

Task Force on Climate-related Financial Disclosures

Guidance on Risk Management
Integration and Disclosure

TCFD

TASK FORCE ON
CLIMATE-RELATED
FINANCIAL
DISCLOSURES

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A. Background and Purpose

Since the Task Force on Climate-related Financial Disclosures (Task Force or TCFD) issued its final recommendations in June 2017, it has monitored climate-related financial disclosure practices and sought to identify and, when possible, address challenges in implementing the TCFD recommendations.¹ As part of those efforts, the Task Force identified specific issues related to implementing its Risk Management recommendation (see [Figure A1](#)), including the following:

- 75% of companies surveyed by the TCFD indicated the Risk Management recommendation is somewhat or very difficult to implement and
- several of these companies indicated they do not have processes for identifying, assessing, or managing climate-related risks.²

Figure A1 Risk Management Recommendation

Disclose how the company identifies, assesses, and manages climate-related risks.

- Describe processes for identifying and assessing climate-related risks.
- Describe processes for managing climate-related risks.
- Describe how processes for identifying, assessing, and managing climate-related risks are integrated into overall risk management.

In addition, the Task Force’s latest status report shows companies’ disclosure of their risk management processes is lower than their disclosure of most other recommended disclosures.³ Given this and the issues noted above, the Task Force developed this guidance to help address some of the issues companies

may face in implementing the Risk Management recommendation.⁴ In particular, this guidance is aimed at companies that 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 TCFD recommendations. Companies with established risk management processes for climate-related risks — regardless of whether those processes are integrated into broader or overall risk management processes — may find [Section E. Disclosure of Risk Management Processes](#) useful for disclosing information in alignment with the Risk Management recommendation.

The remainder of this guidance is organized as follows:

[Section B. Scope and Approach](#). Describes the scope of this guidance to cover financial and non-financial companies with a focus on climate-related risks and the Task Force’s use of defined risk management concepts and terms to ensure consistency of the terminology used.

[Section C. Unique Characteristics of Climate-Related Risks](#). Describes the unique characteristics of climate-related risks that are important to consider when integrating such risks into existing processes.

[Section D. Integration in Practice: Key Principles and Initial Steps](#). Explores the practicalities of integrating climate-related risks into existing risk management processes.

[Section E. Disclosure of Risk Management Processes](#). Describes features of decision-useful risk management disclosures as well as examples of companies’ disclosures.

[Appendices](#). Provide further information on topics covered in the guidance, including transition and physical risk definitions, additional information to support integration, and references.

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¹ TCFD, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures*, June 29, 2017.

² As part of its 2019 status report, the Task Force conducted a survey to better understand companies’ efforts to implement the TCFD recommendations and associated challenges. See the Task Force’s [2019 status report](#), pp. 56–57.

³ See the Task Force’s [2020 status report](#).

⁴ In this document, the Task Force uses the term “companies” to refer to entities with public debt or equity and other organizations implementing the TCFD recommendations.

B. Scope and Approach

The Task Force recognizes companies implementing its recommendations come from various industries and use a wide range of practices and techniques to manage their risks. Some may use fully integrated, enterprise-wide risk management processes while others may use risk management processes that are more focused on individual hazards. In this guidance, the Task Force does not prescribe specific risk management frameworks or approaches as individual companies are best positioned to determine this given their circumstances. Instead, this guidance focuses on integrating climate-related risks into existing risk management processes and disclosing information on those processes.

“Incorporating climate change risks into the existing risk management framework is likely to be the best way to ensure that the impact of climate change is properly considered in decision making.”⁵

1. COMPANIES IN SCOPE

In developing this guidance, the Task Force considered the types of companies that might benefit most from it. Based on the results of the Task Force’s survey for its 2019 status report, companies that found the Risk Management recommendation difficult to implement and indicated they do not have processes for identifying, assessing, or managing climate-related risks were nearly evenly split between financial and non-financial companies. As a result, this guidance is intended to cover a wide range of companies — from banks and insurance companies to various types of non-financial companies, including energy; building and materials; and agriculture, food, and forest products companies. In addition, as with its recommendations in general, the Task Force expects this guidance to be useful to companies of all sizes and located in various countries around the world.

