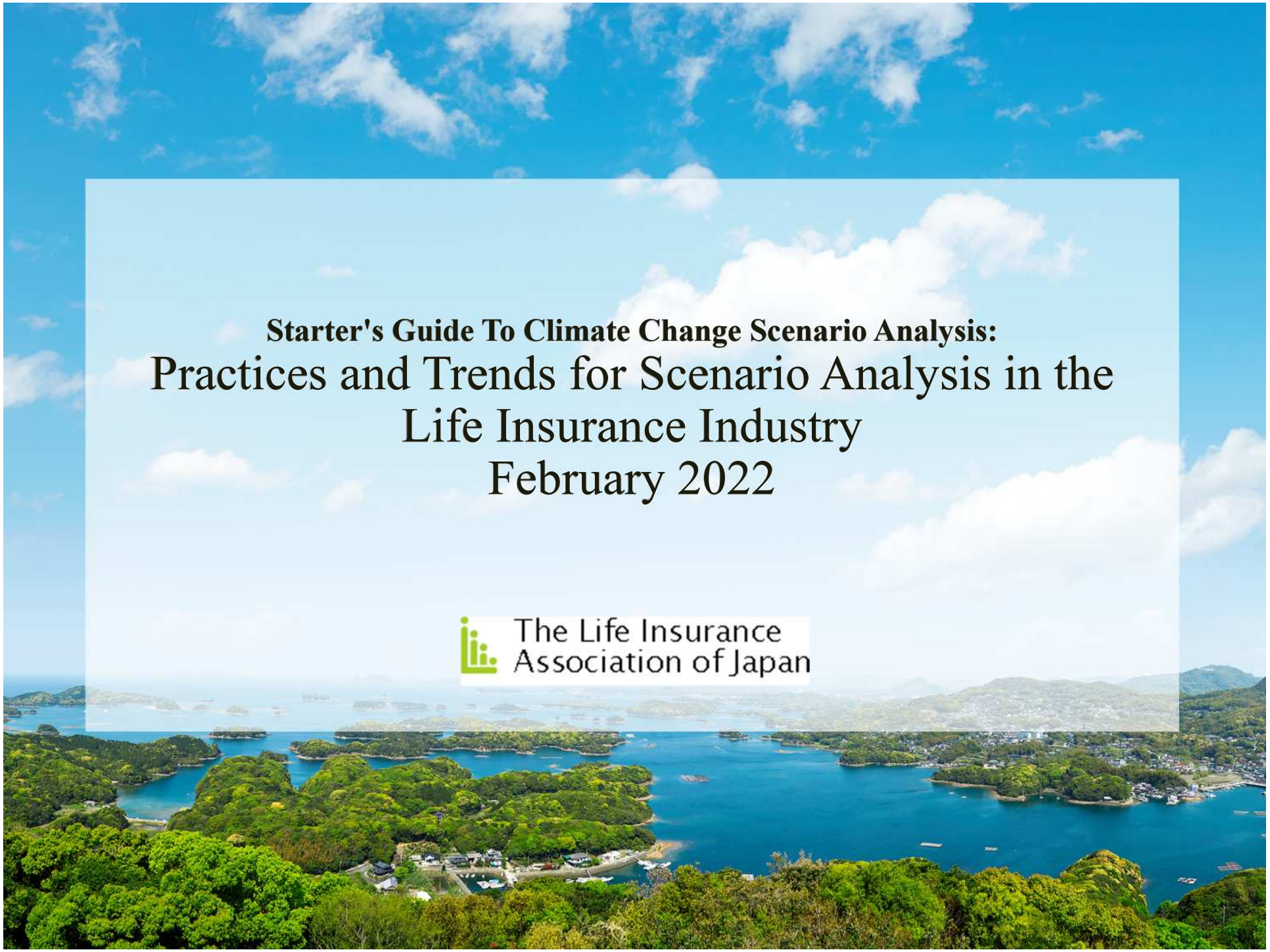

Starter's Guide To Climate Change Scenario Analysis:

Practices and Trends for Scenario Analysis in the Life Insurance Industry

February 2022

The Life Insurance Association of Japan

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Introduction

Background and purpose of this guide

- There are concerns that climate change (global warming) will have a wide range of adverse impacts on human life, quality of life, natural ecosystems, economic activity, and more. In this context, the private sector, particularly financial institutions, are seen as playing a major role in the transition to a decarbonized society.
- Because of growing impacts and concern, there is growing expectation for disclosures relating to sustainability. Japan's Corporate Governance Code calls on listed companies to appropriately disclose their initiatives on sustainability, and companies in prime markets in particular are being expected to enhance the quality and quantity of disclosures based on the TCFD (recommendations) or an equivalent international framework.
  * For an overview of the TCFD recommendations, please refer to the Life Insurance Association of Japan's *Climate Change Starter's Guide*.
- Many companies find the scenario analysis aspects of the TCFD recommendations to be among the most challenging. They need to first understand scenario analysis, not only for their own internal analysis, but also so that institutional investors can interpret the information disclosures of the companies they invest in.
- This Guide was written mainly for people in the insurance industry who are getting started on this topic. It provides basic knowledge and key points to keep in mind, as well some guidelines for initiatives, useful examples, and sources for more information. We hope that it will serve as a reference for companies about to embark on full-scale scenario analysis.
- This Guide also takes into account the sector-specific guidance of the TCFD recommendations, as revised in October 2021.
- This Guide was prepared under contract with Green Pacific Co., Ltd. (GP), a consulting firm specializing in responses to climate change.

I. The current state of climate change

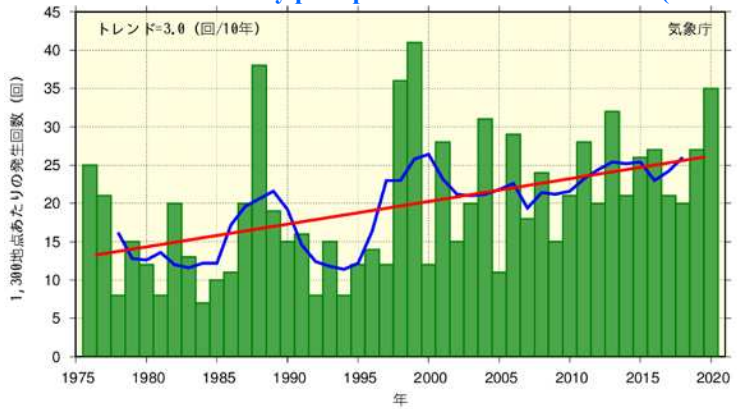
1. Examples from Japan

- Weather-related disasters such as torrential rainfall events are increasing and intensifying everywhere in Japan. In July 2020, Japan experienced heavy rainfall, with historical records smashed in many locations for the amount of rain falling in a 24-hour period. Total rainfall observed nationwide in early July and the number of occurrences of over 50 mm falling per hour were the most nationwide since 1982, resulting in major rivers breaching their banks, sediment-related disasters, and the flooding of low-lying areas, as well as 82 deaths and 4 persons missing.

Source: Kumamoto Stock Photo Archives, "Kiroguma!"

Torrential rainfall in Kumamoto, July 2020

Annual occurrences of hourly precipitation of 80 mm or more (AMeDAS)



- Rainfall of over 80 mm per hour leaves people feeling breathlessness, unsafe, and threatened, umbrellas are completely useless, and poor visibility makes it dangerous to be driving a vehicle.
- For the 10-year period 2011 to 2020, the average annual number of occurrences of rainfall over 80 mm per hour has increased by approximately 1.9 times compared to the period 1976 to 1985.

Source: Japan Meteorological Agency website

Changes in torrential rainfall events

I. The current state of climate change

2. Examples from around the world

- In July 2021, extensive flooding from intensive rainfall events occurred in Germany and Belgium, which previously had little experience of flood damage, resulting in 181 deaths in Germany and 38 deaths in Belgium. In China, 302 people were killed and 50 went missing due to heavy rains in Henan Province.
- In June 2021, an extreme heat wave in western Canada killed more than 230 people. At this time, temperatures in British Columbia smashed records at 49.6℃.

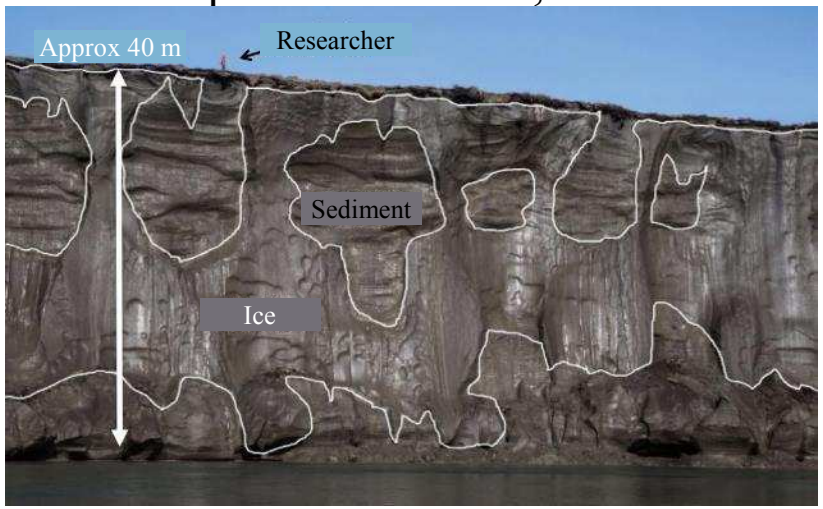
Torrential rains and flooding in Germany

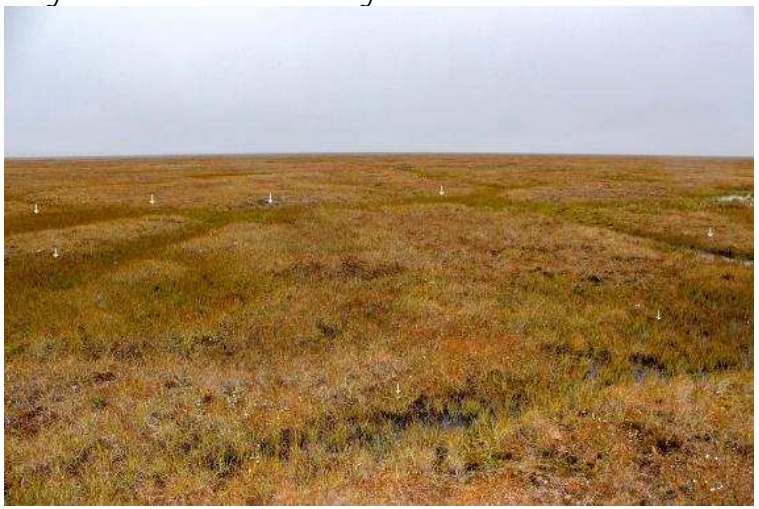
Extreme heat wave in Canada

I. The current state of climate change

2. Examples from around the world

- Permafrost has been melting with the advance of global warming. For millennia it previously stayed frozen all year round. The permafrost layer contains vast amounts of methane, which is released when the permafrost melts. Methane is a greenhouse gas (GHG) with 25 times the global warming potential of carbon dioxide, so its release may further accelerate global warming and climate change.
- There are also concerns that unknown viruses and other pathogens could be released as the permafrost melts, which could adversely affect humanity.





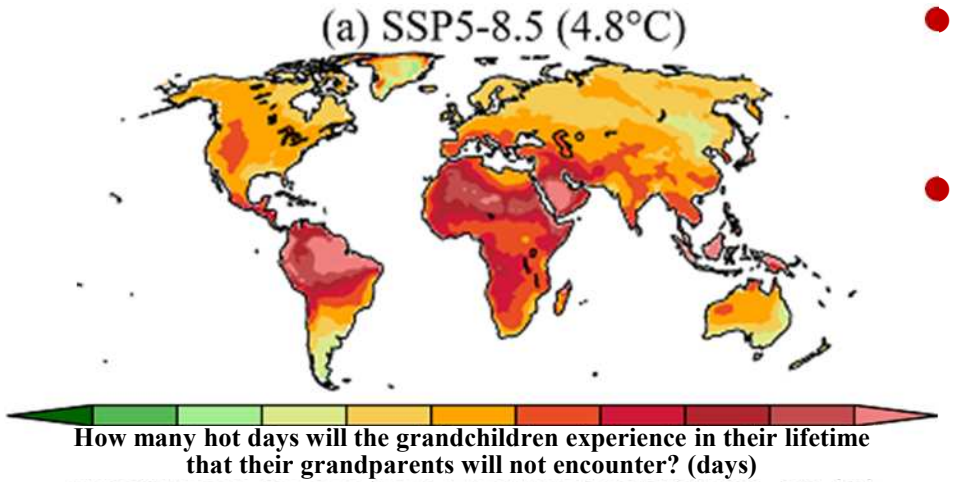
Source: National Institute for Environmental Studies, *Is the permafrost melting due to global warming?* Alaska Research Report 2017, 2018.

Melting permafrost in Alaska

I. The current state of climate change

3. Impacts on future generations

- Intergenerational inequities from the impacts of climate change have also become increasingly apparent. A study published in June 2021 by a team that included the National Institute for Environmental Studies (NIES) estimated the number of times that grandchildren will experience extremely hot days and heavy rainfall events during their lifetime (2020-2100), compared to their grandparents' generation (1960-2040).
- The report suggests that in some tropical areas, the grandchildren's generation may experience extremely hot days more than a thousand times in their lifetimes (in Japan, about 400 times), while their grandparents may not have experienced even one instance in a scenario with no climate change. For torrential rainfall the ratio was estimated at five times or more (about three times in Japan).



Source: National Institute for Environmental Studies, *How many hot days and heavy precipitation days will grandchildren experience that break the records set in their grandparents' lives?* - Assessment of Intergenerational and Regional Inequities in Extreme Weather Events, June 11, 2021 (in Japanese). https://www.nies.go.jp/whatsnew/20210611/20210611.html

- A similar trend was also shown in a paper published in September 2021 in the magazine *Science* by an international research team.
- The paper estimates that children born in 2020 will experience extreme weather events two to seven times more than those born in 1960 if humanity does little to tackle climate change.

Source: Wim Thiery et. al, Intergenerational inequities in exposure to climate extremes, Science, September 26, 2021, Vol 374, issue 6564, pp. 158-160.

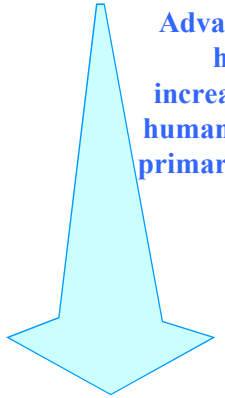
I. The current state of climate change

4. Assessments by the Intergovernmental Panel on Climate Change (IPCC)

- IPCC reports are among the most important sources of information for considering the impacts of climate change.
- In 1988, the IPCC was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to conduct comprehensive assessments of climate change from scientific, technical and socio-economic perspectives, and provides scientific information to contribute to the climate change policies of governments in each country.
- * The reports are produced by approximately 2,500 researchers from 195 countries participating in reviews of the latest scientific findings, ultimately resulting in a "Summary for Policymakers," which is checked line by line by the government representatives of each country, and then released on the consensus of all participating countries.
- * Research has progressed over the past 20 years, regarding the "likelihood that human activity may be the primary cause of warming of the climate system":

Working Group I Report of the IPCC (Physical Science Basis)

1990 First Assessment Report	Likely
1995 Second Assessment Report	Likely
2001 Third Assessment Report	Highly likely (>66%)
2007 Fourth Assessment Report	Very high likelihood (>90%)
2013 Fifth Assessment Report	Extremely high likelihood (>95%)
2021 Sixth Assessment Report	Unequivocal

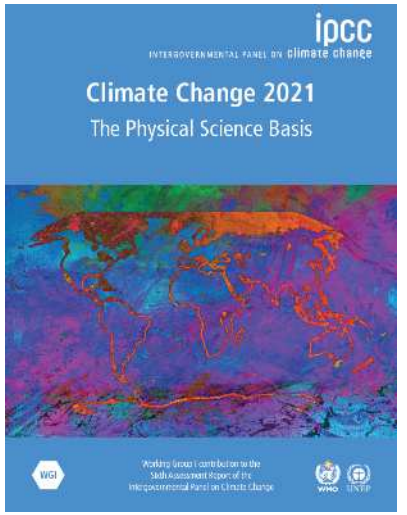


Advances in research have made it increasingly clear that human activities are the primary cause of climate change.

I. The current state of climate change

5. Key points of the Sixth Assessment Report from IPCC Working Group I (August 2021)

- The Sixth Assessment Report comes to about 4,000 pages, so a separate Summary for Policymakers was compiled into just 42 pages. These are some of the topics covered:
  - The scale of recent changes across the climate system as a whole, and the present state of many aspects of the climate system, are unprecedented over many centuries to many thousands of years.
  - The global average temperature (2011-2020) is already about 1.09℃ above preindustrial levels.
  - Human-caused climate change is affecting many extreme weather and climate phenomena around the world.
  - Global average temperatures will continue to rise at least until the middle of this century. The global average temperature at the end of the century will be 1.0 to 5.7℃ above preindustrial levels.



  - Global warming will exceed 1.5 and 2℃ in the 21st century, unless greenhouse gas (GHG) emissions decrease significantly in the next few decades.

- In order to avert unacceptable adverse impacts of climate change, the Paris Agreement calls for global efforts to limit the increase in global average temperature to well below 2℃ above pre-industrial levels, and to pursue efforts to limit the increase to 1.5℃. This latest IPCC report warns that these targets may not be met.

I. The current state of climate change

For reference: Climate-related risks and opportunities

- * TCFD Recommendations describe both "risks" and "opportunities" of climate change.

Source: TCFD Recommendations Recommendations of the Task Force on Climate related Financial Disclosures(2017)

- "Physical risks" include slow-moving "chronic" risks, such as increases in average temperatures, and "acute" risks, such as floods and heat waves.
- "Transition risks" refers to risks that a company with of damage gas (GHG) emissions will be forced to "transition" to decarbonized or low-carbon business, in the context that GHGs are emitted by human socioeconomic activities such as the burning of fossil fuels, and are causing climate change.
- However, companies that can counter these risks or take advantage of changes may also bring new "opportunities."

II. What is scenario analysis?

1. Definition and significance of scenario analysis in TCFD recommendations

- **What is a scenario?**
  - Scenarios are used to consider situations where uncertainty is high and accurate predictions/projections are difficult.
  - They provide a means for companies to think about what will happen to their business in the future if certain trends continue (e.g., policy support for climate change is implemented on a large scale and continuously), or if certain conditions are met (e.g., innovative decarbonization technologies are developed).
  - However, a scenario is a hypothetical model and not intended to provide detailed predictions or forecasts. It is a descriptive representation of a possible future.
- **What is scenario analysis?**
  - Scenario analysis is a method of increasing the flexibility and resilience of a company's strategy for a variety of future situations. It is a method to consider the long-term impacts on a company's business, strategies, finances, and performance, using scenarios to anticipate the impacts of climate change and changes in the business environment due to long-term policy trends related to climate change.
- **Scenarios used for analysis**
  - A company can develop its own scenarios, or refer to existing scenarios created by industry groups or international organizations, etc.

→ This section explains why scenario analysis is important in the TCFD Recommendations and what kinds of responses are anticipated.

II. What is scenario analysis?

2. Why is scenario analysis necessary and important in response to the TCFD Recommendations?

- The TCFD Recommendations call on companies to analyze the financial impacts (risks and opportunities) of climate change on their business and to disclose their efforts based on results of analysis, so it is essential to consider the long-term future on a scale of 10 to 30 years. In addition, the impacts of climate change involve significant uncertainty (e.g., frequency and timing of weather-related disasters).
- Corporate management typically has a time horizon of 3 to 5 years for medium-term plans, and may not have adequate experience formulating plans upon a future vision based on long-term and uncertain conditions.
- The TCFD Recommendations encourage the use of scenario analysis as an effective means of doing so.

TCFD Recommendations (excerpt): B. Climate-Related Risks, Opportunities, and Financial Impacts, 3. Financial Impacts

The Task Force encourages organizations to undertake both historical and forward-looking analyses when considering the potential financial impacts of climate change, with greater focus on forward-looking analyses as the efforts to mitigate and adapt to climate change are without historical precedent.

This is one of the reasons the Task Force believed scenario analysis is important for organizations to consider incorporating into their strategic planning or risk management practices.

Source: TCFD Recommendations

II. What is scenario analysis?

Background: Reasoning for TCFD Recommendations to promote scenario analysis

- For many companies, the most significant impacts of climate change are expressed on a medium- to long-term timescale. Therefore, predicting the timing and scale of such impacts is highly uncertain, even with the latest science. It is therefore very difficult for individual companies to accurately understand the likelihood and scale of climate change impacts on their business, strategy, and financial performance, and to incorporate these considerations into their business.
- To properly incorporate the impacts of climate change into a company's business planning processes, it needs to examine when and how climate-related risks and opportunities may arise and change, and consider how to respond to those changes. The TCFD found that "scenario analysis" was one way to do this.
- If a company uses scenario analysis and discloses the results of its assessment of climate change impacts on its business, investors will be able to see how the company is susceptible to climate-related risks, how it is addressing the potential impacts, and how it intends to deal with future impacts. Companies that are dealing with these issues may also find themselves better able to attract investment and financing.
- Thus, the TCFD concluded that companies should use scenario analysis to evaluate the impacts of climate-related risks and opportunities on business, strategies, and finances; develop responses; and disclose these matters appropriately in their annual financial reports.
- As a result, scenario analysis was deemed to be an important tool among four pillars of strategies of the TCFD Recommendations, which stated that companies should "describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios."

II. What is scenario analysis?

3. How to do it?

"Scenario analysis is an important and useful tool for understanding the strategic implications of climate-related risks and opportunities." Source: TCFD Recommendations

- As a "recommended approach" to scenario analysis, the TCFD stated:

> For an organization in the initial stages of implementing scenario analysis or with limited exposure to climate-related issues, the Task Force recommended disclosing how resilient, qualitatively or directionally, the organization's strategy and financial plans may be to a range of relevant climate change scenarios.
>
> Organizations with more significant exposure to climate-related issues should consider disclosing key assumptions and pathways related to the scenarios they use to allow users to understand the analytical process and its limitations.

Source: TCFD Recommendations

→ **In other words, it is important to start with a qualitative understanding and then move ahead in stages based on the extent of impacts on the organization.**

II. What is scenario analysis?

Background: Qualitative and quantitative scenario analysis in TCFD Recommendations

- Scenario analysis techniques can be qualitative based on descriptive and narrative stories, quantitative based on numerical data or models, or a combination of the two.
- Qualitative scenario analysis is used to explore relationships and trends for which little or no numerical data is available. Quantitative scenario analysis is used to assess measurable trends and relationships using models and other analytical techniques.

Background: Approaches to scenario analysis in the TCFD Recommendations

- The TCFD recommended that all companies consider (1) using scenario analysis to inform their strategy and financial planning processes, and (2) disclosing how resilient their strategies will be for multiple climate scenarios. In addition, while scenario analysis is likely a qualitative exercise for many companies, organizations with a greater exposure to climate risk should conduct more rigorous qualitative and/or quantitative scenario analysis.
- Industries more significantly affected by transition risk (e.g., fossil fuel-based industries, energy-intensive manufacturers, transportation activities) and/or physical risk (e.g., agriculture, transportation and building infrastructure, insurance, and tourism) should consider more in-depth scenario analysis.
- The TCFD recommended selecting a range of plausible scenarios as an important part of scenario analysis. Recommended scenarios include a temperature increase below 2℃ above pre-industrial levels, nationally determined contributions (NDCs) scenarios, and business-as-usual (BaU) scenarios.
- The IPCC and International Energy Agency (IEA) are the main bodies formulating climate change scenarios, but recently, the Network for Greening the Financial System (NGFS) has also published scenarios for the purpose of managing risks in the financial sector (see Chapter VI).

II. What is scenario analysis?

4. The process of scenario analysis

- The TCFD recommended six steps for scenario analysis.
  This handbook focuses mainly on Steps ② to ④, which are at the core of analysis.

① Ensure governance is in place

- Integrate scenario analysis into **strategic planning and corporate risk management processes**.
- Assign supervisory authority to the relevant **boards and committees.**
- Determine how internal and external **stakeholders are to be involved.**

② Assess significance of climate-related risks

Market, technology transition | Reputational | Policy/ legislation | Physical risks

- What are the current and future risks and opportunities?
- Could they become more significant in the future?
- Are the organization's stakeholders concerned?

③ Identify and define scenario scope

Scenarios that cover a set of relevant transition and physical risks for the organization

- Given the scale of risks and opportunities, what scenarios are appropriate?
- What are the analytical options (e.g., input parameters, assumptions)?
- Which scenario(s) should be used?

④ Assess impacts on business

Input costs, operating expenses, revenues, supply chains, business disruptions, timing

- For each scenario, assess potential impacts on the organization's strategic and financial position
- Identify factors most likely to be affected.

⑤ Identify possible responses

Modify business model, portfolio mix, invest in capacity and technology

- Consider how to manage identified risks and opportunities.
- Consider what adjustments are needed in strategic and financial planning.

⑥ Document and disclose

- Document the above process, communicate **to stakeholders**, and provide relevant details (e.g., data/information used, assumptions, analytical methods/results, management team response)

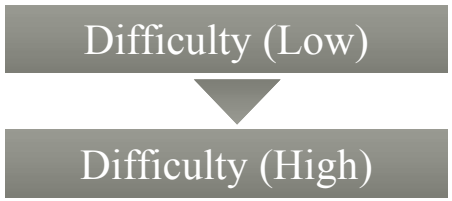
Source: Adapted from TCFD Recommendations

II. What is scenario analysis?

4. The process of scenario analysis

The following points should be considered in scenario analysis:

- Ascertain overall risks and opportunities
  (Step ②: Assess the significance of climate-related risks)
  - What are the adverse impacts (risks)?
  - What are positive impacts (opportunities)?
- Determine your scenarios
  (Step ③: Identify and define the scope of scenarios)
  - Approach 1: Determine your own scenarios
  - Approach 2: Select and adapt existing scenarios
    - Example: IPCC 2℃/1.5℃/4℃ scenario (see ← Chapter IV)
- Understand the extent of risk
  (Step ④: Assess impacts on your business)
  - Qualitatively assess whether or not there are/will be impacts
  - Semi-quantitatively assess the extent of impacts (e.g., large, medium, small) and trends
  - Evaluate quantitatively (e.g., costs, sales)



- Qualitative evaluation is relatively easy, but quantitative evaluation and analysis are more difficult due to constraints on data available for analysis.

III. Scenario analysis for the life insurance industry

1. Why should life insurers do scenario analysis?

- As urged by the TCFD Recommendations, it is crucial for companies to properly understand how climate change could affect them. However, it is difficult to accurately predict *what will occur, when, and to what magnitude*.
- Meanwhile, life insurers play a crucial role in people's lives, and society counts on them to deal with any disruptions caused by climate change and continue maintaining stability and the quality of life of the people.
- Therefore, it is important to understand the impacts of climate change to the extent possible today, and prepare to respond progressively, by anticipating (analyzing) what society might look like and how companies can respond in the future.
- Thus, life insurers can also benefit from scenario analysis to prepare for future uncertainty, as described in Chapter II.

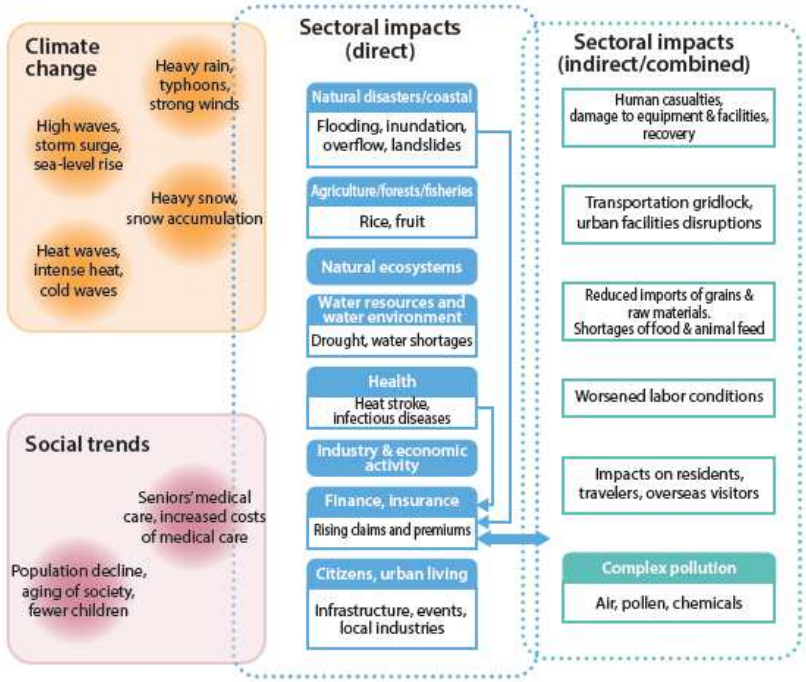
III. Scenario analysis for the life insurance industry

2. Climate change impacts on the life insurance industry

- Climate change can expose the many services provided by life insurance companies to a wide range of inter-related risks (see figure). For example, deaths from weather-related disasters could affect insurance payouts. Floods could damage insurers' branch offices. And as asset owners, insurance companies could also be exposed to the risk of investment losses.

  ⇒ See next page for examples of climate risks for insurance operations.

- Life insurers must consider any impacts these risks could expose them to, both as life insurance providers and as institutional investors.



Inter-connections between climate change, social trends, and sector-by-sector impacts
(Source: Climate Change Starter's Guide)

III. Scenario analysis for the life insurance industry

Background: Examples of climate risks across insurance operations/activities

- The *Issues Paper on Climate Change Risks to the Insurance Sector* describes the following climate risks for insurance operations and activities. It was prepared by the International Association of Insurance Supervisors (IAIS) and Sustainable Insurance Forum (SIF) together with the United Nations Environment Programme (UNEP).

Physical and transitional risks can pose a variety of strategic, operational and reputational risks to insurers across underwriting and investment businesses. Some of the climate factors are long-term in nature, but many have already proven to be important to businesses. These are listed below.

Underwriting risk

Climate change is already affecting the frequency and concentration of high-impact natural catastrophes around the world, leading to increases in weather-related insurance claims.

Investment risk

If climate-related risks significantly disrupt capital markets, insurers' solvency to cover anticipated claims could be significantly affected.

Strategic risk

Risks arising from climate events or (internal or external) scenarios may present challenges to insurers' achievement of strategic goals. Examples include losses due to inappropriate strategies related to climate goals, risks associated with poor management of future plans, or failure to respond to transition factors affecting the industry landscape.

Market risk

Insurers' capacity to underwrite may be constrained by increased physical risk to assets as risk-based pricing rises beyond demand elasticity and customer willingness to pay. Market contractions could further exacerbate barriers for consumers to access insurance.

Operational risk

Physical climate-related factors could affect insurers' own assets (property, equipment, IT systems, human resources, etc.) and lead to increased operating costs, inhibited claims management capacity, or potential stoppages of operations.

Reputational risk

In recent years, underwriting or investment in sectors perceived as contributing to climate change has emerged as a civil society issue. Examples include prominent social movements calling for divestment from fossil fuels and the cessation of underwriting of coal-fired power generation infrastructure.

The impacts of climate change on insurers depend on their core underwriting business areas and investment allocation strategies. However, in the long run, climate change will have implications for all insurers through either their underwriting or investment activities.

(Source: *Climate Change Starter's Guide*)

III. Scenario analysis for the life insurance industry

2. Impacts of climate change on the life insurance industry

Below are examples of plausible risks that could affect each business.

① Life insurance providers

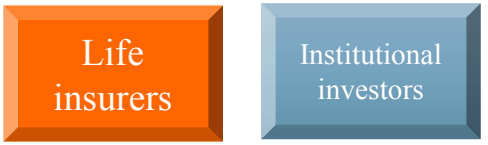
Risk type	Examples of risks in TCFD Recommendations, IAIS, etc.
Physical risk	● Intensification of typhoons, floods, abnormal weather ● Impacts on human health, such as heat stress due to extreme heat, health impacts for vulnerable seniors
Transition risk (Mainly indirect impacts assumed)	● Stricter regulation of greenhouse gas (GHG) emissions, introduction of carbon taxes ● Increased business costs associated with stricter climate-related information disclosure requirements

⇒This guide focuses on **insurance underwriting**, a core function of life insurance companies.

② Institutional investors

Risk type	Examples of risks in TCFD Recommendations, IAIS, etc.
Physical risk (Mainly indirect impacts assumed)	● Operating costs could increase due to impacts on insurance company assets (e.g., real estate, equipment, IT systems, human resources), damage to distribution infrastructure, potential disruptions of business operations
Transition risk	● Policy changes such as carbon pricing that affect a particular sector or asset ● Major public campaigns demanding withdrawal from fossil fuels, criticism of high-emission sectors

→**Starting next page (top right corner), a "button" will indicate whether the content is for life insurance providers (life insurers) or institutional investors.**

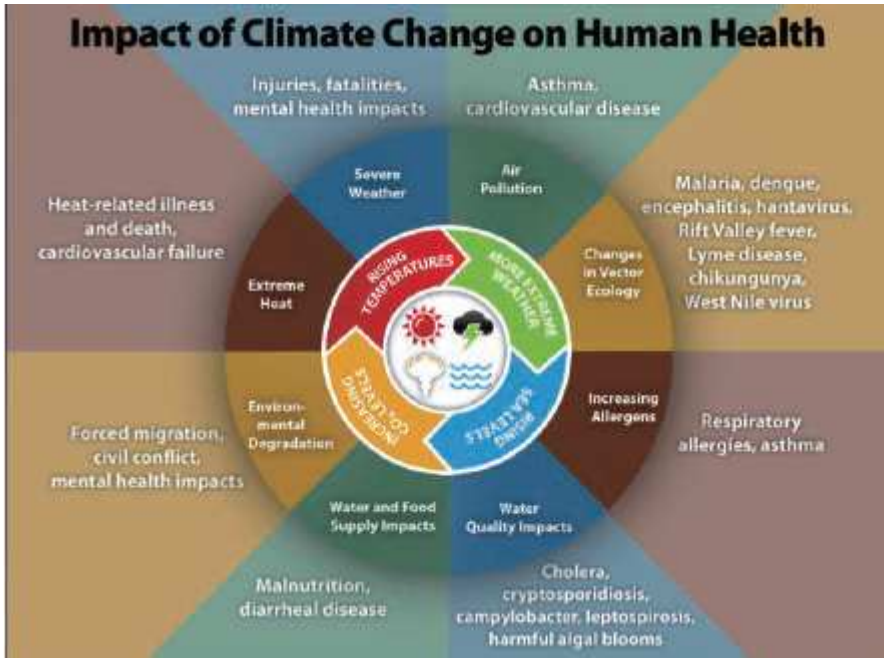


III. Scenario analysis for the life insurance industry

Life insurers

3. The need for scenario analysis in the life insurance industry

- Climate change affects human health and mortality in many ways. This figure shows how changes caused by climate change extend across many areas affecting human health.
- Besides increased illness and death due to extreme heat, extreme weather, and disease vectors, climate change is also cited as affecting human health due to factors such as deterioration in air and water quality, impacts on mental health, and the likelihood of forced migration.
- In Japan, impacts include more actual heat stroke deaths from extreme heat and the expanded range of disease vectors. It is crucial to understand the long-term risks and opportunities caused by climate change.



Climate change impacts on human health
(Source: Climate Change Starter's Guide)
Adapted from Center for Disease Control and Prevention
(https://www.cdc.gov/climateandhealth/effects/default.htm)

III. Scenario analysis for the life insurance industry

Institutional investors

4. The need for scenario analysis by institutional investors

- Life insurers have two major functions: as life insurance providers, and as institutional investors. The TCFD Recommendations point out that in the function of institutional investor, they are influential asset owners (see box).

> Asset owners carry transition/physical risks to which their investments are exposed whether they invest directly or through an asset manager. Similarly, asset owners can enjoy operational benefits from climate change-related investment opportunities.
>
> Large asset owners and asset managers sit at the top of the investment chain and, therefore, have an important role to play in influencing the organizations in which they invest to provide better climate-related financial disclosures.
>
> Source: TCFD Recommendations

- In this context, the financial sector plays a role in addressing climate change in a growing number of ways. At the international level, asset managers and other players in the European financial sector have been very progressive. For example, the Glasgow Financial Alliance for Net-Zero (GFANZ) established in April 2021 by four international alliances (including asset owners, asset managers, banks, and insurers) announced that they would work together to promote "net zero" emissions (see Appendix).
- Clearly, their development of operational strategies today depends directly on having a proper understanding of climate change. In particular, it is absolutely crucial that life insurers, which operate over long- to very long-term time scales, clearly understand the *long-term* risks and opportunities of climate change.

III. Scenario analysis for the life insurance industry

Institutional investors

4. The need for scenario analysis by institutional investors

- Various international initiatives were launched around the time of the COP26 climate conference of November 2021 (see Appendix). An understanding of these developments and key facts can also help companies consider their own approaches. The design and nature of various programs and initiatives already underway in other countries can have significant impacts (both risks and opportunities) on businesses where funds are being invested, and can also affect a company's own business and reputation.
- Meanwhile, a key message from the TCFD Recommendations is that organizations should start where they can, and make steady progress from there. Thus, when it comes to scenario analysis for asset management operations, organizations are encouraged to learn from leading initiatives and use those examples as footholds for considering strategies to prepare for possible futures.
- For actual Programmed scenario analysis, it is essential to have specific data on companies seeking or receiving investment and lending. Besides what is disclosed by companies, information can also be purchased from data providers. Various free tools are also available (see Appendix).

IV. Scenario analysis practices in the life insurance industry

Key points for practitioners

- The next two chapters take two perspectives, first for life insurance providers and then institutional investors, to introduce basic knowledge and provide step-by-step descriptions on how to do scenario analysis.
- This starter's guide is intended for practitioners in the industry who are involved in their scenario analysis. It focuses on understanding the characteristics and key aspects of both dimensions of the industry. The descriptions for each process are provided only as examples. Practitioners will need to assess circumstances based on the unique characteristics of their own company.
- Key points for subsequent stages of work are indicated with the heading "Intermediate/Advanced."

Note: Some contents (slides) from Chapter IV-1 (Life Insurers) are repeated again in Chapter IV-2 (Institutional Investors).

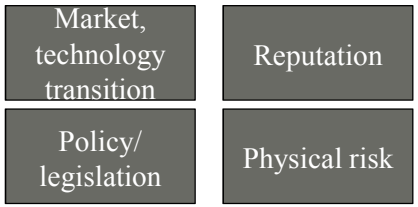
IV-1. Scenario analysis practices in the life insurance industry

Life insurers

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ②: Overview

- This step is to consider the impacts of climate change risks and opportunities that the company is currently facing or may face in the future.
- Typical categories of risks and opportunities to consider for scenario analysis are shown on the right.



- It is necessary to assess the significance for the company in the context of climate change. For example, whether there are risks and opportunities for the company, whether they may become significant in the future, and whether the organization's stakeholders are aware of and have concerns about them.
- The following steps are used for this consideration:
  - (a) Using the TCFD Recommendations, list the risks and opportunities related to the company's business.
  - (b) For each risk and opportunity, determine the extent of potential business impact.
  - (c) Use qualitative statements to describe the rationale and specific impact of that determination.
- In this regard, the key points to consider are how to recognize or ignore a given risk for the industry, as well as the risk for the company, and in how much detail to assess the significance of the risk.

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

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Step ②: Example of assessment of significance

◆ What follows is an example of a process that could be followed for an *assessment of the significance of climate risk* for the business of life insurance.

- Examples of physical risk from the TCFD Recommendations are used as the starting point here.
- Based on a company's specific characteristics and business, the relevant departments and personnel should consider the future significance of these risks and opportunities, and evaluate the extent of their impacts.
- Assessment results and rationale for determinations are summarized in the following table.

Examples of physical risk from TCFD Recommendations	Results of assessment of potential significance to company's business	
	Assessment	Rationale, details
Chronic	**Medium to large**	▪ Heat stroke deaths could increase due to the impacts of heat stress, resulting in increased payments for insurance claims. ▪ As the average temperature rises, the range of disease vectors could expand and morbidity from infectious diseases could increase, resulting in increased payments for insurance claims.
- Changes in precipitation patterns, extreme variability in weather patterns - Increases in average temperature - Sea-level rise		
Acute		
Intensification of extreme weather, including cyclones, floods	**Small**	▪ Injury claims-related insurance payments may increase, but based on experience to date the business impacts are expected to be negligible, even if extreme weather intensifies. ▪ Because the company has no business operations in coastal areas or low-lying areas along rivers, there is little likelihood that employee health and safety or business operations will be affected.

Examples

Note: The above assessment results are examples only. Companies will need to conduct their own assessments based on their own unique characteristics. For example, the large/medium/small assessments indicated are not predetermined. Each company can assess its own situation in terms of the significance of impacts being major or minor, etc.

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ③: Overview

- Next, identify and define the scenarios to be used for the analysis.
- The TCFD Recommendations describe methodologies for analysis using scenarios for the rise in temperature due to changes in greenhouse gas concentrations (see below). Based only on changes in physical conditions such as temperature, it is difficult to portray an exact image of future conditions. However, by combining assumptions about what kind of society will develop under certain climate conditions, it is also possible to envision future changes in human lives, economy and society in more concrete terms.
- Global warming scenarios as well as socioeconomic scenarios (see below) have been developed by the IPCC and other international organizations, government bodies such as Japan's Ministry of the Environment, and major research institutes such as Japan's National Institute for Environmental Studies. Baseline scenarios can be chosen from among what they have produced.
- Based on these scenarios, it is necessary to develop future scenarios to envision and analyze the impacts of climate change on each of the company's respective businesses.
  (For example, analysis might find that in a world where climate change measures are progressing well and the temperature rise is limited, impacts on insurance policy payments due to health impacts, for example, will be lower. Conversely, in a world where the temperature rise is significant due to delayed climate actions, the impacts on insurance policy payments will be greater.)
- The following pages highlight some of the IPCC's scenarios that are most often referenced.

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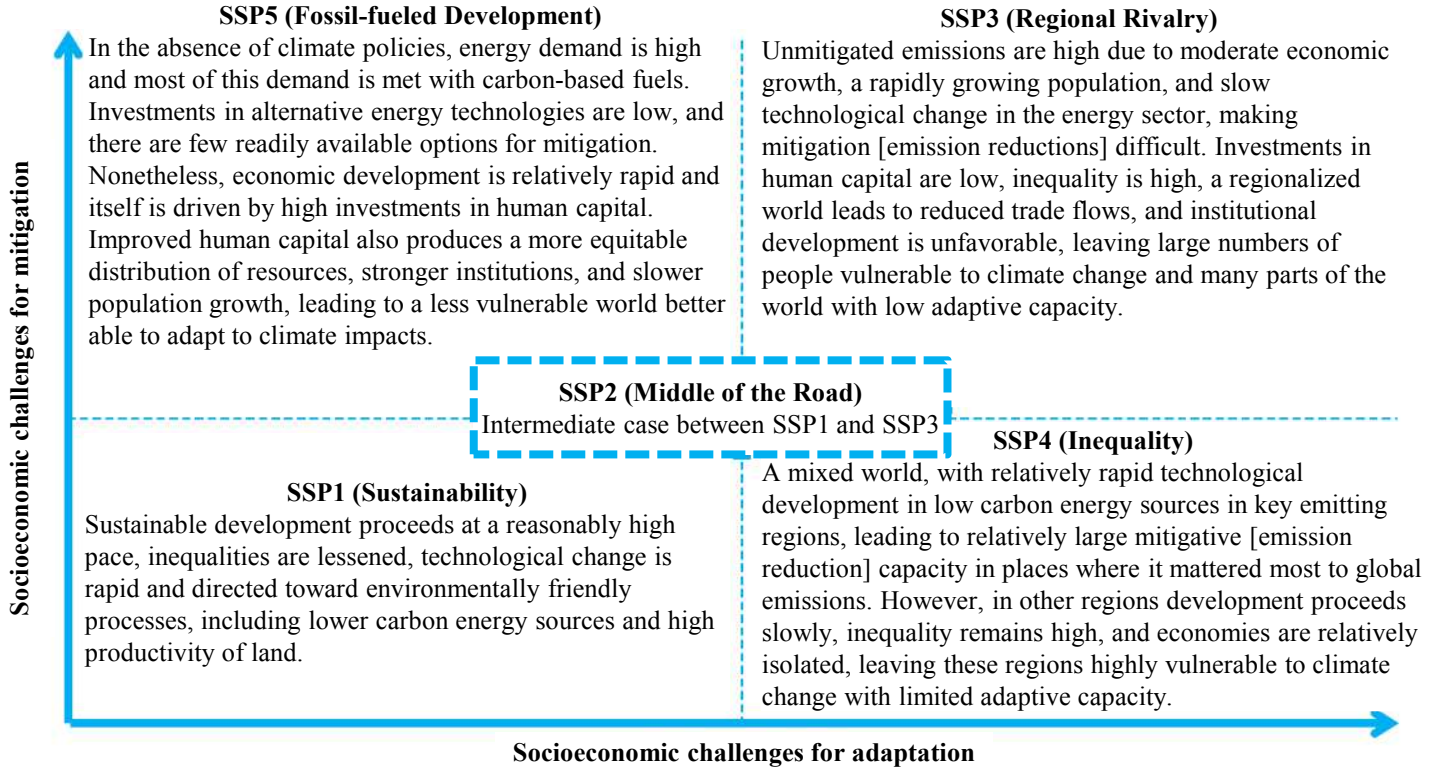
Step ③ Part 1: Commonly-used climate change scenarios (Shared Socioeconomic Pathways: SSP)

- The IPCC uses two types of scenarios to make assumptions about climate change, for which projections are difficult to do. One type is the Shared Socioeconomic Pathways (SSP), which use a narrative form to describe a number of possible futures, approximately for the period 2025 to 2100, considering what society might look like based on certain greenhouse gas emission reduction efforts. The five most commonly used SSP scenarios are shown below.



Source: Ministry of the Environment, Japan, Environment Research and Technology Development Fund S-10, *Report on Comprehensive Study on the Development of Global Climate Change Risk Management Strategies*, 2017.