2. FOCUS ON CLIMATE-RELATED RISKS

In its 2017 report, the Task Force made four recommendations on climate-related financial disclosures, described in [Figure B1](#). Notably, the Task Force’s recommendations related to governance, strategy, and metrics and targets ask companies to disclose specific information on their climate-related risks **and** climate-related opportunities, while the recommendation on risk management focuses on climate-related risks. Since the primary purpose of this guidance is to help companies with implementing the Risk Management recommendation, its primary focus is on climate-related risks. Nevertheless, the Task Force believes consideration of climate-related opportunities is equally as important and recognizes the execution of risk management processes may facilitate the identification of

Figure B1
TCFD Recommendations

The Task Force’s recommendations on climate-related financial disclosures, listed below, are structured around four thematic areas that represent core elements of how companies operate: governance, strategy, risk management, and metrics and targets.

Governance

Disclose the company’s governance around climate-related risks and opportunities.

Strategy

Disclose the actual and potential impacts of climate-related risks and opportunities on the company’s businesses, strategy, and financial planning where such information is material.

Risk Management

Disclose how the company identifies, assesses, and manages climate-related risks.

Metrics and Targets

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

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⁵ Parker Fitzgerald, *Climate Change Risk Management in Financial Services*, November 2019, p. 2.

opportunities. Climate-related opportunities may arise as part of the development of responses to specific climate-related risks — for example operational and restructuring efficiencies and development of new products, services, and markets. In terms of defining climate-related risks, this guidance uses the definitions included in the Task Force’s 2017 report, as described in [Appendix 1: Climate-Related Risks and Potential Financial Impacts](#). In its 2017 report, the Task Force divided climate-related risks into two major categories — (1) risks related to the transition to a lower-carbon economy and (2) risks related to the physical impacts of climate change.

management topics in this guidance. COSO’s ERM framework provides a possible approach for boards and management to use to identify risks, manage such risks within a defined risk appetite, and support the achievement of objectives. The framework describes considerations around linking risk with strategy setting and day-to-day activities and embedding risk throughout a company’s culture and performance management practices. The framework is built around five components, as described in [Figure B2](#); and while all five components are relevant to managing risk, this guidance focuses on the “Performance” component, which aligns with the Task Force’s Risk Management recommendation.

3. COMMON RISK MANAGEMENT LANGUAGE

Since the guidance is intended for companies of all sizes, from a wide range of industries, and located in various countries around the world, the Task Force sought to frame the discussion of risk management processes using concepts from a well-recognized, international risk management framework. As described in [Appendix 2: International Risk Management Frameworks](#), the Task Force uses the Committee of Sponsoring Organizations of the Treadway Commission’s (COSO’s) enterprise risk management (ERM) framework as the foundation for discussing risk

Importantly, while this guidance uses concepts from COSO’s ERM framework, it is intended for use with other risk management frameworks as well, such as ISO 31000 or company-specific risk management frameworks and processes. In addition, the Task Force recognizes companies implementing its recommendations may be subject to specific laws and regulations that affect how they operate — including how they manage risk — and what information they disclose. This guidance should not be seen as superseding laws and regulations to which a company is subject.

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Figure B2
COSO’s Risk Management Components



Executive Summary: Enterprise Risk Management — Integrating with Strategy and Performance, © 2017, Committee of Sponsoring Organizations of the Treadway Commission (COSO). All rights reserved. Used with permission.

Note: Emphasis added to Performance component.

C. Unique Characteristics of Climate-Related Risks










In integrating climate-related risks into their existing processes, companies should consider the unique characteristics of these risks as they may affect how integration is accomplished. In this section, the Task Force provides a brief description of the wide-ranging implications of climate change and then highlights the unique characteristics of climate-related risks.

In terms of the range of implications of climate change, it is widely recognized that continued emission of greenhouse gases will cause further warming of the Earth and that warming above 2° Celsius (2°C), relative to the preindustrial period, could lead to catastrophic economic and social consequences.⁶ In its special report

on the impacts of global warming of 1.5°C, the Intergovernmental Panel on Climate Change (IPCC) warned limiting the global average temperature to a maximum of 1.5°C requires “rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities.”⁷ Some of the possible implications associated with different levels of warming are shown in Figure C1.⁸

These implications include potential impacts on human health, infrastructure, transportation systems, energy, food, and water supplies. For companies, this means climate change can affect their facilities and operations, supply and distribution chains, employees, and customers.