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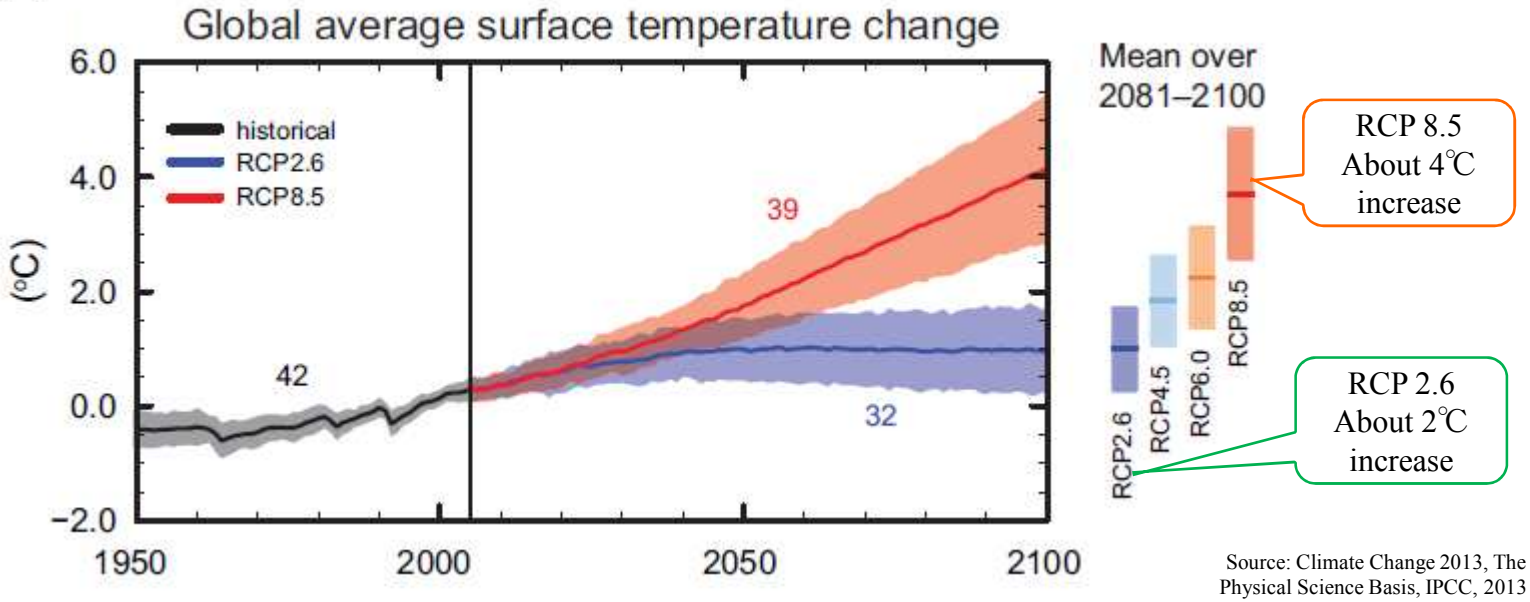
Step ③ Part 2: Commonly-used climate change scenarios (Representative Concentration Pathways: RCP)

- Another set of scenarios for future GHG concentrations is known as Representative Concentration Pathways (RCP). The emissions pathways determine the intensity of the greenhouse effect (radiative forcing).* The global average temperature rise (e.g., 2℃ or 4℃) due to increased GHG concentrations is typically expressed relative to pre-industrial levels (late 18th century).
- For example, RCP 2.6 is a scenario in which the Paris Agreement target of limiting warming to 2℃ is achieved, with a pathway to radiative forcing of 2.6 W/m^2 by the end of the 21st century. In the RCP 8.5, scenario, radiative forcing is 8.5 W/m^2 at the end of the 21st century, and the global average temperature rise is 4℃.



Source: Climate Change 2013, The Physical Science Basis, IPCC, 2013

* Radiative forcing, measured as the amount of radiation per unit of area, is an indicator of changes in the energy balance between the atmosphere and the ground surface due to changes in factors such as carbon dioxide concentrations and solar radiation. When radiative forcing is positive the ground surface warms, and when negative the ground surface cools.

Sources: EIC Net, Japan Center for Climate Change Actions, etc.

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Life insurers

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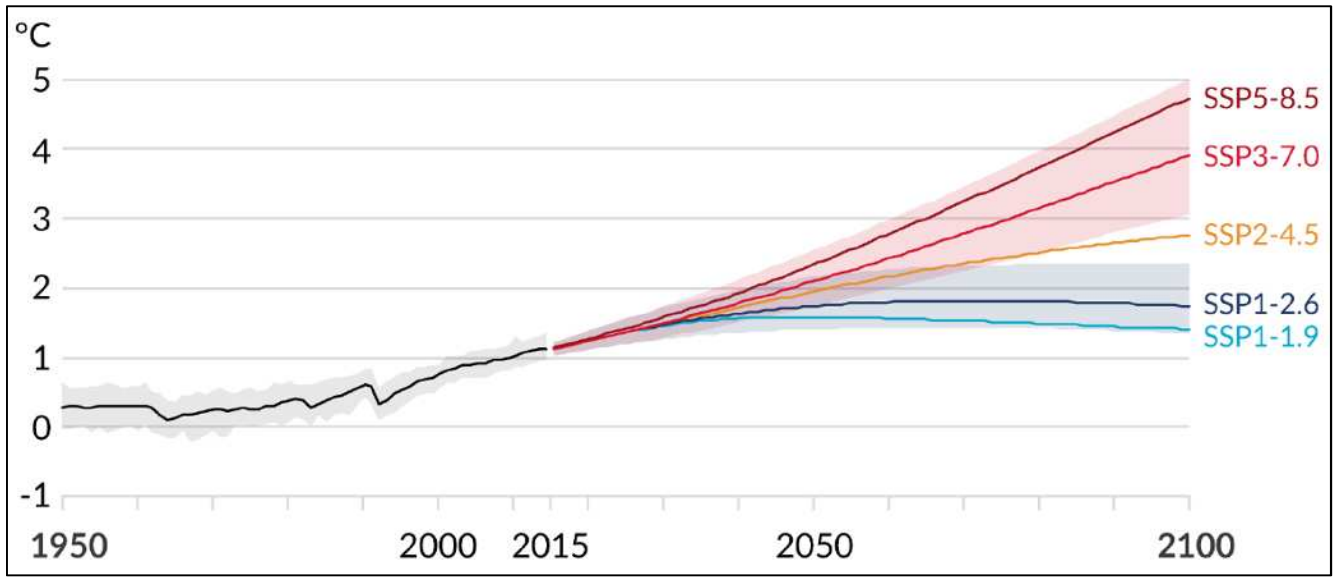
Background: Scenarios presented in the IPCC Sixth Assessment Report (combination of SSP and RCP)

- The IPCC Sixth Assessment Report used a combination of SSP and RCP scenarios. For example, SSP1-1.9 is a combination of SSP-1 and RCP-1.9. Among scenarios, it has the lowest CO_2 emissions and corresponds to the Paris Agreement's target of 1.5℃.



Trends in global average atmospheric temperature relative to 1850-1900

Source: IPCC Sixth Assessment Report

- IEA, NGFS, and other organizations have also proposed climate scenarios. Chapter VI provides an overview (see also the Appendix for NGFS).

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

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Step ④: Overview

- Having assessed the level of significance of risk and identified scenarios, the next step is to assess and analyze the potential impacts of climate change on the organization's strategic and financial position, for each scenario.
- As described in Chapter I, assessment and analysis are generally classified as either "qualitative" or "quantitative" approaches. Qualitative assessment and analysis are generally relatively easy to do and can be performed using narrative descriptions based on one's own observations and understanding. They can be used when no numerical data is available, or when looking for trends. On the other hand, quantitative assessment and analysis are often more difficult due to constraints such as insufficient data and models required for analysis.
- The TCFD Recommendations urge companies that are doing scenario analysis for the first time to start with a qualitative approach. More experienced companies may wish to use more advanced methods to perform quantitative analysis. The approach a company uses will depend on its own needs, resources, and so on.

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Life insurers

② Assess significance of risks → ③ Identify/define scenarios → **④ Assess business impacts** → ⑤ → ⑥

Step ④: Impact assessment examples (page 1 of 4)

- When considering the extent physical risk impacts, Japanese companies could use research focused specifically on the impacts of climate change in Japan. A large volume of useful data and research results has been published by the Ministry of the Environment and others（see page 87）.
- Among physical risks from climate change in Japan, increased intensity and frequency of extreme heat events in particular are expected to affect the life insurance industry. Future projections for Japan are shown below.

Future prediction

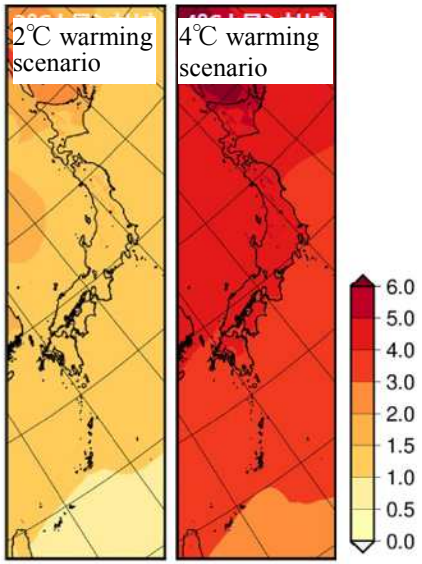
Conditions in Japan if temperature is 2℃ or 4℃ above pre-industrial levels at end of 21st century (1850-1900)

	2℃ warming (Paris Agreement 2℃ goal achieved)	4℃ warming (No additional mitigation beyond current actions)
Average temperature	1.4℃ warming	1.4℃ warming
Average temperature (world)	1.4℃ warming	1.4℃ warming
Annual extremely hot days	+2.8 days	+19.1 days
Annual hot nights	+9.0 days	+40.6 days
Annual freezing days	−16.7 days	−46.8 days

Note: Numbers are estimates.

- In both scenarios, Japan's average temperatures are projected to be higher at the end of the 21st century, and many regions will have more extremely hot days (max temp above 35℃) and hot nights (min temp 25℃), and fewer freezing days (min temp below 0℃) annually.
- The magnitude of warming is greater in the 4℃ warming than the 2℃ warming scenario.
- Within each scenario, the warming is greater in higher latitudes, and greater in winter than summer.

Source: Ministry of Education, Culture, Sports, Science and Technology, and Japan Meteorological Agency, *Japan Climate Change Report 2020*.



Average difference in annual temperature (Japan) at end of 21st century
Image shows average annual temperature in Japan at end of 21st century (ave. of 2076-2095) relative to end of 20th century (ave. of 1980-1999)

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Life insurers

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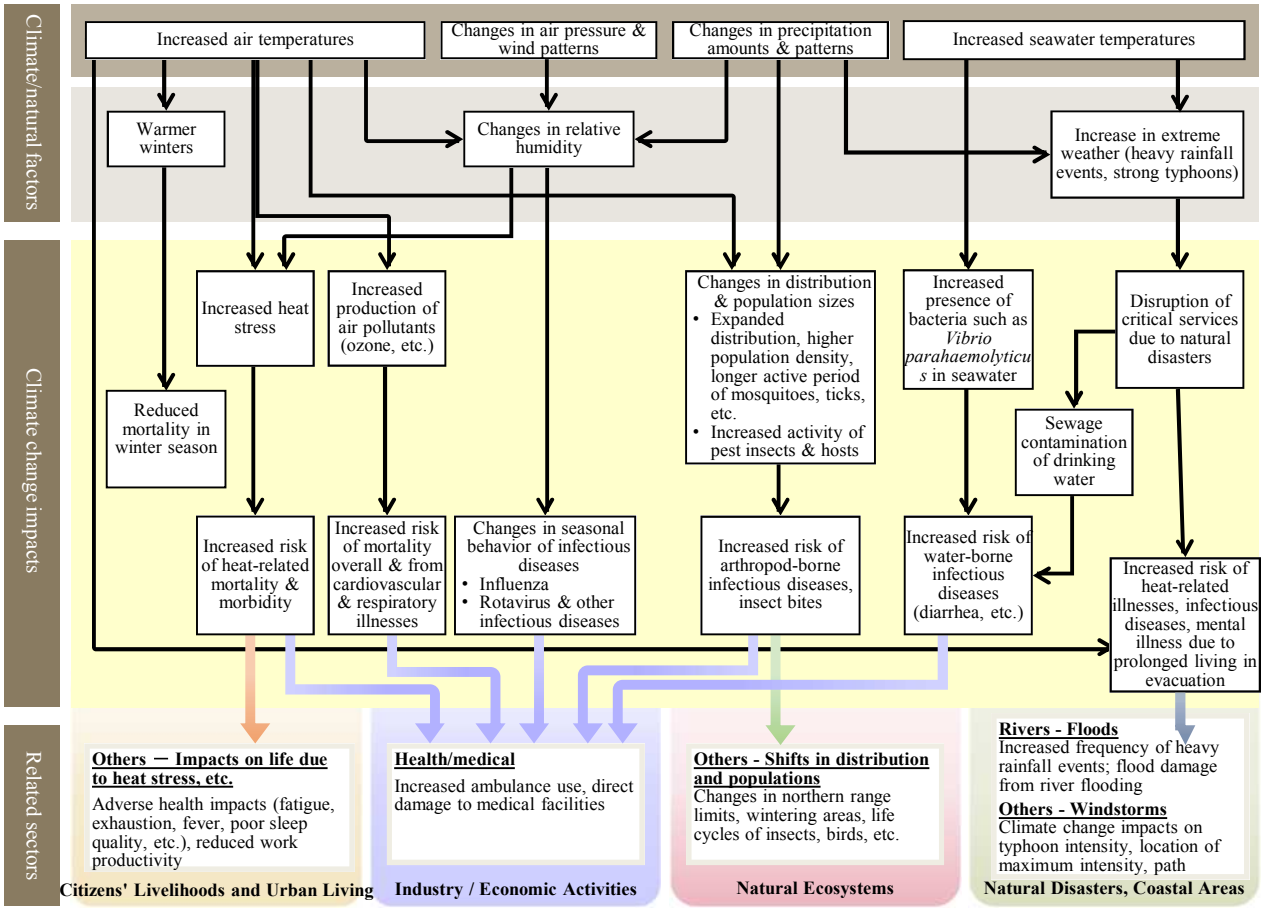
Step ④: Impact assessment examples (page 2 of 4)

- This flowchart the Ministry of the Environment depicts the impacts of climate change on the health sector. The impacts of climate change are inter-related with many of these phenomena. Information on the relevant pathways for each of these changes can be used to help identify those that may affect the company, and to evaluate the extent of their impacts.



Flowchart of projected climate change impacts (on human health)

Source: Ministry of the Environment, *Climate Change Impact Assessment Report, Detailed Report*, 2020.

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Life insurers

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ④: Impact assessment examples (page 3 of 4)

- What events/changes/phenomena caused by climate change can affect the life insurance industry? Reports by Japan's Ministry of the Environment and other bodies detail impacts that have already occurred, as well as projected future impacts. Companies can use these reports to analyze impacts that might affect them, and their extent. This table provides some examples.

Examples

Summary of Climate Change Impacts in Japan (excerpt)

Sector	Impacts	Description
Natural disasters	River flooding	Frequency and scale of floods will increase with more intense heavy rainfall events, etc.
	Sea-level rise	Sea levels will rise due to thermal expansion of seawater, melting of glaciers, etc., resulting in damage to levees, damage from storm surges, etc.
	Storm surges, high waves	Increased risk of storm surges, high waves due to higher sea levels and changes in typhoon frequency, intensity, paths, etc.
	Coastal erosion	Coastal erosion may worsen due to sea level rise, etc.
	Debris flows, landslides	Increased frequency and scope of landslide disasters due to increased frequency of heavy rainfall events.
Human health	Warmer winters	Increases in average temperatures could reduce the ratio of cold-related deaths.
	Heat stress	Elevated temperatures could increase deaths from cardiovascular disease, etc. Increased occurrence of and mortality from heat-related illnesses in summer. Adverse impacts on the elderly, especially those who do not have air conditioning or refrain from using it.
	Infectious diseases	Increased morbidity from vector- and water-borne infectious diseases, etc.
Industry	Impacts on medical systems	Impacts of water supply disruptions and turbidity on dialysis treatments, flood damage to medical facilities

Source: Ministry of the Environment, *Climate Change Impact Assessment Report*.

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

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Step ④: Impact assessment examples (page 4 of 4)

- Next, among the climate change-related events/phenomena considered above, a company should review possible impacts on its own business based on implications of assessments in existing research findings. Qualitatively assess the relevance to the company and analyze trends (increasing, decreasing, magnitude, etc.). This table provides some examples.

Source: Ministry of the Environment, *Climate Change Impact Assessment Report.*

Examples of qualitative and trend analysis

Category	Sub-category	Summary of impacts	Significance	Urgency	Confidence	Future trends at 2℃ warming	Future trends at 4℃ warming	Relevance to company's life insurance business
Extreme heat	Mortality risk	Higher temperatures could increase mortalities from cardiovascular disease, and mortalities of elderly persons	●	●	●	→	↗	Shorter life spans.
	Heat-related illnesses, etc.	Increased occurrence of heat-related illnesses due to hotter summer temperatures	●	●	●	↗	↗	More patients with heat-related illnesses, especially among the vulnerable elderly population, resulting in a shorter healthy life span.
Infectious diseases	Vector-borne infectious diseases	Increased morbidity due to expanded range of mosquito-borne disease vectors	●	●	▲	→	↗	Increased number of patients. However, the impacts on human life in Japan are not projected to be significant, due to availability of treatment, etc.
	Other infectious diseases	Seasonal changes and changes in risk of occurrence may occur. Exploitation of tropical forests and melting of permafrost may increase outbreaks of new infectious diseases.	◆	■	■	→	↗	Increased number of patients.
…	…	. . .						

Note: The above analytical results are examples only. Companies will need to conduct their own analysis based on their own unique characteristics.

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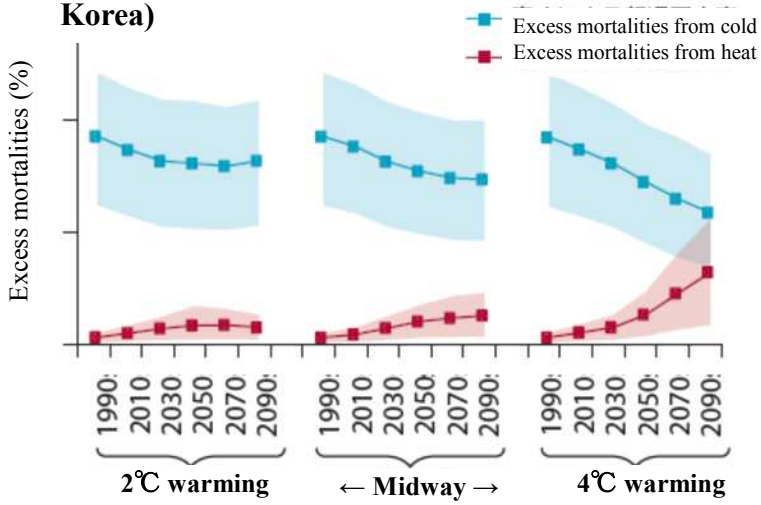
② Assess significance of risks → ③ Identify/define scenarios → **④ Assess business impacts** → ⑤ → ⑥

Intermediate/advanced: Deeper impact assessment (e.g., correlation between extreme heat and excess mortality)

- Among physical risks from climate change in Japan, increased intensity and frequency of extreme heat events in particular are expected to affect the life insurance industry.
- An increase in average temperature leads to an increase in excess mortality due to heat, but also reduces excess mortality due to cold. As this research is ongoing, companies should also review the latest research and consider complex interactions among impacts.
- The figure (right) is one example of published research.

  This study (on right) projects that if the average temperature increases by 4℃ in the future in Japan and other East Asian countries, the increase in excess mortality due to heat in 2090 may exceed the decrease in excess mortality due to cold.



Temperature increase and mortality to 2100

Source: Climate Change Starter's Guide

Source: Figure adapted from Gasparini, A. et.al., *Projections of temperature-related excess morality under climate change scenarios*, Lancet Planet Health 2017; 1: e360-67.

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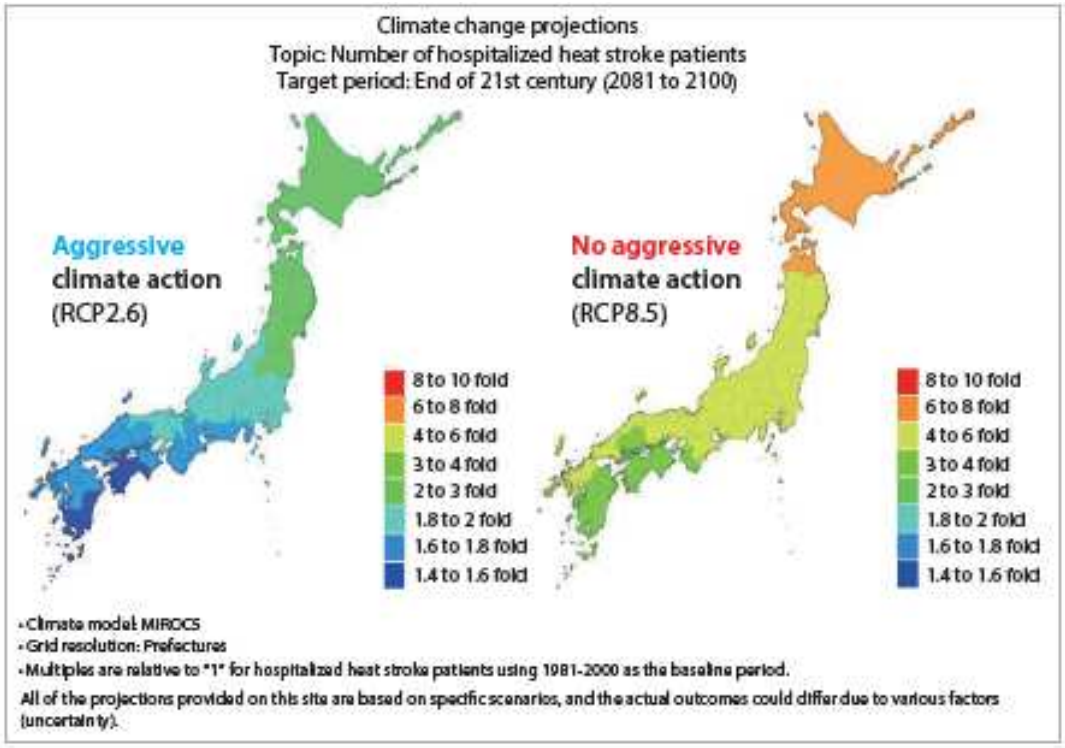
Intermediate/advanced: Deeper impact assessment (e.g., correlation between extreme heat and morbidity)

- Not only is mortality projected to increase, but also the number of patients transported by ambulance due to heat-related illnesses. The following figure shows projected increases in the number of emergency patients transported due to heat-related illnesses if the future average temperature rises by 2℃, and an even larger increase if the temperature rises by 4℃.