Figure C1
Possible Implications of Different Temperature Increases

Warming by 2100	<2°C		3°C	5°C
	1.5 °C	2 °C		
Physical Impacts				
 Sea-level rise	0.3-0.6 m	0.4-0.8 m	0.4-0.9 m	0.5-1.7 m
 Chance of ice-free Arctic summer	1 in 30	1 in 6	4 in 6 (63%)	6 in 6 (100%)
 Frequency of extreme rainfall	+17%	+36%	+70%	+150%
 Increase in wildfire extent	x1.4	x1.6	x2.0	x2.6
 People facing extreme heatwaves	x22	x27	x80	x300
 Land area hospitable to malaria	+12%	+18%	+29%	+46%
Economic Impacts				
 Global GDP impact (2018: \$80tn)	-10%	-13%	-23%	-45%
 Stranded assets	Transition: fossil fuel assets (supply, power, transport, industry)		Mixed: some fossil fuel assets and some physical stranding	Physical: uninhabitable zones, agriculture, water-intensive industry, lost tourism
 Food supply	Changing diets, yield loss in tropics		24% yield loss	60% yield loss, 60% demand increase

⁶ IPCC, *Fifth Assessment Report*, Cambridge University Press, 2014.

⁷ IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, October 2018.

⁸ Content in this figure is adapted from the CRO Forum’s *The Heat Is On—Insurability and Resilience in a Changing Climate*, January 2019. The CRO Forum indicates its report “relies heavily on the [IPCC] for data and charts, drawn from SR15 and AR5 working papers.”

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Based on economic models that have been adapted to take a broader view of climate-related risk — such as allowing for damage from tipping points, extreme events, and socio-political consequences of food crises, migration, and conflict — global GDP (gross domestic product) could be significantly lower by 2100, especially at higher levels of warming.⁹ In addition to climate-related physical risks, companies also need to consider risks associated with society's responses to climate change and the transition to a lower-carbon economy (climate-related transition risks), which include policy changes, reputational impacts, and shifts in market preferences and technology. For example, the development and use of emerging technologies such as renewable energy and battery storage will affect the competitiveness of certain companies, their production and distribution costs, and ultimately the demand for their products and services from end users.

Given the wide-ranging implications of climate change in the short term and over the longer term, assessing the associated risks involves dealing with a set of complex variables and connections, many of which operate at different temporal and spatial scales. A critical aspect of integrating climate-related risks into existing processes involves taking into account the unique characteristics of these risks — described in [Table C1](#) — that might not be fully considered in the existing processes. This is the case whether climate-related risks are viewed as stand-alone risks or drivers of existing risks.

Recognizing these unique characteristics is important for understanding how climate-related risks may affect a company; and integrating climate-related risks into existing risk management processes often requires adjusting existing processes to ensure these unique characteristics are reflected.

Table C1 Characteristics of Climate-Related Risks

Different effects based on geography and activities	The effects of climate change and climate-related risks occur on local, regional, and global scales with different implications for different businesses, products and services, markets, operations, and value chains, among others.
Longer time horizons and long-lived effects	Some climate-related risks exist and play out over time horizons that stretch beyond traditional business planning and investment cycles . These risks and related impacts may occur as a result of decades-long changes in driving forces (e.g., greenhouse gas concentrations in the atmosphere) leading to climate-related physical or transition risk changes over the short, medium, and long term.
Novel and uncertain nature	Many of the effects of climate change have no precedent, limiting the ability to apply statistical and trend analysis based on historical data. Climate change is a dynamic and uncertain phenomenon and possible mitigation responses are also complex, with many unknowns such as the development and deployment of critical technologies and adaptation strategies as well as changing market and consumer behaviors.
Changing magnitude and nonlinear dynamics	Climate-related risks may manifest at different scales over time, with increasing severity and scope of impacts. Climate systems may exhibit thresholds and tipping points that result in large, long-term, abrupt, and possibly irreversible changes . ¹⁰ Understanding the sensitivities of tipping points in the physical climate system, as well as in ecosystems and society, is essential for understanding climate-related risks.
Complex relationships and systemic effects	Risks associated with climate change are interconnected across socioeconomic and financial systems . Such interconnected risks are often characterized by knock-on effects and systemic effects, requiring a multidimensional perspective to assess the short-, medium-, and long-term implications for a company.

⁹ According to the [CRO Forum's report](#) (p. 14), "global GDP could be 25-40% lower by 2100 in a >3°C scenario versus baseline." These estimates are more severe than many other studies; however, the Network for Greening the Financial System (NGFS) — a group of 72 central banks and supervisors — has indicated existing studies likely *underestimate* the risks associated with increased warming levels. In [Climate Scenarios for Central Banks and Supervisors](#), the NGFS describes damage estimates associated with 3°C of warming from several studies, which range from a loss of 2% of global GDP to a loss of 25%. The NGFS indicates estimates vary for many reasons, such as the modeling approach used and whether impacts are considered to directly affect growth rate. It also highlights few studies fully capture the potential risks of tipping points and most assume socioeconomic factors such as population, migration, and conflict remain constant even at high levels of warming.

¹⁰ Lenton, T. M., et al., "Climate Tipping Points—Too Risky to Bet Against," *Nature*, Vol. 575, 2019.

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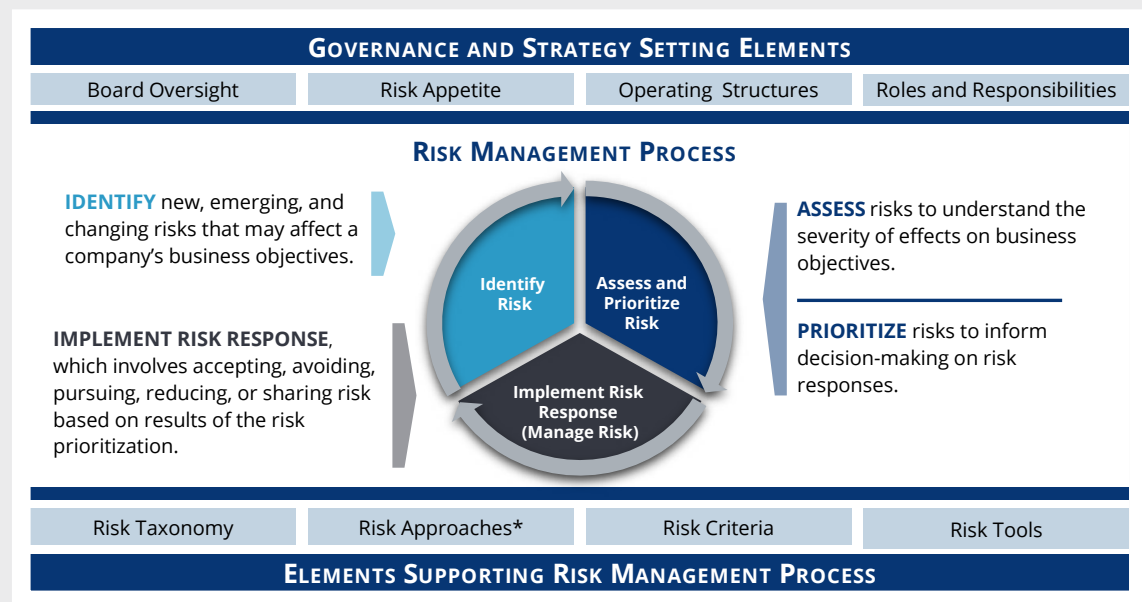
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D. Integration in Practice: Key Principles and Initial Steps

This section describes principles the Task Force believes should underpin the integration of climate-related risks into a company's existing risk management processes and outlines initial steps that may help a company begin such an integration. As mentioned previously, the Task Force recognizes companies implementing its recommendations come from various industries and use a wide range of practices and techniques to manage their risks. Some may use fully integrated, enterprise-wide risk management processes while others may use risk management processes that are more focused on individual hazards. While there are various

ways companies manage their risks in terms of organizational structure, roles and responsibility, and the specific approaches and tools used, there is a general set of overarching activities or processes and associated key elements that are common to risk management in most companies (even if referred to differently). Given this general consistency in overarching or common risk management processes and key elements (see Figure D1), we refer to these throughout the guidance when discussing the integration of climate-related risks into risk management processes.¹¹

Figure D1
Common Risk Management Processes and Key Elements



* Risk approaches include approaches used for identifying and assessing risks.