Projected changes in numbers of heat illness patients transported by ambulance

Source: Climate Change Starter's Guide

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Life insurers

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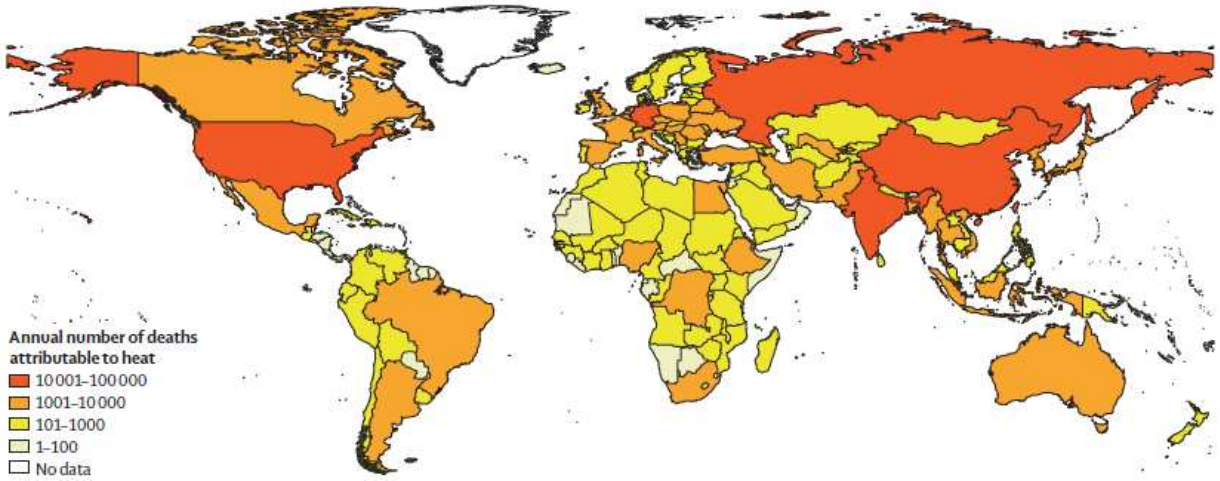
Intermediate/advanced: Deeper impact assessment (e.g., correlation between climate change and mortality in countries around the world)

- Published research indicates that some countries will face greater impacts than Japan. Thus, companies expanding overseas should also consider impacts on overseas operations.
- For example, an analysis by the British medical journal *Lancet* found that annual heat-related mortalities are increasing. This figure shows the annual number of heat-related deaths (average of 2014–2018) for adults older than 65. Many mortalities have been recorded in many countries that have strong connections with Japan, including the United States, China, India, and Russia.



Number of heat-related deaths of adults older than 65 (average of 2014–2018)

Source: The 2020 report of the Lancet Countdown on health and climate change: responding to converging crises
Lancet, Vol 397 January 9, 2021

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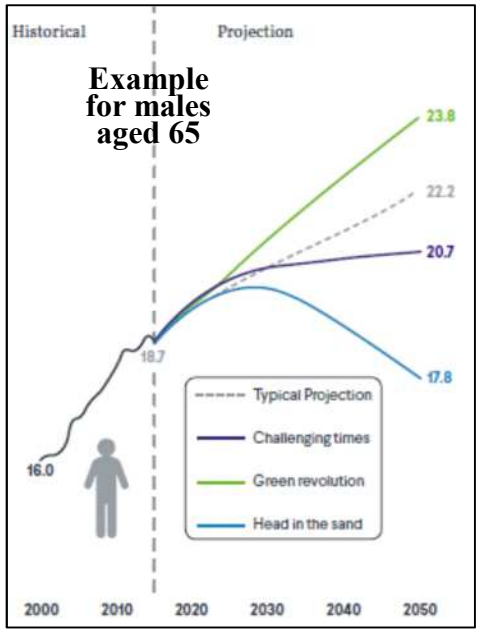
Intermediate/advanced: Examples of quantitative scenario analyses in other countries

- A UK pension fund thinktank has published examples of current life expectancy projections for people aged between 20 and 60, based on three scenarios: "Green Revolution," "Challenging times," and "Head in the Sand" (details such as specific methods are not disclosed).
- The "**Head in the Sand**" scenario assumes that society completely fails to cope with the risks of climate change, resulting in global food shortages, worse outbreaks of infectious diseases, and so on. This scenario suggests that life expectancy is shortened for all age groups and that the gap may be greater for the younger population than in the "**Green Revolution**" scenario, which engages in more aggressive climate responses due to increased awareness and technology.

Scenario	Gender	Age and life expectancy as of 2018				
		Age 20	Age 30	Age 40	Age 50	Age 65
Green revolution	Male	3.7	3.0	2.4	1.9	0.9
	Female	3.8	2.9	2.2	1.6	0.8
Head in the sand	Male	−10.4	−8.1	−5.8	−3.6	−1.1
	Female	−10.1	−8.1	−6.0	−4.0	−1.4

Source: Club Vita, Hot and Bothered? - How climate change might affect UK longevity



- Large volumes of data are needed for these kinds of analysis.
  At the research level, usable methodologies are already available.
- Examples of papers presenting such detailed quantitative analyses can be found in the Appendix.

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

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Intermediate/advanced: Putting quantitative scenario analysis into practice

- The extent of climate change impacts on life expectancy and health vary even within Japan, depending on factors such as location north to south, and age group.
- A growing body of research has been published in recent years. Research on human impacts of climate change is currently ongoing, and much remains to be done, as there is still a lack of quantitative data, such as what changes are likely to occur, where, and when.
- Therefore, if insurance companies conduct more detailed quantitative scenario analyses at this point in time, they will probably have to engage in joint research with researchers and research institutions that can access the relevant data.
- Below are some specific examples of possible efforts.
  - Gathering and analyzing the latest currently available research findings (see Appendix).
  - Interpreting the latest understanding through exchanges with experts and academics, etc.
  - Considering the use of collaborative research and other means to assess impacts quantitatively.

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

② ③ ④ ⑤ Identify possible responses ⑥ Document and disclose

Step ⑤: Identify possible responses

- This step is to identify the actions a company can take regarding the risks and opportunities identified in analysis to this point and their impacts on the business.
- Scenario analysis is a key aspect of "strategy" of the four pillars of the TCFD. At this point, practitioners need to consider how the results of scenario analysis should be incorporated into the company's strategy.
- Companies are expected to make appropriate and realistic decisions about how to manage the risks and opportunities identified, using scenario analysis results. They should consider possible actions, such as what adjustments are needed in strategic and financial planning.
- In TCFD Recommendations, examples of some possible responses include changes to business model, changes to portfolio mix, and investments in capabilities and technologies.
- The results of the review done here are also very relevant for the next step, "disclosure." Thus, it is important to have a shared awareness companywide, not just among operational managers, but also in senior management.

IV-1. Scenario analysis practices in the life insurance industry

Life insurers

② ③ ④ ⑤ Identify possible responses ⑥ Document and disclose

Step ⑥: Document and disclose

- Finally, this step is to document the findings obtained so far and communicate them to stakeholders.
- Examples of key information that should be disclosed include inputs (e.g., data and information used), assumptions, analytical methods, output (e.g., results of analysis), and anticipated responses by the management team.
- However, as we saw in Steps ② through ④, there are often constraints such as the lack of available data or information for scenario analysis, and technical difficulties. Therefore, the key is to aim to implement the best possible disclosure at this stage, rather than aiming for perfection.
- The results of scenario analysis often include confidential information directly linked to a company's business strategies.
- There is no obligation to disclose everything with the results of scenario analysis. Regarding what, where, and how to disclose, each company needs to consider and decide strategically, based on the results of analysis, and the accuracy and reliability of the analytical process.

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ②: Overview

- This step looks at the impacts of climate change risks and opportunities that the company is currently facing or may face in the future.
- Typical categories of risks and opportunities to consider for scenario analysis are shown on the right.

Market, technology transition	Reputation
Policy/ legislation	Physical risk

- It is necessary to assess the significance for the company in the context of climate change. For example, whether there are risks and opportunities for the company, whether they may become significant in the future, and whether the organization's stakeholders are aware of and have concerns about them.
- The following steps can be followed for this consideration:

  (a) Using the TCFD Recommendations, list the risks and opportunities related to your company's business.

  (b) For each risk and opportunity, determine the extent of potential business impact.

  (c) Use qualitative statements to describe the rationale and specific impact of that determination.
- In this regard, key points to consider are how to select a certain risk for the company, as well as for the industry, and to what level of detail to assess the significance of the risk.

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ②: Example of assessment of significance

◆ What follows is an example of a process that could be followed for an *assessment of the significance of climate risk* for asset management operations.

- Examples of transition risk from the TCFD Recommendations are used as the starting point here.
- Based on a company's specific characteristics and business, the relevant departments and personnel should consider the future significance of these risks and opportunities, and evaluate the extent of each impact.
- Assessment results and rationale for determinations are summarized in the following table.

Examples of transition risk from TCFD Recommendations	Results of assessment of potential significance to company's business	
	Assess-ment	Rationale (Example)
Policy/ legal - Progress in pricing greenhouse gas emissions - More rigorous greenhouse gas emission reporting requirements - More requirements/regulations on existing products/services - More lawsuits	Medium	- New legislation developed/introduced in Japan or other countries (e.g., carbon tax, emissions trading) may affect investment portfolios. - The costs of doing business may increase for large emitters, as a result of new requirements to reduce and/or disclose emissions, or other requirements.
Technology - Replacement of existing products/services with low carbon options - Failed investments in new technology - Upfront costs of transition to low carbon technology	Large	- Rapid adoption of decarbonization technology may transform the market, and value of investment portfolios that provide traditional products and services may decrease. - Failed investments in decarbonization technology and increased transition costs may reduce value of investment portfolios.
Market - Changes in consumer behavior - Uncertainty of market signals - Skyrocketing raw material costs	Small	- Investment portfolios may be affected by changes in consumer behavior (demand) and market sentiment as they avoid products and services from companies with high emissions.
Reputation - Changes in consumer preferences - Criticism of the sector - Increased stakeholder anxiety or negative feedback	Large	- If high emissions companies are in the portfolio and they are slow to move toward net zero, there may be pressure from organizations that promote decarbonization efforts, including shareholder resolutions and legal action.

Note: These assessment results are examples only. Companies will need to conduct their own assessments based on their own unique characteristics. For example, the large/ medium/ small assessments indicated are not predetermined. Each company can assess its own situation in terms of the significance of impacts being major or minor, etc.

IV-2. Scenario analysis practices in the life insurance industry

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Institutional investors

Step ③: Overview

- Next, identify and define the scenarios to be used for the analysis.
- The TCFD Recommendations describe methodologies for analysis using scenarios for the rise in temperature due to changes in greenhouse gas concentrations (see below). Based only on changes in physical conditions such as temperature, it is difficult to portray an exact image of future conditions. However, by combining assumptions about what kind of society will emerge under certain climate conditions, it is also possible to envision future changes in human lives, economy and society in more concrete terms.
- Global warming scenarios as well as socioeconomic scenarios (see below) have been developed by the IPCC and other international organizations, government bodies such as Japan's Ministry of the Environment, and major research institutes such as Japan's National Institute for Environmental Studies. Baseline scenarios can be chosen from among what they have produced.
- Based on these scenarios, it is necessary to develop future scenarios to envision and analyze the impacts of climate change on each of the company's respective businesses.
  (For example, analysis might find that in a world where climate actions are making good progress and warming is limited, the value of companies that own significant fossil fuel assets will drop. Conversely, in a world with significant warming due to delayed climate actions, the performance of companies that are involved in renewable energy technologies may be sluggish.)
- The following pages highlight some of the IPCC's scenarios that are most often referenced.

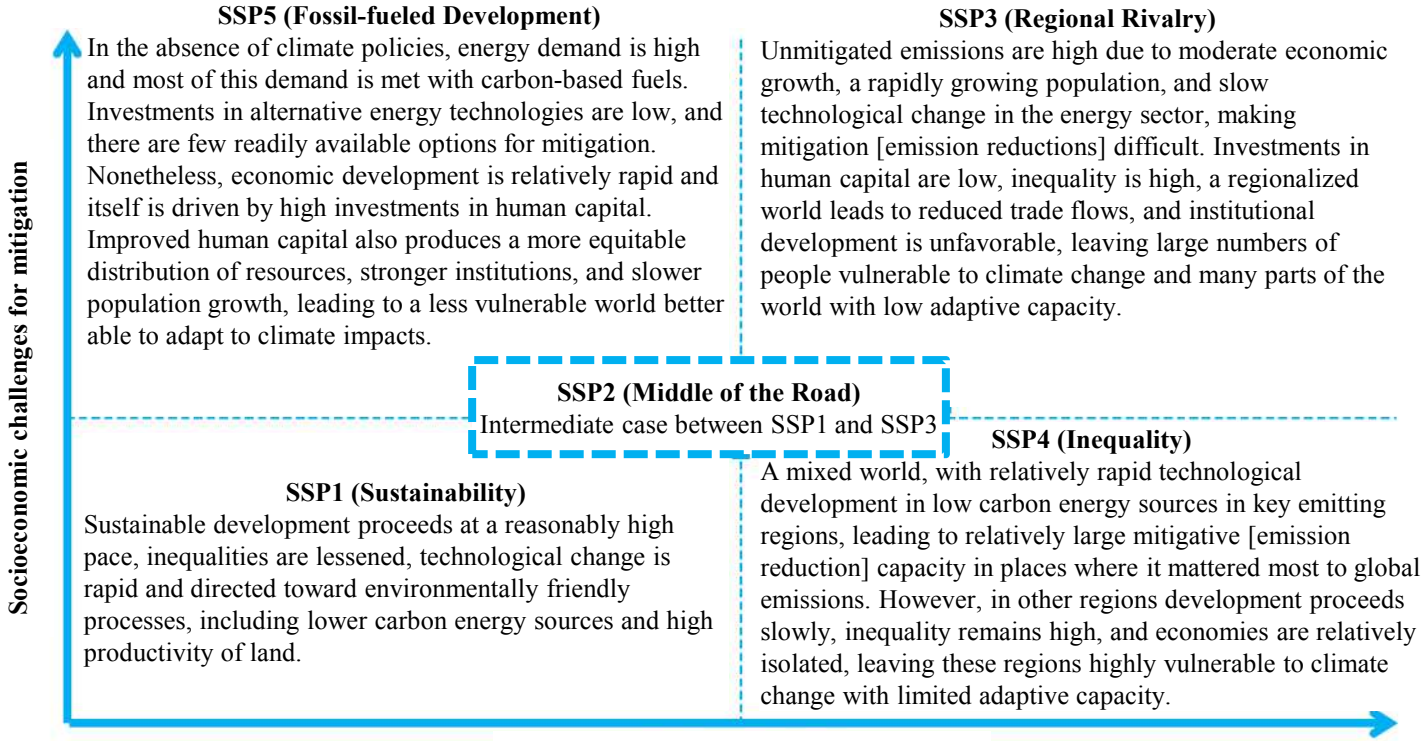
IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ③ Part 1: Commonly-used climate change scenarios (Shared Socioeconomic Pathways: SSP)

- The IPCC uses two types of scenarios to make assumptions about climate change, for which projections are difficult to do. One type is the Shared Socioeconomic Pathways (SSP), which use a narrative form to describe a number of possible futures, approximately for the period 2025 to 2100, considering what society might look like based on certain greenhouse gas emission reduction efforts. The five most commonly used SSP scenarios are shown below.



Source: Ministry of the Environment, Japan, Environment Research and Technology Development Fund S-10, *Report on Comprehensive Study on the Development of Global Climate Change Risk Management Strategies*, 2017.

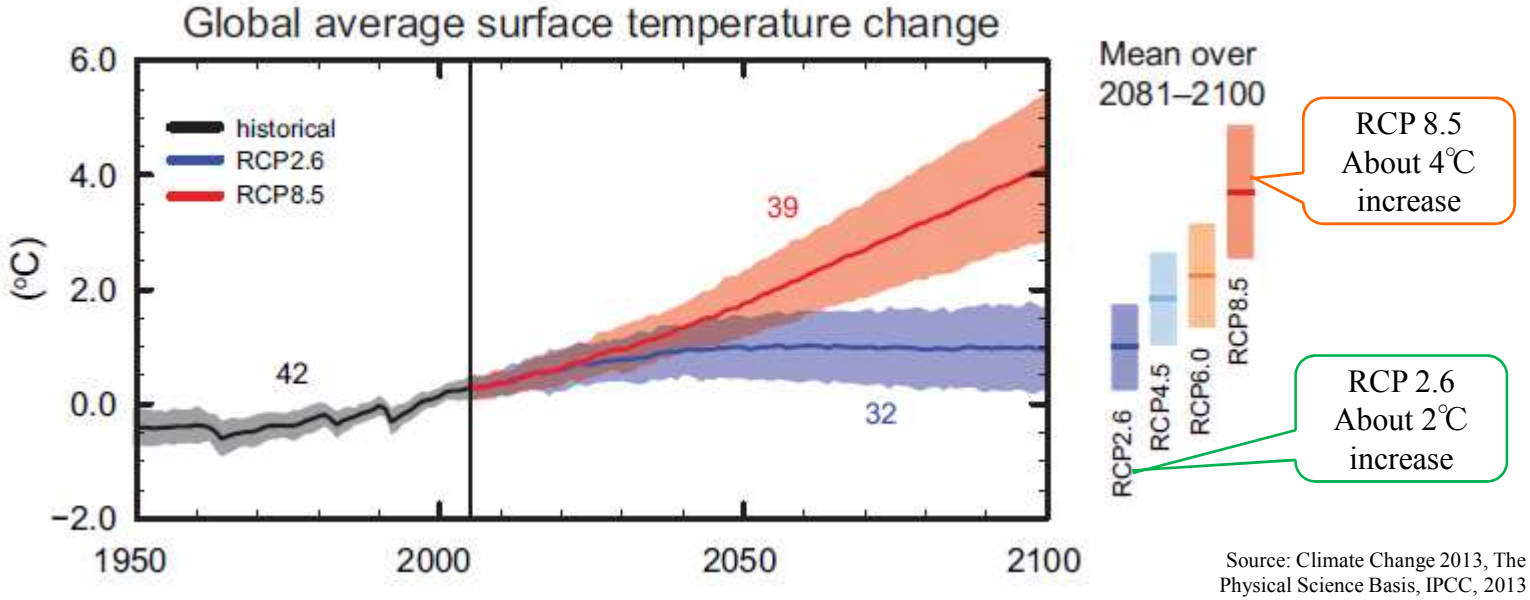
IV-2. Scenario analysis practices in the life insurance industry

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Institutional investors

Step ③ Part 2: Commonly-used climate change scenarios (Representative Concentration Pathways: RCP)

- Another set of scenarios for future GHG concentrations is known as Representative Concentration Pathways (RCP). The emissions pathways determine the intensity of the greenhouse effect (radiative forcing).* The global average temperature rise (e.g., 2℃ or 4℃) due to increased GHG concentrations is typically expressed relative to pre-industrial levels (late 18th century).
- For example, RCP 2.6 is a scenario in which the Paris Agreement target of limiting warming to 2℃ is achieved, with a pathway to radiative forcing of 2.6 W/m^2 by the end of the 21st century. In the RCP 8.5, scenario, radiative forcing is 8.5 W/m^2 at the end of the 21st century, and the global average temperature rise is 4℃.



Source: Climate Change 2013, The Physical Science Basis, IPCC, 2013

* Radiative forcing, measured as the amount of radiation per unit of area, is an indicator of changes in the energy balance between the atmosphere and the ground surface due to changes in factors such as carbon dioxide concentrations and solar radiation. When radiative forcing is positive the ground surface warms, and when negative the ground surface cools.

Sources: EIC Net, Japan Center for Climate Change Actions, etc.

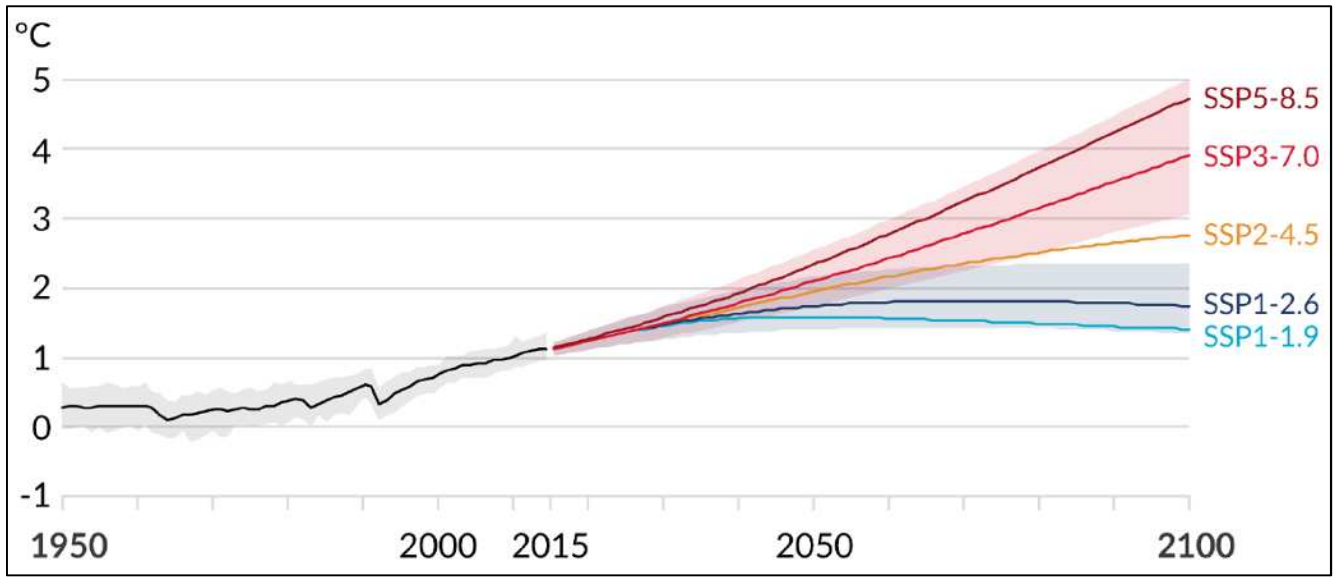
IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Background: Scenarios presented in the IPCC Sixth Assessment Report (combination of SSP and RCP)

- The IPCC Sixth Assessment Report used a combination of SSP and RCP scenarios. For example, SSP1-1.9 is a combination of SSP-1 and RCP-1.9. Among scenarios, it has the lowest CO_2 emissions and corresponds to the Paris Agreement's target of 1.5℃.



Trends in global average atmospheric temperature relative to 1850-1900

Source: IPCC Sixth Assessment Report

- IEA, NGFS, and other organizations have also proposed climate scenarios. Chapter VI provides an overview (see also the Appendix for NGFS).

IV-2. Scenario analysis practices in the life insurance industry

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Institutional investors

Step ④: Overview

- Having assessed the level of significance of risk and identified scenarios, the next step is to assess and analyze the potential impacts of climate change on the organization's strategic and financial position, for each scenario.
- As described in Chapter I, assessment and analysis are generally classified as either "qualitative" or "quantitative" approaches. Qualitative assessment and analysis are generally relatively easy to do and can be performed using narrative descriptions based on one's own observations and understanding. They can be used when no numerical data is available, or when looking for trends. On the other hand, quantitative assessment and analysis are often more difficult due to constraints such as insufficient data and models required for analysis.
- The TCFD Recommendations urge companies that are doing scenario analysis for the first time to start with a qualitative approach. More experienced companies may wish to use more advanced methods to perform quantitative analysis. The approach a company uses will depend on its own needs, resources, and so on.

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ④: Understand the trends in your company's portfolio

- Regarding scenario analysis, the TCFD Recommendations encourage organizations to proceed step-by-step, starting with what is feasible. In asset management, it is crucial to start by understanding the trends in a company's own portfolio.
- Many investment and loan portfolios are likely to be very diverse, so the first point to check is, *how much of your portfolio consists of major greenhouse gas emitters*?
- Large GHG emitters could be Scope 1, Scope 2, or Scope 3 companies (see ☛ p. 58). Depending on company scale and production volume, companies in the following industries generally tend to have high GHG emissions:
  - Scope 1 and 2: Power, steel, chemical, cement, paper, shipping, aviation
  - Scope 3: Automotive, electrical equipment, machinery, gas supply, residential equipment
- By knowing the monetary value and percentage of shares held by the company in each industry, including stocks and bonds, it is possible to ascertain the general trend of GHG emissions in the portfolio.
- To determine the emissions of large GHG emitters in its portfolio, a company could review the integrated, corporate social responsibility (CSR), or sustainability reports of companies in the portfolio. A growing number of companies are disclosing this information, so it will be possible to track those that have been doing so for some time, including their progress over time.

Note: The use of external data providers is one option for determining GHG emissions. See the next page for details.

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Reference: Using external consultants to determine GHG emissions

- To determine the GHG emissions of companies in an investment portfolio for scenario analysis, it is necessary to obtain GHG emissions data for those companies. However, if a firm is investing in many companies, it could be impractical without extra assistance to collect GHG emissions data from the published materials of every single company.
- Besides a firm using its own resources to gather information, there is an option of using so-called "data providers" that sell GHG emissions data on listed companies. A number of them exist, mainly in the United States and Europe. A firm could select a suitable provider and purchase GHG emissions data from it on the companies in which it is invested. However, some providers estimate emissions using their own independent criteria, so it is advisable to cross-check using GHG emissions data from more than one provider in order to improve data reliability.
- Some data is also available publicly, although the level of accuracy may be lower. Paris Agreement Capital Transition Assessment (PACTA) is a free, open-source methodology and tool developed by the 2° Investing Initiative (2DII), with support from the United Nations Principles for Responsible Investment (PRI). Services such as these can enable users to measure the alignment between financial asset portfolios and climate scenarios (Source: PACTA website).
  Note 1: See “Examples of guidance and tools for scenario analysis” at end of this guide.
  Note 2: Users should verify data accuracy and the appropriateness of analytical methods.
- As outlined above, practitioners need to first determine the GHG emissions in their investment portfolios, and based on that information, conduct future scenario analysis (e.g., analysis of a portfolio's transition pathway to zero emissions by 2050).
- Scope 1 and 2 disclosures by companies are generally very reliable, but Scope 3 disclosures still need some improvement. Because of this, scenario analysis of investment portfolios should be done carefully when dealing with Scope 3, through conscientious review of measurement methodologies used for published data, etc.

IV-2. Scenario analysis practices in the life insurance industry

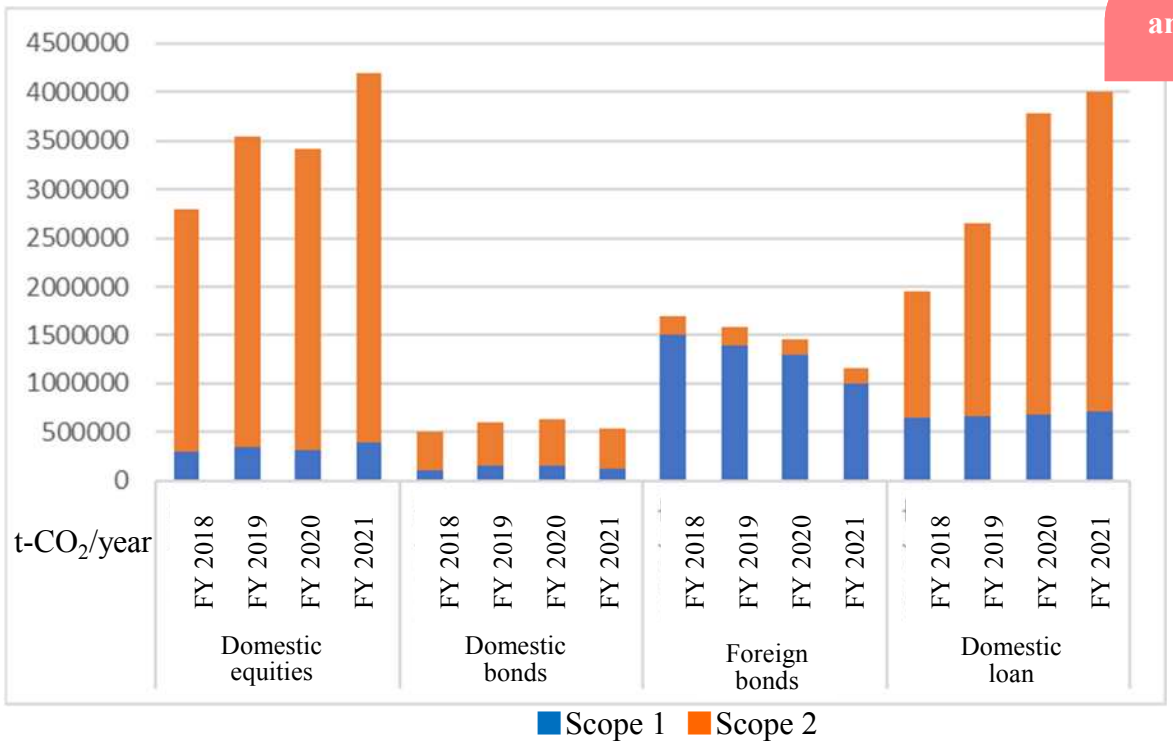
Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ④: Understand the trends in your company's portfolio

- This graph shows the calculation of GHG emissions in the portfolio of a hypothetical life insurance company (Company A). A simple example of how GHG emissions are calculated is as follows: Company B has 1 million tons of CO_2 emissions per year, and Company A owns 1% of Company B's shares, so Company A's portfolio includes 10,000 tons of emissions. If emissions are calculated this way, for all Company A's owned shares, bonds, and loans, then added together, it could be presented as shown as in this graph.

Example of portfolio analysis for Life Insurance Company A



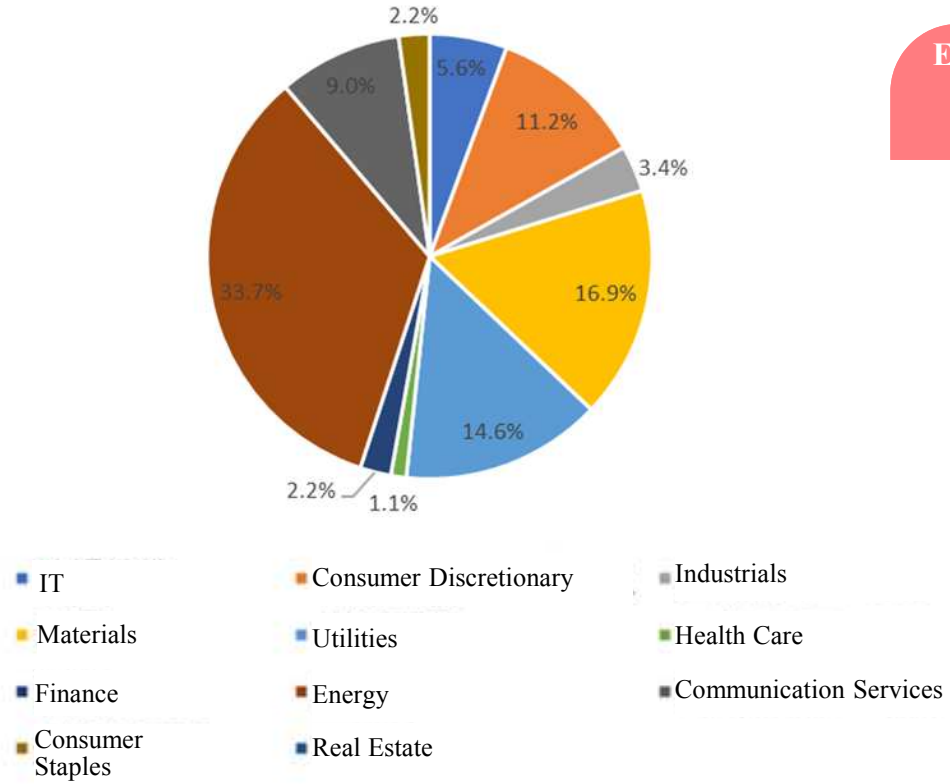
IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Step ④: Understand the trends in your company's portfolio

- This pie chart shows the sector-by-sector share of GHG emissions in Company A's portfolio (previous page). It is obvious that energy, materials (e.g., steel), and public utilities (e.g., electricity, gas) account for a large share.
- To move Company A's portfolio toward goals such as zero emissions by 2050, it will be important to start engagement efforts with these companies first.



Example of portfolio emissions shares for Life Insurance Company A

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② Assess significance of risks → ③ Identify/define scenarios → ④ Assess business impacts → ⑤ → ⑥

Intermediate/Advanced: Envisioning your company's future investment portfolio

- Once you have a good grasp of your company's investment portfolio, the next step could be to do a "transition pathway analysis."
- A transition pathway analysis is an assessment of how the portfolio's climate change risk will change in relation to future climate change scenarios.
- For example, one approach would be to assess the portfolio's resilience in the context of transition risk over time, by comparing (a) estimates of the portfolio's future greenhouse gas emissions (e.g., emission targets of companies in the portfolio), with (b) CO_2 emission factors and emission trends sector-by-sector as estimated from carbon budgets* calculated based on climate change scenarios (e.g., the IPCC's 1.5℃ scenario).
- However, when it comes to transition pathway analysis, there is a dizzying array of indicators, standards, and methodologies. Thus, practitioners need to consider their options in light of the situation of international discussions, including the TCFD.

* Carbon budget: The upper limit of cumulative greenhouse gas emissions to keep the global temperature rise due to human activities below a certain level. The carbon budget is estimated at 500 billion tons if the temperature rise is to be kept to 1.5℃ at a 50% probability.

IV-2. Scenario analysis practices in the life insurance industry

② ③ ④ ⑤ Identify possible responses ⑥ Document and disclose

Institutional investors

Step ⑤: Identify possible responses

- This step is to identify the actions a company can take regarding the risks and opportunities identified in analysis to this point and their impacts on the business.
- Scenario analysis is a key aspect of "strategy" of the four pillars of the TCFD. At this point, practitioners need to consider how the results of scenario analysis should be incorporated into the company's strategy.
- Companies are expected to make appropriate and realistic decisions about how to manage the risks and opportunities identified, using scenario analysis results. They should consider possible actions, such as what adjustments are needed in strategic and financial planning.
- In TCFD Recommendations, examples of some possible responses include changes to business model, changes to portfolio mix, and investments in capabilities and technologies.
- The results of the review done here are also very relevant for the next step, "disclosure." Thus, it is important to have a shared awareness companywide, not just among operational managers, but also in senior management.

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

② ③ ④ ⑤ Identify possible responses ⑥ Document and disclose

Step ⑥: Document and disclose

- Finally, this step is to document the findings obtained so far and communicate them to stakeholders.
- Examples of key information that should be disclosed include inputs (e.g., data and information used), assumptions, analytical methods, output (e.g., results of analysis), and anticipated responses by the management team.
- However, as we saw in Steps ② through ④, there are often constraints such as the lack of available data or information for scenario analysis, and technical difficulties. Therefore, the key is to aim to implement the best possible disclosure at this stage, rather than aiming for perfection.
- The results of scenario analysis often include confidential information directly linked to a company's business strategies.
- There is no obligation to disclose everything with the results of scenario analysis. Regarding what, where, and how to disclose, each company needs to consider and decide strategically, based on the results of analysis, and the accuracy and reliability of the analytical process.

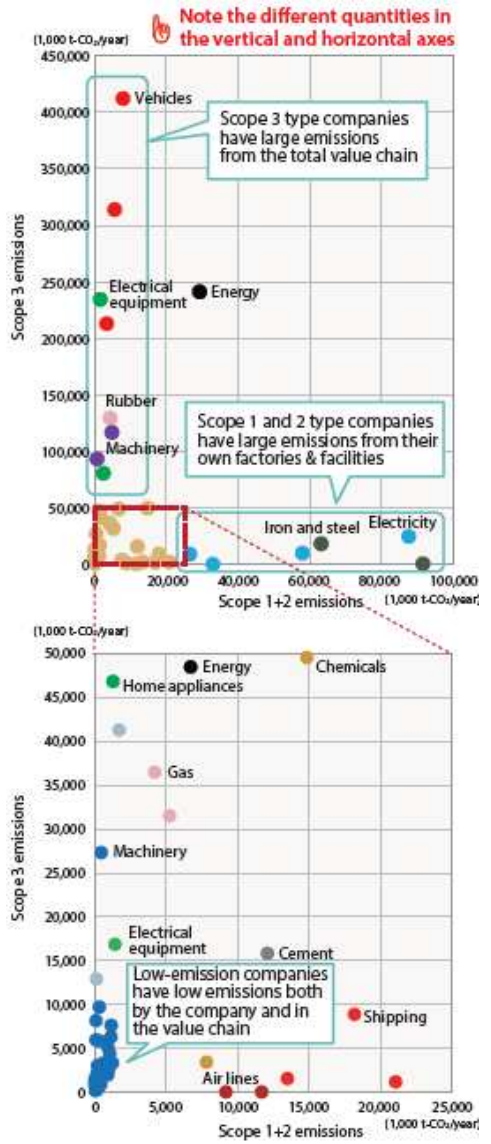
IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

◆ Going further: Deciphering the scenario analyses of (and engagement with) companies in investment portfolios

1. Understanding GHG emissions profiles of companies in a portfolio

- Companies can have significantly different GHG emissions profiles depending on the nature of their business. When practitioners are trying to decipher the scenario analyses of companies in a portfolio, a good grasp of their GHG emissions profiles will help practitioners understand the transition risks and response strategies of those companies.
- For engagement with a company, it is helpful to know which of the following three types it is, based on GHG emissions disclosure data (☛ see graphs on right, from Figure II-7 on p. 18 of the Life Insurance Association of Japan's *Climate Change Starter's Guide*).
  - Scope 1 and 2: Companies that primarily consume fossil fuels and electricity for their own operations
  - Scope 3: Companies whose raw materials are mainly fossil fuels or products made from fossil fuels, or whose products consume fossil fuels or electricity
  - Low emission: Companies whose total Scope 1, 2 and 3 emissions are significantly lower than 1 million t-CO_2/year each year



Emission trends of Japanese companies
Source: Climate Change Starter's Guide

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

◆ Going further: Deciphering the scenario analyses of (and engagement with) companies in investment portfolios

2. Spotlight on scenario analyses and disclosures of companies in your investment portfolio

- Climate change-related information is often disclosed in securities, integrated, sustainability, and CSR reports. Referring to these documents can help determine whether or not scenario analysis has been conducted and information disclosed by companies in a portfolio.

→ If this information has not been disclosed or is not sufficiently explicit, a process of engagement could be effective in encouraging companies in a portfolio to conduct a scenario analysis (i.e., climate change response).

- When it comes to assessments and analyses, the following approaches may be useful to decipher what is written in published materials.
  - When reading securities, integrated, and CSR reports, practitioners can compare statements contained in those documents regarding responses to the TCFD Recommendations, in order to confirm whether or not they are mutually consistent. It is particularly important to see whether or not strategies arising from scenario analyses are elaborated with some consistency.
  - Next, confirm that the results and strategies of the scenario analyses are clearly reflected in explanatory materials aimed at investors (e.g., medium-term management plans). If they are not reflected in the relevant plans, one interpretation could be that the company's responses to the TCFD Recommendations were only superficial.

IV-2. Scenario analysis practices in the life insurance industry

Institutional investors

◆ Going further: Deciphering the scenario analyses of (and engagement with) companies in investment portfolios

3. Deciphering scenario analyses

- The TCFD Recommendations encourage companies to disclose the results of their scenario analyses, so it is important for disclosures to be understandable and compelling.
- If disclosures of scenario analyses are understandable and compelling, readers should be able to follow the flow, from risks and opportunities, to future transition risk pathways, strategies to reduce risk and benefit from opportunities, and financial impacts and assessments of strategies.
- In addition, by reading the scenario analyses of the companies concerned, taking into account the GHG emission profiles of portfolio companies that have previously been ascertained, it is possible to determine whether their analyses align with their profiles, whether they are leading to appropriate actions and strategies, and so on.

4. Confirming whether or not scenario analysis results are reflected in corporate management

- Once you understand the scenario analysis of a company in a investment portfolio, the next step is to assess whether the results are being applied in the actual management of the company.

→ As a way to confirm the impact of scenario analysis on the corporate management, it is possible to use the opportunity of engagement with management, including the company president, to confirm and assess senior management's level of understanding of climate change responses.

→ If the results of the analysis are not utilized in the management of companies in investment portfolios, engagement could be used as a means of encouraging the review of responses based on the results of analysis and of the reflection of analysis in corporate management.

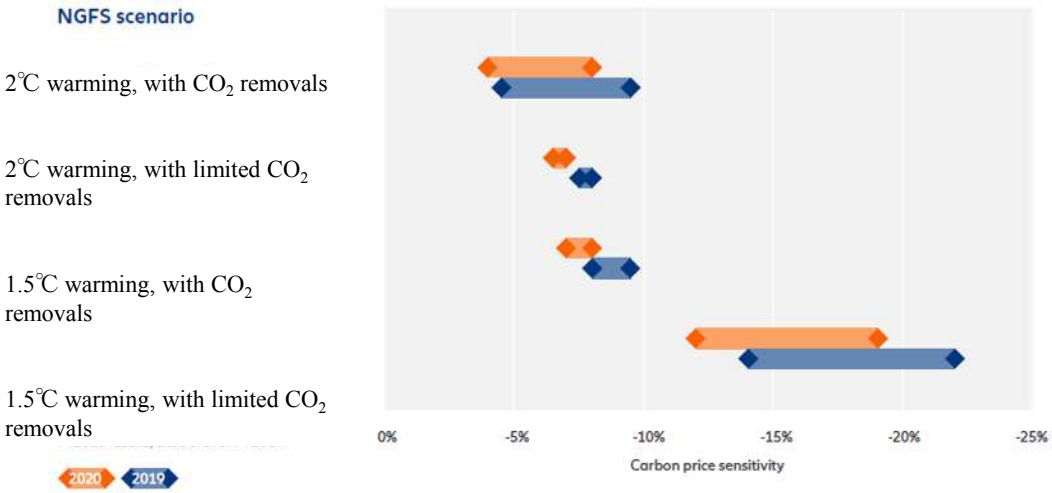
V. Case studies of disclosure of scenario analysis

Institutional investors

The next several pages provide examples of companies that are currently doing scenario analyses and disclosures.

Intermediate/advanced: International insurer uses multiple scenarios (Allianz)

- The Allianz 2020 Sustainability Report, published in May 2021, describes how the firm used a combination of scenarios for average warming between 1.5℃ and 4℃, including existing scenarios (IPCC, NGFS, EU, etc.), as well as its own and third-party scenarios.
- In an analysis of the impact of carbon price fluctuations using the NGFS scenario, the portfolio's market value losses were 4 to 8 percent for a rise of 2℃ and 12 to 19 percent for a rise of 1.5℃.
- However, limitations were also pointed out, including the fact that this analysis only covered listed stocks, and only Scope 1 and 2 emissions.



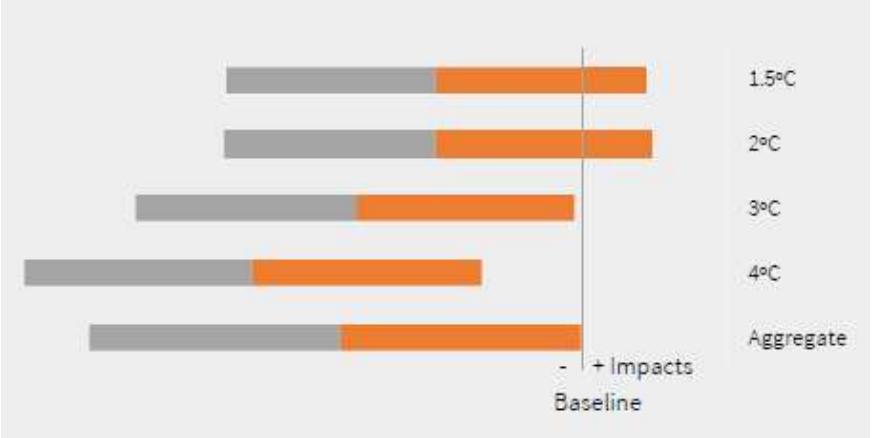
Source: Allianz Sustainability Report 2020
https://www.allianz.com/en/sustainability/publications/sustainability-report.html

V. Case studies of disclosure of scenario analysis

Institutional investors

Intermediate-advanced: International insurer uses Climate VaR (Aviva)

- Aviva's Climate-Related Financial Disclosure Report 2020 covers the state of scenario analysis. It explains that transition risks are likely to emerge more rapidly than physical risks, and that extreme physical risks pose a fundamental threat to the insurance business model.
- It also points out that many of the general climate scenarios are limited in their ability to reflect a chaotic world making little progress in climate actions, while the pace of warming and coordination of international policies are gradual. Aviva writes that it is continuing its own further reviews, in particular, enhancing the Climate Value-at-Risk (Climate VaR*) index developed by the financial services company MSCI.
- After applying Climate VaR for a variety of scenarios, the finding was that with 4℃ of warming, the greatest negative impacts on long-term returns were on equities, corporate bonds, real estate, real estate loans, and sovereign exposures, while with 1.5℃ and 2℃ of warming, there was a potential positive upside.



Source: Aviva's Climate-Related Financial Disclosure 2020
https://www.aviva.com/sustainability/reporting/climate-related-financial-disclosure/

*Climate VaR: A method of analyzing the present value of costs and benefits of climate change and future changes in corporate value, and determining the results as an impact on the equity and bond values of the company concerned.

V. Case studies of disclosure of scenario analysis

Life insurers | Institutional investors

Examples of disclosures by Japanese life insurers (from 2021 disclosures)

For reference, here are some examples of companies that are currently doing scenario analyses and disclosures.

- Identifying and describing physical and transition risks and opportunities

➢ **Nippon Life Insurance Company** (top right) identifies significant impacts, risks and opportunities in the context of strategy and risk management, and shows that scenario analysis is being conducted as part of strategy and risk management.

Life insurance business	Given that life insurance policies have long-term coverage periods, Nippon Life recognizes as a physical risk the impact that higher average temperatures driven by global warming and the increasing severity of extreme weather can have on people's health over the mid and long terms. We conduct scenario analysis of the impacts of such risks on our business. In addition, Nippon Life strives to reduce CO_2 emissions in various fields in order to reduce the environmental impact of its business activities. Note: For details on initiatives to reduce CO_2, please see p. 102.
Asset management	Nippon Life undertakes mid- and long-term investment and finance to match the duration of its insurance policies. We believe that climate change presents the risk of physical damage to investment and finance assets and the risk of impairment in the value of investment and finance assets associated with the transition to a low-carbon society. On the other hand, we believe that green finance in companies, technologies and projects that contribute to a low-carbon society will lead to an increase in investment and finance opportunities. Nippon Life will incorporate these perspectives on climate-related risks and opportunities into its investment and finance decisions through integration across all asset classes. Moreover, Nippon Life has set a target of ¥1,500.0 billion for the cumulative amount of ESG-themed investment and finance for the period covering the fiscal year ended March 31, 2018 to the fiscal year ending March 31, 2024. For ESG-themed investment and finance, the use of funds is linked to the theme of achieving the Sustainable Development Goals (SDGs). Nippon Life is actively working to achieve this target. We will also support positive initiatives by investee companies by conducting dialogue related to climate change. By doing so, we will strive to improve the corporate value of investee companies and reduce the climate change risk of our investment and finance portfolio. <Conduct Dialogue Related to Climate Change> Through dialogue with investee companies, Nippon Life encourages them (1) to conduct and disclose quantitative and

Source: Nissay Annual Report 2021 https://www.nissay.co.jp/english/annual/2021.html

➢ **Meiji Yasuda Life Insurance Company** (bottom right) shows the main responses of the company based on qualitative assumptions about how each risk and opportunity affects each operating company and institutional investor, and how the impacts occur on both long and short-term time scales.

	Risks and opportunities arising from climate change ● Risk ● Opportunity	Primary impact on business activities ■ As a business operator ■ As an institutional investor	Timespan*	Main initiativ enhanc
Physical risks	● The increasing frequency and magnitude of wind and flooding disasters (e.g. typhoons, high tides, concentrated heavy rains) due to global rises in temperatures and sea levels ● An increase in the number of people who suffer from heat stroke and the spread of tropical infectious diseases (e.g. malaria and dengue fever) ● A decrease in opportunities for people to go out due to the frequent occurrences of extreme heat and typhoons ● Growing demand for new insurance products and services designed to address the needs of customers experiencing increasing economic anxiety amid the risks of disasters related to extreme winds and flooding, of heat stroke and of infectious diseases	■ An increase in the payment of insurance claims and benefits for a growing number of persons insured passing away or being hospitalized ■ Temporary suspension of our business operations in areas affected by natural disasters due to damage incurred by employees, sales personnel (e.g. MY life plan advisors), shops, IT systems and transportation infrastructure ■ Impairment of the value of stocks, corporate bonds and loans held by Meiji Yasuda due to disaster-related damage incurred by investees and supply chain disruption	Long term	• Calculated of death ins benefits tha increasing n winds and t cases of he the impact business m • Conducting flooding dis base run by their disast in line with measures i risk areas a • Newly form (DX) strateg business op utilization o
Transition risks	● The tightening of regulations on CO_2 emissions and other factors affecting climate change as well as the introduction of carbon and other taxation measures with higher tax rates with the aim of promoting global warming countermeasures ● Deterioration in the business performance of investees engaged in CO_2 emission-intensive operations (due to a shift in demand toward alternative products and growing costs for the introduction of new facilities with lower CO_2 emissions) ● Deterioration in reputation if our response to climate change-related risks is deemed insufficient	■ Growing costs of measures to reduce CO_2 emissions from real estate, vehicles and other properties owned by Meiji Yasuda ■ Deterioration in prices of stocks held by Meiji Yasuda and increased defaults in corporate bonds and unrecoverable loans ■ Growing opportunities for investment in and financing of businesses and projects associated with decarbonization due to rising number of R&D endeavors	Short term	• Push ahead switching o paperless, endeavors Meiji Yasud • Initiated the related imp Meiji Yasud • Promote di encourage emissions while takin

Source: Meiji Yasuda Life Integrated Report 2021

https://www.meijiyasuda.co.jp/english/disclosure/annual-reports/backnumber/pdf/annual_2021_01.pdf

V. Case studies of disclosure of scenario analysis

Life insurers | Institutional investors

Examples of disclosures by Japanese life insurers (from 2021 disclosures)

For reference, here are some examples of companies that are currently doing scenario analyses and disclosures.

- Scenario analysis of impacts on insurance revenues and payments and asset management income

➢ The **T&D Insurance Group** (table on right) conducted a scenario analysis of physical risks, transition risks, and opportunities for the Group. The report provides a qualitative review of the results of the analysis and strategic responses for two scenarios (1.5℃ and 4℃ of warming).

	The world under the 1.5°C scenario	The world under the 4°C scenario
Overview	Tighter regulations and the introduction of a carbon tax. Expanded disclosure requirements (increased business costs for companies).	Due to the large rise in average temperatures, the impact of frequent and intense natural disasters becomes significant.
Physical risks (impact on underwriting profitability)	Increases in the number of heat stress deaths and heat stroke hospitalizations. Both of these increases will be gradual over a long period of time, which will limit their impact on underwriting profitability.	Significantly higher average temperatures will lead to an even larger increase in heat stress deaths and heat stroke hospitalizations than under the 1.5°C scenario.
Transition risks (impact on investment income)	Expansion of new technologies such as renewable energy. To avoid damage to investment income from the impact on investees and borrowers, we will, as appropriate, promote investment and financing activities to businesses and companies that contribute to the transition to a society with low or net-zero carbon emissions.	As in the 1.5°C scenario, the impact on investees and borrowers will be small, since there will be no sudden changes in the environment. In order to avoid damage to our investment income, we will avoid or withdraw investment and financing to firms with significant physical risks.

Source: T&D Insurance Group Sustainability Report 2021
https://www.td-holdings.co.jp/en/csr/report/

Results of analysis

Green road scenario

Situations related to the asset management business			Relevance to the asset management business	Effects on the portfolio		
Category	Subcategory	Trend		Short term 2025	Medium term 2030	Long term 2050
Policy and legal	Carbon pricing	Strengthened	Affects corporate value of the portfolio	Moderate	Major	Major
	Information disclosure	Strengthened	Affects our information disclosure and corporate value of the portfolio	Moderate	Major	Major
	Fossil fuel regulation	Strengthened	Affects corporate value of the portfolio	Minor	Moderate	Moderate
Technology	Ongoing use of existing technologies	Decrease	Negatively affects corporate value of the portfolio	Moderate	Major	Major
	Development of		Positively affects			

- Scenario analyses for life insurance business, asset management business

➢ **Sumitomo Life Insurance Company** (table on left) established two scenarios, then identified events and future trends that could affect the firm's business areas. Next, impacts on mortality (for life insurance business) and impacts on the portfolio (for asset management business) were assessed as minor, moderate, or major.

Source: Sumitomo Life Sustainability Report 2021 https://www.sumitomolife.co.jp/english/about/ir-stock/pdf/sr2021.pdf

V. Case studies of disclosure of scenario analysis

Life insurers | Institutional investors

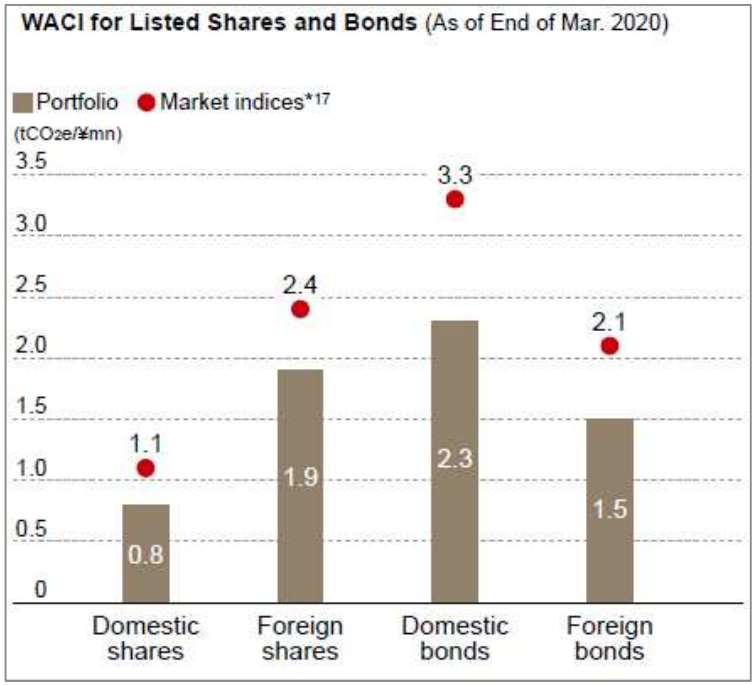
Examples of disclosures by Japanese life insurers (from 2021 disclosures)

For reference, here are some examples of companies that are currently doing scenario analyses and disclosures.

- Research on quantitative impacts (as life insurer) and analysis of total carbon emissions and weighted average carbon intensity (WACI) (as institutional investor)

  - **Dai-ichi Life Holdings** estimated the correlation between peak temperatures across Japan and mortality based on the company's actual payments made for death insurance claims. Under the RCP8.5 scenario (4℃ warming by end of 21st century), mortality rates increased by 1.0%, equivalent to an increase of 4 billion yen in payments.

  - As an institutional investor, the company also analyzed total carbon emissions and WACI, as TCFD recommends for disclosures (results shown in graph on right).



Source: Dai-ichi Life Holdings, Annual Integrated Report 2021

https://www.dai-ichi-life-hd.com/en/investor/library/annual_report/index.html

VI. What are the latest trends in scenario analysis?
Implementing the Recommendations of the TCFD (updated)

Update of "Implementing the Recommendations of the TCFD"

In October 2021, the TCFD updated its sector-specific guidance relating to "Implementing the Recommendations of the TCFD." Major updates that apply across all sectors are summarized below.

- Strategy: **The following was added as "recommended disclosures" to more explicitly address disclosure of key information from plans for transitioning to a low-carbon economy (transition plans).**

> ➢ Organizations that have made GHG emissions reduction commitments, operate in jurisdictions that have made such commitments, or have agreed to meet investor expectations regarding GHG emissions reductions, should describe their plans for transitioning to a low-carbon economy, which could include GHG emissions targets and specific activities intended to reduce GHG emissions in their operations and value chains or to otherwise support the transition.
>
> Source: TCFD "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures," updated October 2021.

- Transition plans are detailed in the TCFD's "Guidance on Metrics, Targets, and Transition Plans," published at the same time as the main report.
- In this context, transition plans are seen as part of a company's overall business strategy, which represents a set of goals and actions to support the transition to a low-carbon economy, including the reduction of GHG emissions.

VI. What are the latest trends in scenario analysis?
Implementing the Recommendations of the TCFD (updated)

Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures (updated)

- Metrics and targets (summary)
  - Where appropriate, organizations should consider providing forward-looking metrics, consistent with their business or strategic planning time horizons.
  - All organizations should provide their Scope 1 and Scope 2 GHG emissions independent of a materiality assessment.
  - Organizations should consider disclosing Scope 3 GHG emissions, depending on their materiality.
  - The governance processes should be as rigorous as those used for existing public financial disclosures, including review by the chief financial officer, audit committee, and Board of Directors, as appropriate.

Source: TCFD "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures," updated October 2021.

VI. What are the latest trends in scenario analysis?
Implementing the Recommendations of the TCFD (updated)

"Implementing the Recommendations of the TCFD" (updated)

The following additions have been made for asset owners:

- Metrics and targets
  - Asset owners should describe the extent to which assets they own and their funds and investment strategies, where relevant, are aligned with a well below 2℃ scenario, using whichever approach or metrics best suit their organizational context or capabilities.
  - Asset owners should disclose GHG emissions for assets they own and the weighted average carbon intensity (WACI) for each fund or investment strategy. These emissions should be calculated in line with the Global GHG Accounting and Reporting Standard for the Financial Industry developed by the Partnership for Carbon Accounting Financials (PCAF Standard) or a comparable methodology. (Note: PCAF is discussed on p. 72.)
  - In addition to WACI, asset owners should describe the methodologies used, and consider providing other carbon footprinting metrics they believe are useful for decision-making (total carbon emissions, carbon footprint, carbon intensity, exposure of carbon-related assets, etc.).

Source: TCFD "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures," updated October 2021.

- The principles of the TCFD Recommendations have not changed in this edition, but the update of sector-specific guidance provides more detailed guidance for disclosures. It is also important that companies continue monitoring these international trends for their deliberations.

VI. What are the latest trends in scenario analysis?
Implementing the Recommendations of the TCFD (updated)

TCFD guidance reports published after the main TCFD Recommendations

- Guidance on Scenario Analysis for Non-Financial Companies (2020)
  - Provides practical, process-oriented ways for companies to use climate-related scenario analysis and ideas for disclosing the resilience of their strategies to different climate-related scenarios. For financial institutions, it is useful to understand what should be noted when deciphering companies' scenario analyses.
- Guidance on Risk Management Integration and Disclosure (2020)
  - This document describes the issues that companies should consider if they are interested in integrating climate-related risks into their existing risk management processes and disclosing information on their risk management processes in alignment with the Task Force's recommendations.
- Guidance on Metrics, Targets, and Transition Plans (2021)
  - The latest guidance on climate-related metrics and company transition plans for a low-carbon economy. The guidance also describes the categories of cross-industry climate-related metrics. Provides detailed explanations of transition plans, along with the setting of specific metrics and targets.

VI. What are the latest trends in scenario analysis?
Various initiatives

- The work of the TCFD is becoming a common framework for many initiatives in response to climate change. Indeed, many organizations around the world have launched their own initiatives, leading to what may be a dizzying array of standards and methodologies.
- For example, documents from the secretariat of the Sustainable Finance Expert Committee (Financial Services Agency, Japan) lists major initiatives, introduced below.
- The next two pages describe the PCAF, which is developing methodologies for measurement and disclosures of indirect greenhouse gas emissions arising from investment and financing by financial institutions.

Activities on their focus

I Investors	BI Banks & Investors	B Banks	Commitment	GHG measurement	Scenario analysis	Target setting	Promoting action
Collective Commitment to Climate Action			◆				
Net Zero Asset Owner Alliance			◆				
Net Zero Asset Managers Initiative			◆				
PCAF				◆			
PACTA					◆		
Paris Aligned Investment Initiative					◆		
SBTs for Financial Institutions						◆	
Climate Action 100+							◆

Source: Prepared by Financial Services Agency, Japan, based on PCAF materials.

Initiative name (parent body)	Purpose and activities	Members (Japan)
Collective Commitment to Climate Action (UNPRB)	Aim is to decarbonize loan portfolios. Expected to set targets, conduct engagement with companies, disclose information.	38 (0)
Net Zero Asset Owner Alliance (UNEPFI-PRI)	Aim is to decarbonize portfolios. Expected to set targets/strategies, actively engage with companies/industries, disclose information.	35 (1)
Net Zero Asset Managers Initiative (CDP-PRI-GIG)	Aim is to decarbonize portfolios. Expected to set targets/strategies, conduct active engagement.	73 (2)
Partnership for Carbon Accounting Financials (PCAF)	An investor-led initiative to develop global GHG accounting standards that can be adapted to various asset classes.	115 including banks, investors (0)
Paris Agreement Capital Transition Assessment (PACTA) (2℃ Investing Initiative/PRI)	Publishes free scenario analysis tools to measure investment/loan portfolio alignment with Paris Agreement goals.	Used by 3,000+ organizations
Paris Aligned Investment Initiative (GIG)	Supports construction of portfolios aligned with Paris Agreement.	112 (0)
SBTS for Financial Institutions	Framework for financial institutions to formulate and certify science-based targets (SBT) to keep them below 1.5℃ or 2℃.	77 committed (4)
Climate Action100+ (GIG/PRI)	Joint engagement targeting 100+ large emitter companies worldwide	575 (14)

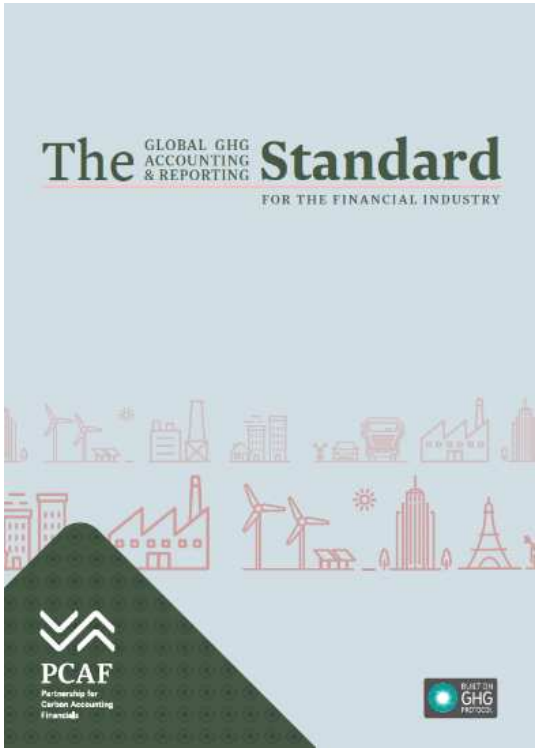
Source: Financial Services Agency, Sixth meeting of Sustainable Finance Expert Committee, April 2021.

VI. What are the latest trends in scenario analysis?

Various initiatives: PCAF

Partnership for Carbon Accounting Financials (PCAF)

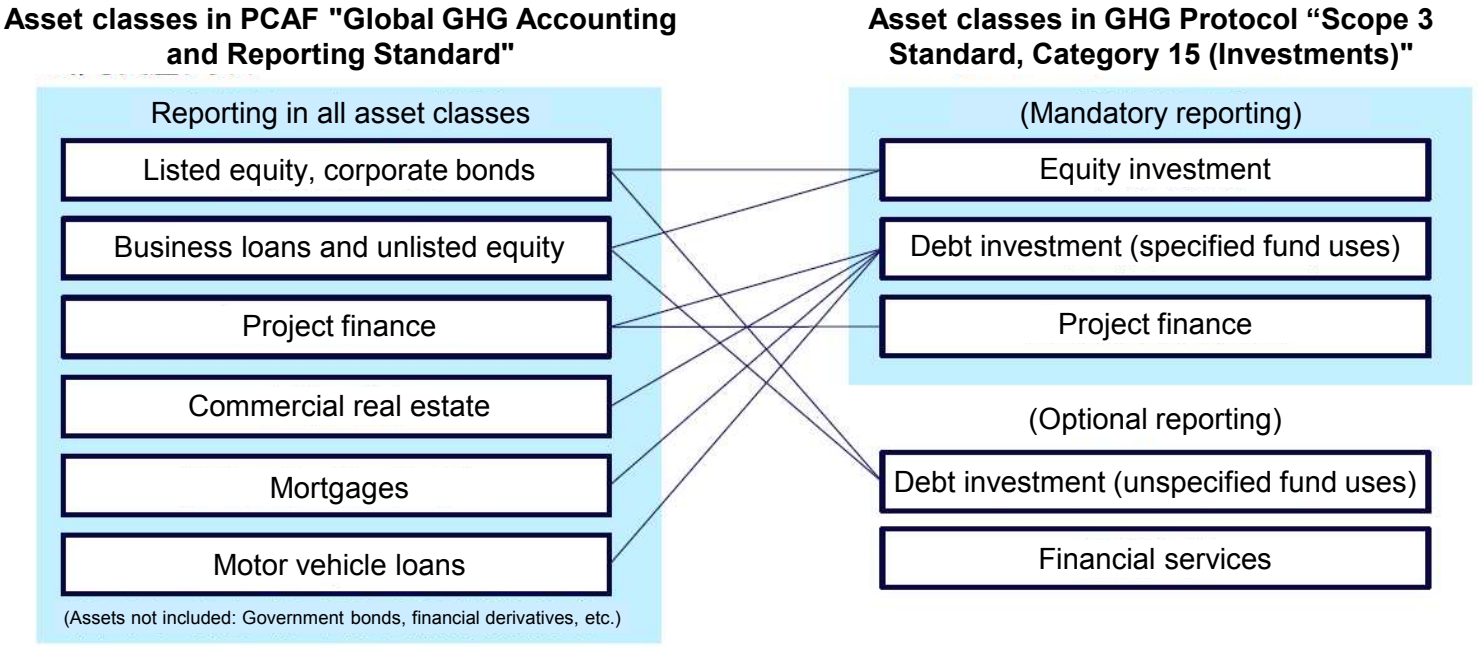
- The PCAF was launched in the Netherlands in 2015 and is an international initiative mainly involving European financial institutions. As of January 2022, 197 organizations had joined, representing total assets of $57.3 trillion. It includes 10 companies from Japan.
- In 2020, the PCAF released the Global GHG Accounting & Reporting Standard, guidance that complies with GHG protocols, in order to develop unified international methodologies for financial institution assessments and disclosures of GHG emissions associated with financing and investment.
- The PCAF standard also takes into account sector-specific guidance from the TCFD Recommendations as revised in October 2021 (see p. 61).



VI. What are the latest trends in scenario analysis?
Various initiatives: PCAF

Partnership for Carbon Accounting Financials (PCAF)

- The PCAF calls for disclosures in six asset categories listed here. Since only a limited number of companies are doing disclosures of Scope 3 emissions, it calls for disclosures only in sectors where Scope 3 is of particular importance.



Prepared by Central Research Institute of Electric Power Industry based on GHG Protocol (2011), PCAF (2020).

Source: Motoshi Tomita, "Trends in measurement and target-setting for Scope 3 emissions in financial institution portfolios" Central Research Institute of Electric Power Industry, April 2021 (in Japanese).

- Please refer to the Appendix for details of formulas calculations in each asset class.

VI. What are the latest trends in scenario analysis?

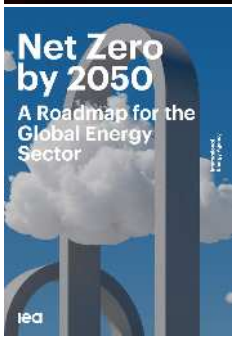
Scenarios by major organizations

- Various organizations have released climate change scenarios.
- In addition to the IPCC scenarios mentioned above, the following pages describe scenarios of equally high credibility. First, scenarios from the International Energy Agency (IEA), which have been used for years by policy authorities and companies, particularly in the energy sector. Second, from the Inevitable Policy Response (IPR, a climate change scenario development program) by Principles for Responsible Investment (PRI, a UN-led initiative). Finally, from NGFS, a network of financial regulators.

VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: IEA

International Energy Agency (IEA) - World Energy Outlook (WEO) 2021



- Published October 2021 (386 pages). IEA publishes this report annually, but this time it was created as a handbook for policymakers for the COP26 climate meeting held in November 2021.
- Prior to this, "Net Zero by 2050 - A Roadmap for the Global Energy Sector" was released in May 2021. It was prepared at the request of the UK, which held the COP26 presidency, and was primarily sent to investors.
- WEO 2021 covers the efforts of governments to date, the significance and issues of net zero pledges, and what is necessary to achieve net zero globally by mid-21st century. The direction is the same as in the IEA Roadmap. Here are some of the contents in terms of future projections.
  - Based on energy and climate measures currently being implemented, the global temperature in 2100 is projected to be 2.6℃ above pre-industrial levels.
  - If governments' net zero pledges are fully implemented, the temperature rise would be 2.1℃.
  - In both cases, the temperature rise would be greater than the target of the Paris Agreement, and could not be kept within 1.5℃.

Note: The base year for these scenarios was 2019, but where available, the latest data from 2020 was used for energy production and demand.

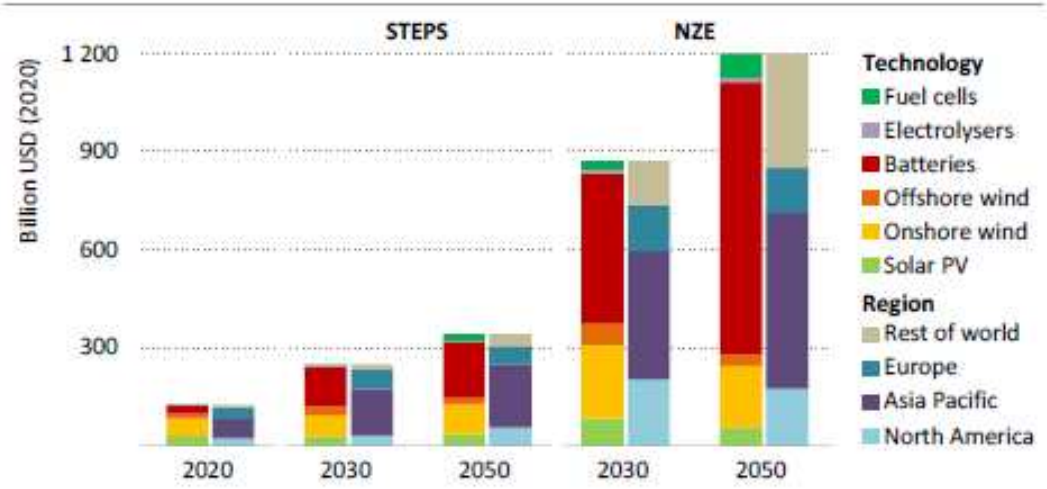
VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: IEA

International Energy Agency (IEA) - World Energy Outlook (WEO) 2021

- This figure compares how the market for clean energy technology is projected to grow from 2030 to 2050, using a current policy-only scenario (STEPS) and a net zero scenario (NZE).
- Under NZE, battery storage technology is expected to make significance advances.
- Regionally, the Asia-Pacific is expected to see the greatest market growth.

Figure 1.3 ▹ Estimated market size for selected clean energy technologies by technology and region, 2020-2050



There is explosive growth in clean energy technologies over the next decade in the NZE, leading to a clean energy market worth a cumulative USD 27 trillion by 2050

Source: IEA World Energy Outlook (WEO) 2021.

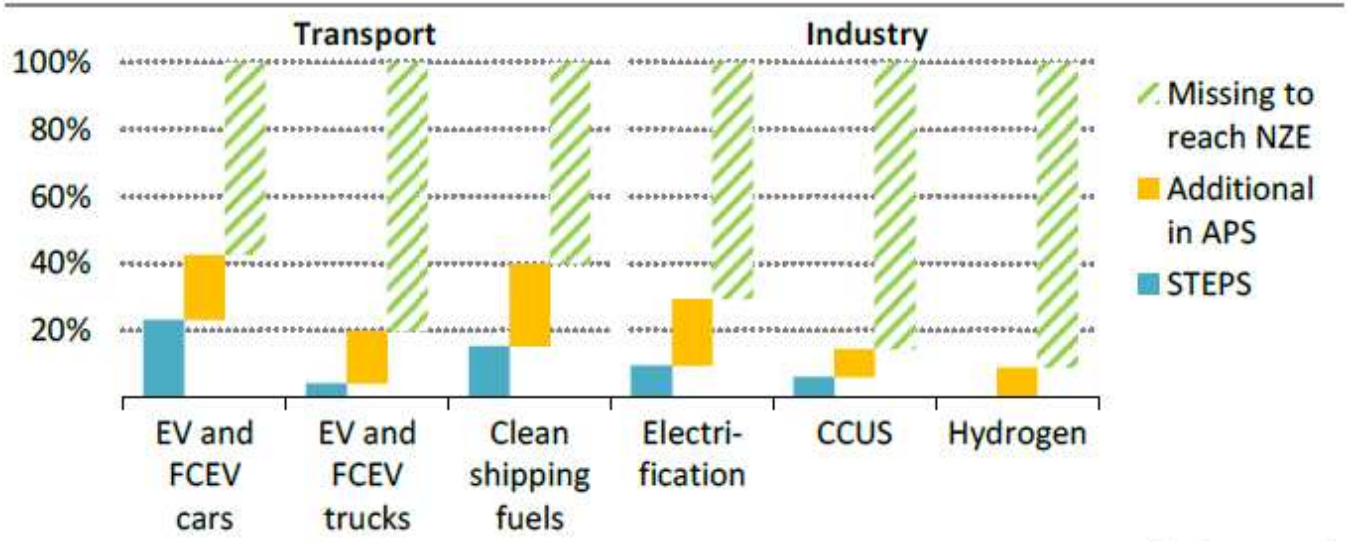
VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: IEA

International Energy Agency (IEA) - World Energy Outlook (WEO) 2021

- At the same time, however, many sectors are still slow to make technological advances toward net zero. This figure suggests that electrification, carbon capture, utilization and storage (CCUS), and hydrogen are among those technologies.

Figure 3.10 ▷ Tracking progress towards 2030 milestones in transport and industry by scenario



A number of key milestones in the NZE related to clean energy transitions in end-uses significantly lag in the APS

Source: IEA World Energy Outlook (WEO) 2021.

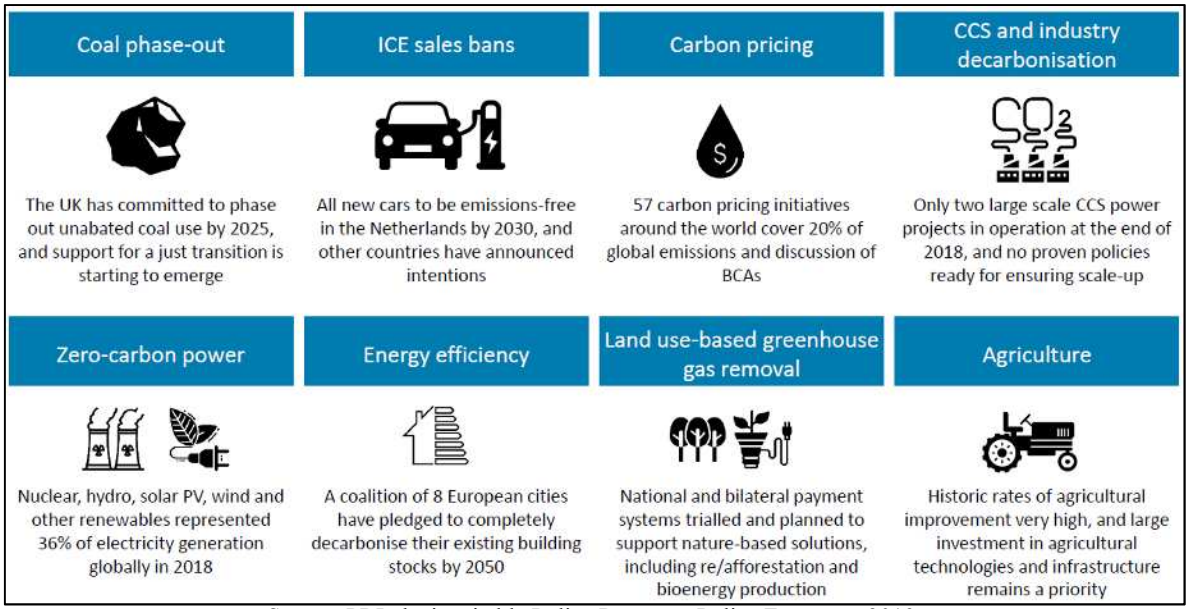
VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: IPR of PRI

Inevitable Policy Response (IPR) of UN Principles for Responsible Investment (UN-PRI)

- The Principles for Responsible Investment (PRI) are promoting the Inevitable Policy Response (IPR) initiative to encourage the financial sector to prepare for climate-related policy and regulatory risks.
- These scenarios foresee policies that governments will likely have to adopt as "inevitable" responses as climate change worsens, and consider changes in society that would likely result. When published in 2019, it attracted attention for covering the land use and agricultural sectors, where such policies had not yet been broadly introduced.

Policy sectors covered in projections



Source: PRI, the inevitable Policy Response Policy Forecasts, 2019.

VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: IPR of PRI

Inevitable Policy Response (IPR), Principles for Responsible Investment (UN-PRI)

- In October 2021, IPR published two scenarios. One was the Forecast Policy Scenario (FPS), which updates 2019 forecasts, and assumes that government initiatives will make significant progress over the next 10 years. Among the assumptions made under this scenario:
  - By 2030, zero-emission vehicles account for about 30% of all vehicles, and solar and wind power will account for more than 30% of the world's electricity generation.
  - The energy sector will reduce emissions by 75% from 34 $GtCO_2$ in 2020 to 9 $GtCO_2$ by 2050.
- However, the Required Policy Scenario (RPS) was newly created because the FPS would still not be enough to limit the temperature rise to 1.5℃. Key actions listed in this scenario:
  - Forest destruction ends globally by 2025. Alternatively, more sequestration by energy systems will be needed, including BECCS (see note).
  - Coal use will be phased out in most developed countries, including China, by 2035.
  - All new fossil fuel vehicles will be phased out in most markets by 2040, and the world will transition to 100% clean electricity by 2045.

Note: The base year for these scenarios is 2020.

Note: BECCS refers to bioenergy with carbon capture and storage (CCS) and relies on electricity generation from biomass. This technology is seen as reducing net CO_2 in the atmosphere by capturing and storing CO_2 emitted during biomass combustion, so net emissions are considered to be zero.

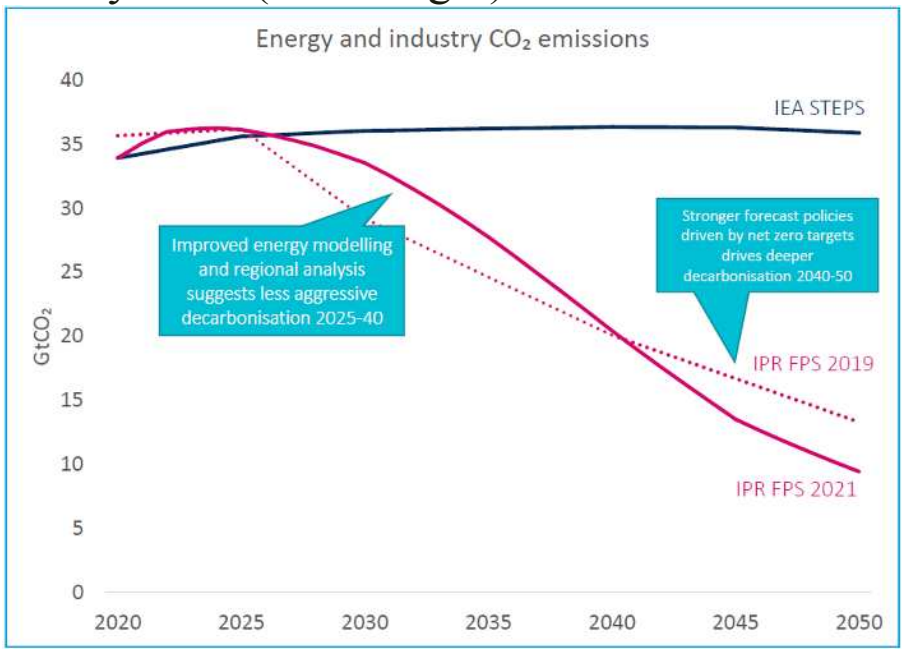
Source: PRI, Inevitable Policy Response 2021 Emissions & 1.5℃ required Policy Scenario (1.5℃ RPS) Policy Summary, October 2021.

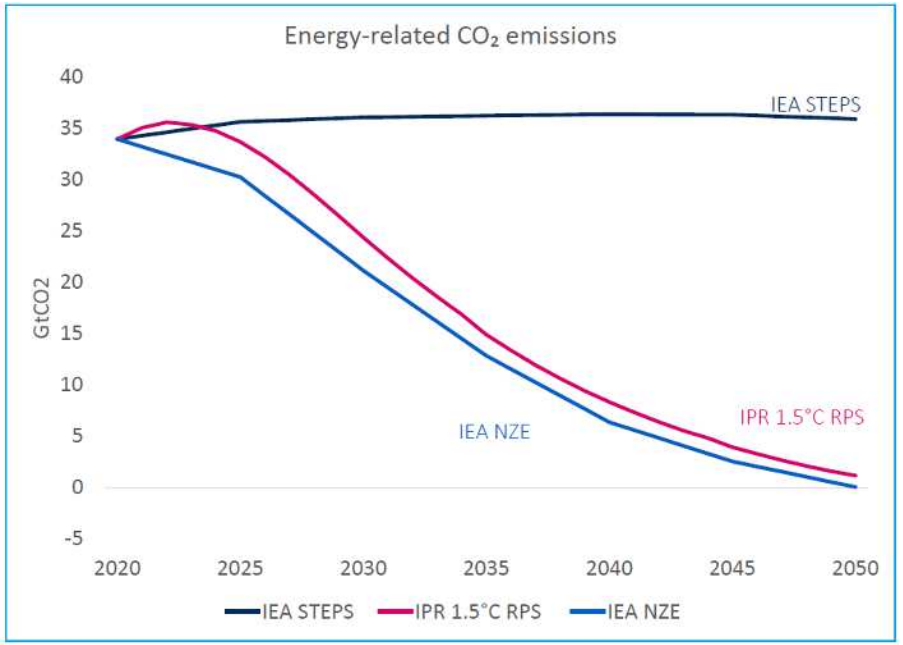
VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: IPR of PRI

Inevitable Policy Response (IPR) of Principles for Responsible Investment (PRI)

- The 2021 edition of FPS is an update with improved energy models and regional analyses, taking into account the increasing number of countries that have made net zero declarations (below left).
- The new RPS corresponds to the IEA net zero scenario introduced on p. 75, but it has reportedly been developed with more detailed consideration of food- and land-related systems (below right).





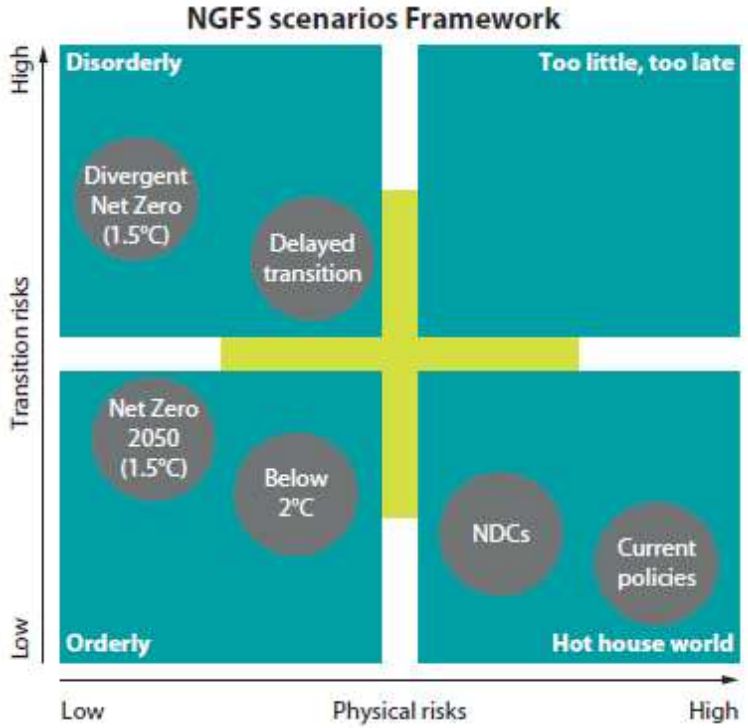
Source: PRI, inevitable Policy Response 2021 Emissions & 1.5℃ required Policy Scenario (1.5℃ RPS) Policy Summary, October 2021.

VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: NGFS

Network for Greening the Financial System (NGFS)

- The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) is a network of national central banks and financial regulators established in 2017 with the aim of considering financial regulators' responses to climate change risks. As of December 2021, there were 16 observers and 105 members, including the Japan Financial Services Agency and Bank of Japan.
- NGFS released six scenarios in June 2021. They are revisions of the previous year's versions and intended for use by member financial regulators.
- These scenarios were released along with details of how they were developed, as well as underlying data and tools. They can also be used by organizations other than government regulators.



Source: NGFS Climate Scenarios for central banks and supervisors, 2021

VI. What are the latest trends in scenario analysis?
Scenarios by major organizations: NGFS

NGFS(Network for Greening the Financial System)

- The six NGFS scenarios are summarized below.

Category	Scenario	Description
Orderly scenarios Assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.	**Net Zero 2050***	Stringent climate policies and innovation aim to limit global warming to 1.5℃, reaching global net zero CO_2 emissions around 2050. Some jurisdictions such as the US, EU and Japan reach net zero for all GHGs.
	Below 2℃	The stringency of climate policies gradually increases, giving a 67% chance of limiting global warming to below 2℃.
Disorderly scenarios Higher transition risk due to policies being delayed or divergent across countries and sectors.	**Divergent Net Zero**	Reaches net zero around 2050 but with higher costs due to divergent policies introduced across sectors leading to a quicker phase out of oil use.
	Delayed Transition	Annual emissions do not decrease until 2030. Strong policies are needed to limit warming to below 2℃. CO_2 removal is limited.
Hot house scenarios Some climate policies are implemented in some jurisdictions, but globally efforts are insufficient to halt significant global warming. The scenarios result in severe physical risk including irreversible impacts like sea-level rise.	**Nationally Determined Contributions (NDCs)**	Includes all pledged policies, even if not yet implemented.
	Current Policies*	Only currently implemented policies are preserved, leading to high physical risks.

* The base year for these scenarios is 2020.

* The Appendix introduces the global perspectives for these two scenarios.

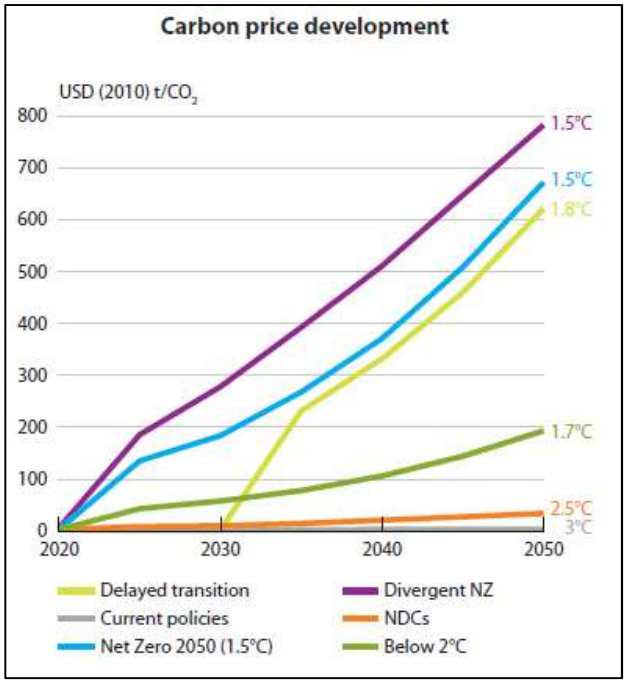
Source: NGFS Climate Scenarios for central banks and supervisors, 2021.

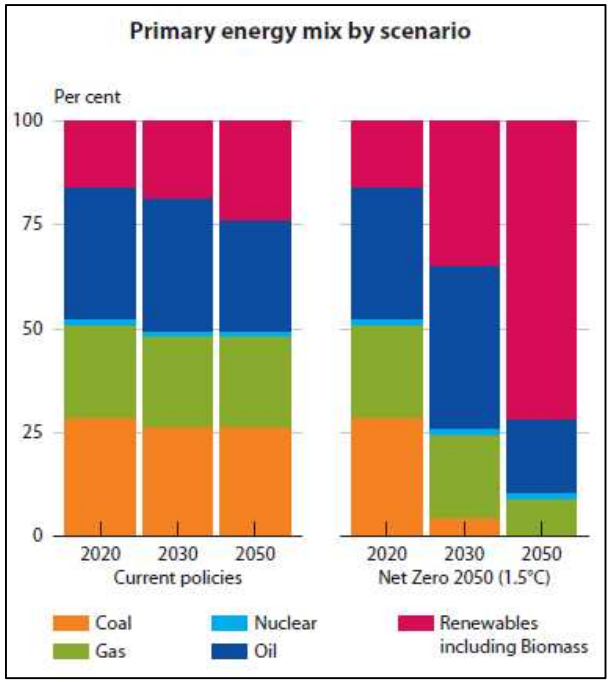
VI. What are the latest trends in scenario analysis?

Scenarios by major organizations: NGFS

NGFS

- Each scenario has assumptions for carbon prices and energy mix, as shown below. Under the current policies scenario (gray: 3℃ rise) carbon prices are only a few dollars even in 2050, but rise to nearly 800 USD in the 1.5℃ scenario (light blue, purple). The energy mix must reach about 90% renewables for net zero.





Source: NGFS Climate Scenarios for central banks and supervisors, 2021.

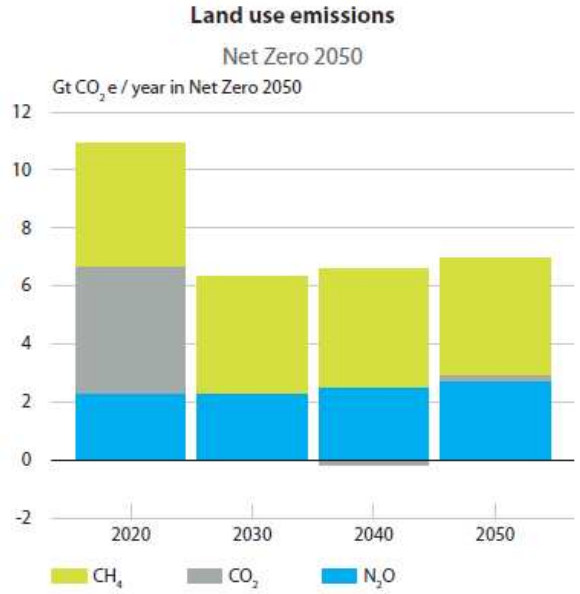
VI. What are the latest trends in scenario analysis?

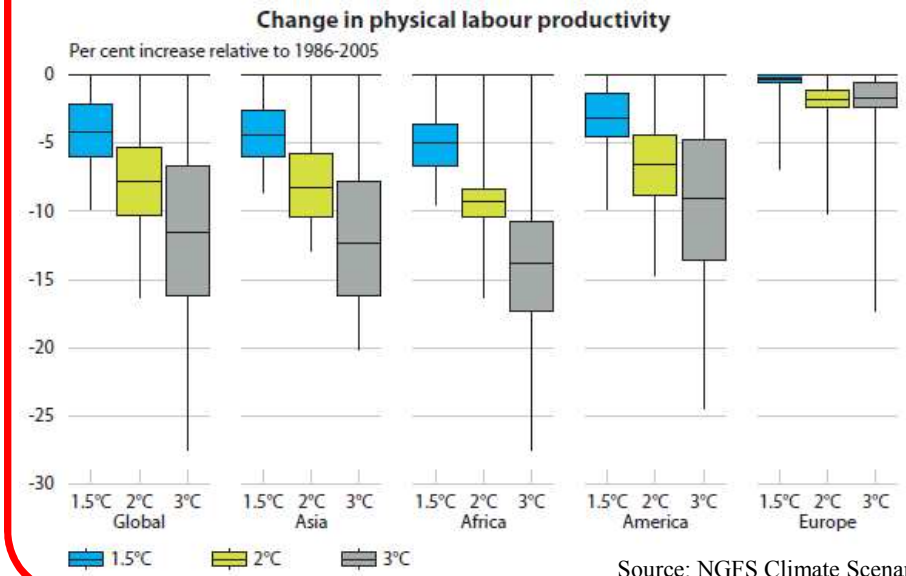
Scenarios by major organizations: NGFS

NGFS: Intermediate/advanced

Land use change

- As shown in the figure (right), NGFS scenarios assume CO_2 removals by carbon capture, utilization, and storage (CCUS), and by forests. To reach net zero in 2050, CO_2 emissions from land use change need to be zero by 2030.





Physical risk - labor productivity

- Assumptions are also made on multiple physical risks. At 3℃ warming, labor productivity is reduced by 12% worldwide. This is three times the reduction under the 1.5℃ scenario. Regional differences are also significant. However, this model is still highly uncertain and requires further consideration.

Source: NGFS Climate Scenarios for central banks and supervisors, 2021.

VI. What are the latest trends in scenario analysis?

Major events before and after COP26

Column: COP26 (November 2021) and major related events

- COP26 attracted unprecedented attention, but there were also many related developments prior to the event.
- First was the Climate Leaders' Summit in April 2021 (United States), followed by the release of the IEA Roadmap in May, then the May/June G7 Summit announcement of a commitment to net zero by 2050. The IPCC's Sixth Assessment Report came out in August, followed by IEA's release of WEO 2021, and then just before COP26, countries at the G20 Summit at the end of October pledged to work together to achieve success at COP 26 and continue commitments to meet the goals of the Paris Agreement.
- The Paris Agreement provides mechanisms for signatories to gradually strengthen their climate actions. At the heart of this is the Global Stocktake (GST). It is designed to review and evaluate progress of climate change measures across the international community every five years, and compare them with the objectives and long-term targets of the Paris Agreement.
- The first Global Stocktake began in November 2021, immediately after COP26, and will continue for 2 to 2.5 years. By the end of 2023, the results of information gathering and technical assessments will be reviewed, the necessary international cooperation will be considered, and NDCs for each country will be revised.

Examples of guidance and tools for scenario analysis

Key examples of guidance for scenario analysis

- Guidance 2.0 on Climate-related Financial Disclosure (TCFD Guidance 2.0) and Case Studies, TCFD Consortium, July 2020. https://tcfd-consortium.jp/news_detail/20073103
- Examples of strategic planning using TCFD: Scenario analysis practical guide, incorporating climate-related risks and opportunities, Ver. 3.0, Ministry of the Environment, Japan, March 2021. http://www.env.go.jp/policy/tcfd.html
- Guidance for responding to Recommendations from the Task Force on Climate-related Financial Information Disclosures in the real estate sector (TCFD Guidance for Real Estate Sector), Ministry of Land, Infrastructure and Transport, March 2021. https://www.mlit.go.jp/totikensangyo/totikensangyo_tk5_000215.html
- Introduction to disclosures on climate-related risks and opportunities in the food, agriculture, forestry and fisheries sectors: A manual on climate-related disclosures for Japanese food businesses, Ministry of Agriculture, Forestry and Fisheries, June 2021. https://www.maff.go.jp/j/kanbo/kankyo/seisaku/climate/attach/pdf/visual-60.pdf
- Guidance on utilizing climate-related information to promote green investment 2.0, TCFD Consortium, October 2021. https://tcfd-consortium.jp/news_detail/21100501

Examples of guidance and tools for scenario analysis

Examples of tools mainly for asset management data collection and analysis

- Paris Agreement Capital Transition Assessment (PACTA): https://www.transitionmonitor.com/
  - The 2° Investing Initiative (2DII) was developed with support from UN Principles for Responsible Investment (PRI). It can be used with scenario analysis to measure portfolio consistency with goals of the Paris Agreement.
- Transition Pathway Initiative (TPI): https://www.transitionpathwayinitiative.org/sectors
  - Based on public data, it conducts transition pathway analysis of major emitters in line with IEA scenarios, and analyzes and publishes corporate climate initiatives.
- Investor Energy-Climate Action Toolkit - Developing the framework and platform for non state actors' contribution to the Paris Agreement (InvECAT): https://cordis.europa.eu/project/id/785087
  - Led by UNEP-FI and Bloomberg with EU research funding. A toolkit for setting and monitoring energy and climate goals.
- Open Source Breakthrough For Climate-Smart Investing (OS-Climate): https://os-climate.org/
  - Led by the Linux Foundation. An open source model data platform for finance that addresses climate change risk management, etc. Founding members include Amazon, Allianz, Microsoft and S&P Global.
- SENSES Project - SENSES Climate Change Scenario Toolkit: https://climatescenarios.org/toolkit/
  - Modules that enable companies to understand and communicate climate change scenarios. Visualization uses narrative or exploratory approaches.
- The PRI website offers a variety of useful tools, data providers, and methodologies for scenario analysis. Regarding IRP, details are also provided for scenario assumptions, etc.

  https://www.unpri.org/climate-change/climate-scenario-analysis/3606.article

  https://www.unpri.org/sustainability-issues/climate-change/inevitable-policy-response

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APPENDIX

What is scenario analysis?

The origins of scenario analysis

- For more than 50 years, the scenario analysis method has been used to develop long-term strategies for “issues that are difficult to foresee."[*1]
- A scenario is a narrative about the future.[*2] The difference between a scenario and a "projection" (or forecast or prediction) is that generally projections consider the future as an extension of the past. However, this is difficult for phenomena that have a high level uncertainty or are difficult to foresee. For example, what will happen if fundamental structural changes occur in society in the near future.[*2]
- Just because a "scenario" is a narrative about the future, doesn't mean that just any story can be created. Normally, it is necessary to create a "realistic" scenario and verify the likelihood of it being realized using a quantitative or other type of model.[*2]

*1 Source: Theory of scenario planning: Techniques and practical application (Masahiro Kakuwa, Japan Oil, Gas and Metals National Corporation, 2016).

*2 Source: Energy Transformation Scenario 2021: The latest scenario work by Shell (Masahiro Kakuwa: Japan Oil, Gas and Metals National Corporation, 2021)

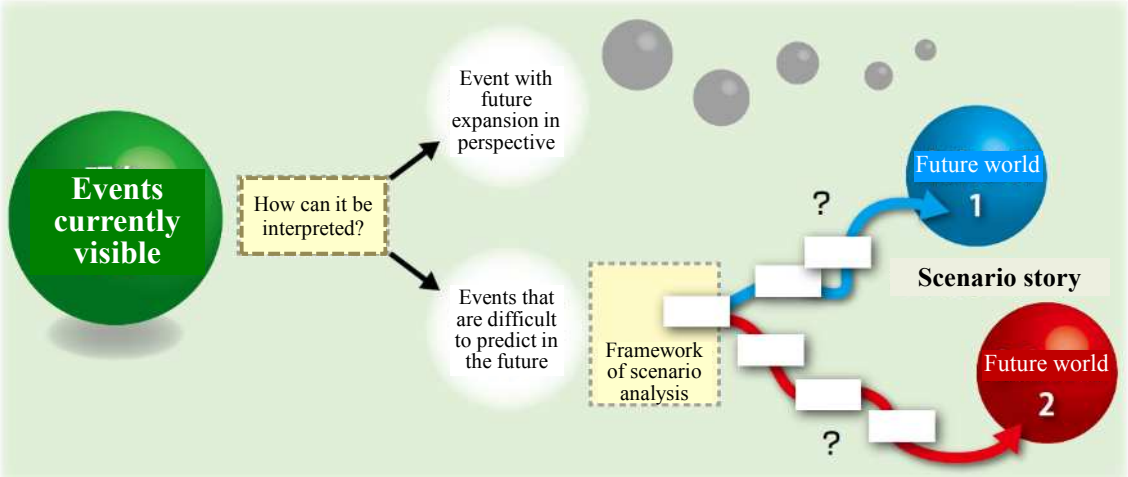
What is scenario analysis?

What are the features of scenario analysis?

- Companies and organizations have their own unique purpose to exist. To fulfill their purpose, their leaders establish a vision and strategy. In other words, leaders need to be fully aware of where the organization is headed in the future.*2
- However, the business environment is constantly changing.
- The path to the future environment may be discontinuous.*2
- This is why scenario analysis is needed.
- The first thing to do for scenario analysis is to clarify the organizational purpose and vision for the future (see figure).*1

*1 Source: Theory of scenario planning: Techniques and practical application (in Japanese) (Masahiro Kakuwa, Japan Oil, Gas and Metals National Corporation, 2016).

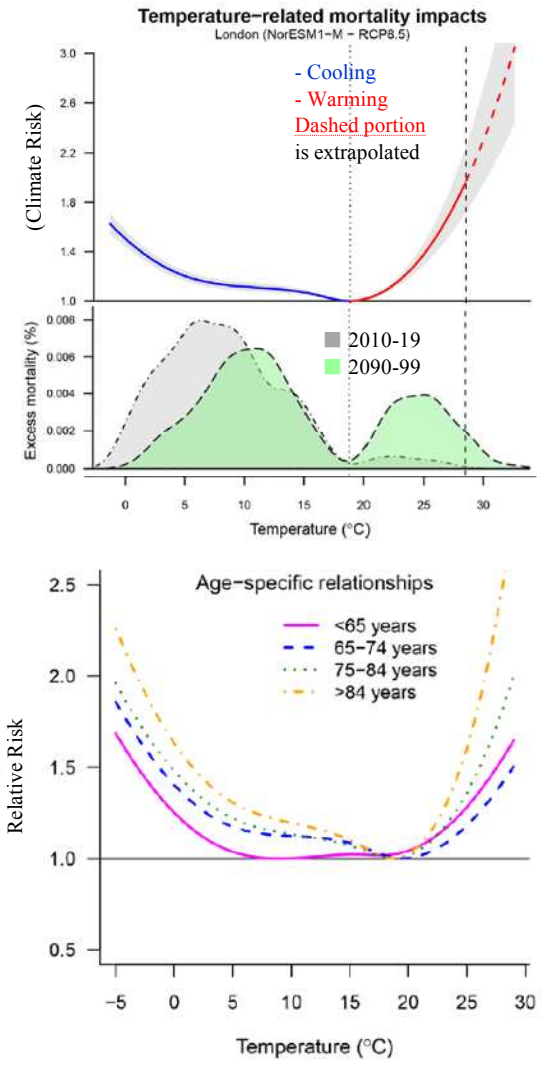
*2 Source: Energy Transformation Scenario 2021: The latest scenario work by Shell (in Japanese) (Masahiro Kakuwa: Japan Oil, Gas and Metals National Corporation, 2021)



Example: Quantitative assessment of impacts on human mortalities

Paper: Tutorial on methodologies for projection and assessment

- Quantitative analysis of the impacts of extreme heat due to climate change is very challenging due to complex risk patterns and uncertainty in scenarios. The paper referenced here presents a detailed methodology as a "tutorial," and demonstrates the importance of having the cooperation of experts in multiple disciplines, such as epidemiology, statistics, climate science, and more.
- This paper projected and assessed the impacts of temperature on mortality rates in London.
- It applied actual data on London's daily average temperatures, total actual mortalities by age group, and daily model temperature data, to 2.6℃ (RCP 4.5) and 4℃ (RCP8.5) warming scenarios.
- With a 4℃ increase, excess mortality rates increased due to extreme heat, especially among the elderly (see figure).
- In Japan, it is also possible to study quantitative impacts based on the methodologies described in this paper, using data such as the number of mortalities by region and by age.



Source: Vicedo-Cabrera, A.M., et. al., Hands-on Tutorial on a Modeling Framework for Projections of Climate Change Impacts on Health, Epidemiology, Volume 30, Number 3, May 2019.

Partnership for Carbon Accounting Financials (PCAF): Formulas for specific asset classes

- As mentioned in Chapter VI, PCAF standards include formulas to calculate GHG emissions for each asset class.
- These two pages show the formulas for calculating the six asset classes under consideration.

Financed emissions: Listed equity and corporate bonds

$$Financed\ emissions = \sum_{c} \left(\frac{Outstanding\ amount\ c}{Enterprise\ Value\ Including\ Cash\ c} \right) \times Company\ emissions\ c$$

Financed emissions: Business loans and unlisted equity

$$Financed\ emissions = \sum_{c} \left(\frac{Outstanding\ amount\ c}{Enterprise\ Value\ Including\ Cash\ c} \right) \times Company\ emissions\ c$$

Financed emissions: Commercial real estate

$$Financed\ emissions = \sum_{b,e} \left(\frac{Outstanding\ amount\ b}{Property\ value\ at\ origination\ b} \right) \times Energy\ consumption\ b,e \times Emission\ factor\ e$$

Source: PCAF, Global GHG Accounting and Reporting Standard for the Financial Industry, 2020

Partnership for Carbon Accounting Financials (PCAF): Formulas for specific asset classes

- Formulas for six asset classes (continued)

Financed emissions: Project finance

$$Financed\ emissions = \sum_{p} \left(\frac{Outstanding\ amount\ p}{Total\ equity + dept\ p} \right) \times Project\ emissions\ p$$

Financed emissions: Mortgages

$$Financed\ emissions = \sum_{b,e} \left(\frac{Outstanding\ amount\ b}{Property\ value\ at\ origination\ b} \right) \times Energy\ consumption\ b \times Emission\ factor\ e$$

Financed emissions: Motor vehicle loans

$$Financed\ emissions = \sum_{v,f} \left(\frac{Outstanding\ amount\ v}{Total\ value\ at\ origination\ v} \right) \times Distance\ travel\ v \times Efficiency\ v,f \times Emission\ factor\ f$$

Source: PCAF, Global GHG Accounting and Reporting Standard for the Financial Industry, 2020

Network for Greening the Financial System (NGFS) scenarios

Worlds depicted by NGFS scenarios

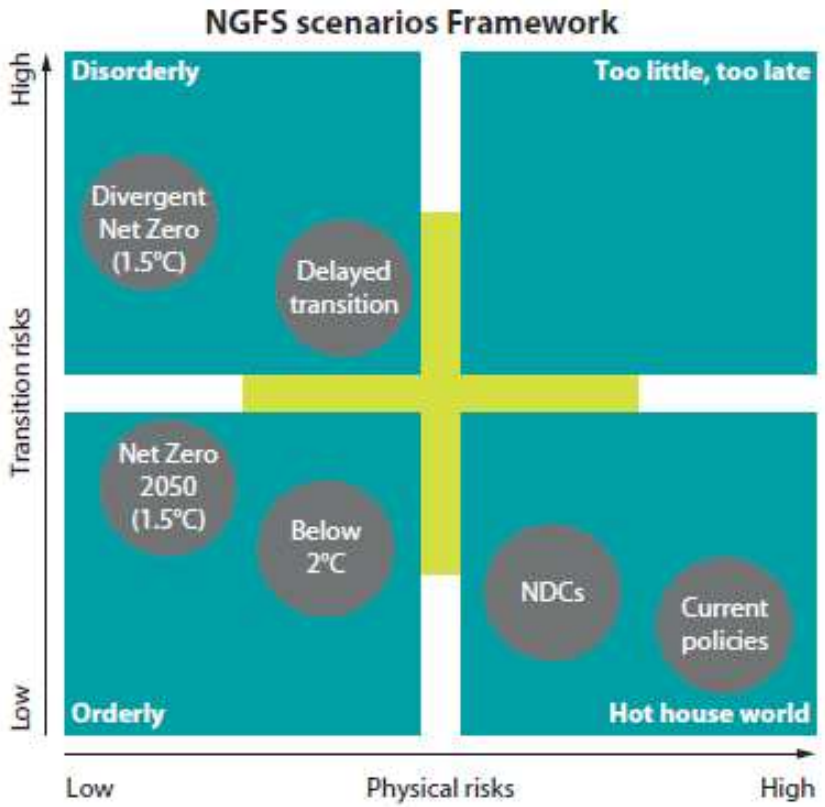
In this Appendix, we look at two "worlds" among the NGFS scenarios covered on page 80 of this handbook: one with the lowest emissions and one with the highest.

- A "Net Zero 2050" world
  - Decarbonization of electricity: Fivefold increase in renewables over the next 30 years.
  - Electrification of buildings, industries, and transportation: By 2050 more than half of the buildings, industry, and transportation-related energy is electrified.
  - Transition to carbon neutral fuels: In 2050, more than 40% of gas, liquid, and solid fuels are carbon neutral.
  - CO2 storage and removal: Carbon removals of about 5 Gt/year are required to cost-effectively achieve 1.5℃ by 2050.
  - Energy conservation for the entire economy: Reduce energy intensity by about 60% between 2020 and 2050.
  - Decarbonization of agricultural, forestry and other land uses: CO_2 emissions from these sectors can reach net zero by 2030.

Network for Greening the Financial System (NGFS)

Worlds depicted by NGFS scenarios (continued)

- Current policies: Physical risk in a world of 3℃ average temperature rise.
  - Increase in average temperature: If no action is taken, average global temperature will exceed 1.5℃ in the 2030s and 2℃ by about 2050.
  - High temperatures versus labor productivity: Labor productivity could fall by an average of 12% globally.
  - Changes in population exposed to extreme weather: More than an eightfold increase in global population exposed to effects of drought.
  - Direct losses due to tropical cyclones: Could increase by as much as 45%.



Direction and focus of future NGFS initiatives

NGFS: Glasgow Declaration

The NGFS announced the Glasgow Declaration on November 3, 2021 at COP26. It states the intention to work on the following initiatives in the coming years:

- further enhance and enrich its climate scenario, thus providing on a regular basis an important public good for a broad range of stakeholders, both public and private;
- deepen its analysis on integrating climate change considerations into monetary policy strategies and frameworks, in the context of the mandates of its members;
- intensify the work to bridge the data gaps that currently hinder the identification, management and mitigation of climate-related risks;
- supplement the set of NGFS practical guides with guidelines on TCFD-aligned reporting for central banks, and facilitate uplift in supervisory capabilities and the global consistency of supervisory practices;
- step up its efforts on capacity building, with a particular focus on members from emerging and developing economies, to support members' progress in addressing climate-related and environmental risks and in implementing the NGFS recommendations;
- keep exploring emerging topics such as the impact of the loss of biodiversity or the risks associated with climate-related litigation, and work towards addressing them, in the context of the mandates of its members;
- continue to cooperate with standard-setters, other policy makers, the financial sector, academia and other relevant stakeholders to keep on distilling best practices, identifying challenges and solutions and avoiding duplication of work.

Alliances based on financial institution initiatives

Glasgow Financial Alliance for Net Zero (GFANZ)

- Established April 2021. This is an alliance that combines four financial initiatives described below. It was officially inaugurated on November 3, 2021 at COP26, when three more initiatives joined.
- Chaired by Mark Carney, former Governor of the Bank of England, UN Special Envoy on Climate Action and Finance. Co-chaired by Michael Bloomberg, Global Ambassador of Race to Zero campaign and chair of TCFD. Vice chair is Mary Schapiro, former chairman of the U.S. Securities and Exchange Commission, and Head of the Secretariat for TCFD. Permanent secretariats are located in Europe, United States, Asia, Africa.
- All member companies must be certified under the United Nations Race to Zero campaign and use the guidelines for achieving net zero emissions based on scientific evidence to develop plans for reducing GHG emissions (covering Scopes 1, 2 and 3).
- They must commit to setting provisional targets for 2030 and to transparent reporting and accounting in line with Race to Zero standards.
- In addition, GFANZ announced that it would regularly report to the G20 Financial Stability Board (FSB).
- As of January 1, 2022, more than 450 companies had joined, representing total assets of $130 trillion. Four Japanese life insurers are members through NZAOA, described on the next page.

Alliances based on financial institution initiatives

Net Zero Asset Owner Alliance (NZAOA)

- Established in September 2019 at the UN Secretary-General's Climate Action Summit.
- It was initiated by Caisse des Dépôts, La Caisse de depôt et placement du Québec (CDPQ), Folksam Group, PensionDanmark, and SwissRe. Shortly afterward, Alecta, AMF, CalPERS, Nordea Life and Pension, Storebrand, and Zurich Insurance joined as founding members.
- Committed to transition to net zero emissions with no and low overshoot pathways by 2050.
- As of January 1, 2022, more than 69 companies had joined, representing total assets of $10.4 trillion. Four Japanese life insurers are members.

Alliances based on financial institution initiatives

Net Zero Banking Alliance (NZBA)

- Jointly led by UNEP FI and the Prince of Wales' Sustainable Markets Initiative Financial Services Taskforce (FSTF). **Established April 2021**.
- As of January 2022, 102 companies from 40 countries were members, representing total assets of $67 trillion.
- There were initially no members from Japan, but five Japanese financial institutions (groups) had joined by October 2021.

Alliances based on financial institution initiatives

Net Zero Asset Managers initiative (NZAM)

- **Launched October 2020**. As of January 2022, 220 companies were signatories, representing total assets under management of $57 trillion.
- As of January 1, 2022, 9 companies from Japan had signed.

Net-Zero Insurance Alliance (NZIA)

- **In July 2021**, NZIA was launched by eight insurers and reinsurers under the Principles for Sustainable Insurance (PSI), in cooperation with UNEP-FI, in the lead-up to November 2021 (COP26).
- As of January 2022, there were 20 members, including one each from Kenya, Korea and Japan, and all others from Europe. From Japan, Tokio Marine joined in January 2022.

Alliances based on financial institution initiatives

New GFANZ members announced at COP26

Paris Aligned Investment Initiative (**PAII)**

- Established May 2019. A global forum led by investor groups to help investors align their portfolios with the goals of the Paris Agreement. It includes four networks working together: Institutional Investors Group on Climate Change (IIGCC, Europe), Ceres (United States), Asia Investor Group on Climate Change (AIGCC, Asia), and Investor Group on Climate Change (IGCC, Australia).

Net Zero Financial Service Provider Alliance (**NZFSPA**)

- Established September 2021. It has 23 signatories (as of January 2022), including the world's largest rating agencies, audit networks, major index providers, global stock exchanges, data providers, and advisory service providers.

Net Zero Investment Consultant Initiative (**NZICI**)

- Established September 2021. Members include 12 major investment consultancy companies. It assists customers in prioritizing real emission reductions by integrating advice on net-zero into investment consulting services.

Starter's Guide to Climate Change Scenario Analysis:

Practices and Trends for Scenario Analysis in the Life Insurance Industry

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https://www.hq-greenpacific.co.jp/