¹¹ Figure D1 is based on concepts included in COSO and WBCSD's *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

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A general understanding of risk management processes and how they relate to strategy is also important context for this guidance. In this regard, the Task Force highlights a concept from COSO’s ERM framework, as described below.

Every organization — whether for-profit or not — exists to create and preserve value for its stakeholders; and value is created, preserved, or eroded through management’s decisions across all activities, from setting strategy and executing on business objectives to operating the organization on a day-to-day basis.¹²

The overarching purpose of risk management — in whatever form it takes — is to support a company in achieving its strategy and business objectives to create value for its stakeholders. The primary purpose of *disclosing* risk management processes is to provide context for how the company thinks about and addresses the most significant risks to successfully executing its business objectives and accomplishing its strategy.

1. KEY PRINCIPLES TO GUIDE INTEGRATION OF CLIMATE-RELATED RISKS

The Task Force identified specific, key principles — shown in [Table D1](#) — to help companies achieve effective integration of climate-related risks into existing risk management processes. The Task Force further believes these key principles are also useful for the ongoing management of climate-related risks, which is beyond the scope of this guidance.¹³

The key principles are woven into the discussion in this section on integrating climate-related risks into existing risk management processes. The principles support climate change considerations being included in the elements of risk management processes consistently and proportionately, taking into account other risks to which the risk management process applies. Interconnections between climate-related risks and other risks should be considered as part of the integration process and where the existing elements are applied to a limited business or strategic planning horizon, integration should take account of the longer time horizons over which climate-related risks might materialize.

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Table D1 Key Principles for Integration



Interconnections. Integrating climate-related risks into existing risk management requires analysis and collaboration across the company. The principle of interconnections means all relevant functions, departments, and experts are involved in the integration of climate-related risks into the company’s risk management processes and in the ongoing management of climate-related risks.



Temporal Orientation. Climate-related physical and transition risks should be analyzed across short-, medium-, and long-term time frames for operational and strategic planning, which may require extending beyond traditional planning horizons.



Proportionality. The integration of climate-related risks into existing risk management processes should be proportionate in the context of the company’s other risks, the materiality of its exposure to climate-related risks, and the implications for the company’s strategy.



Consistency. The methodology used to integrate climate-related risks should be used consistently within a company’s risk management processes to support clarity on analysis of developments and drivers of change over time.

¹² COSO, *Applying COSO’s Enterprise Risk Management — Integrated Framework*, September 2004.

¹³ The key principles for integration complement and should be read in conjunction with the TCFD’s “[Fundamental Principles for Effective Disclosure](#).”

2. INITIAL STEPS FOR INTEGRATING CLIMATE-RELATED RISKS INTO RISK MANAGEMENT

The Task Force’s guidance on integrating climate-related risks into existing processes is organized as a set of high-level, initial steps and is intended to support companies in identifying important considerations for integration.¹⁴ In addition, the Task Force views these initial steps — summarized below — as iterative rather than strictly sequential.

Step 1 – Ensure there is a general understanding across the company of climate change concepts and its potential impacts.

Step 2 – Identify the specific risk management processes and elements that may need to be adjusted for the integration of climate-related risk as well as the functions and departments responsible for those processes and elements.

Step 3 – Incorporate climate-related risks into the existing risk taxonomy and risk inventory used

in the company. This includes mapping climate-related risks to existing risk categories and types.

Step 4 – Adapt existing risk management processes and key elements based on information gained in the previous steps and the characteristics of climate-related risk as described in [Section C. Unique Characteristics of Climate-Related Risks](#).

These steps draw on guidance developed by COSO and the World Business Council for Sustainable Development (WBCSD) on integrating environmental, social, and governance-related risks into risk management processes (COSO-WBCSD guidance) as well as other COSO documents and are meant to provide a starting point for companies in thinking through the integration of climate-related risks into existing risk management processes.¹⁵ There are multiple considerations related to integration a company may need to explore; and *some* of these are depicted in [Figure D2](#). Those reflected in bold, blue text are described in this sub-section.

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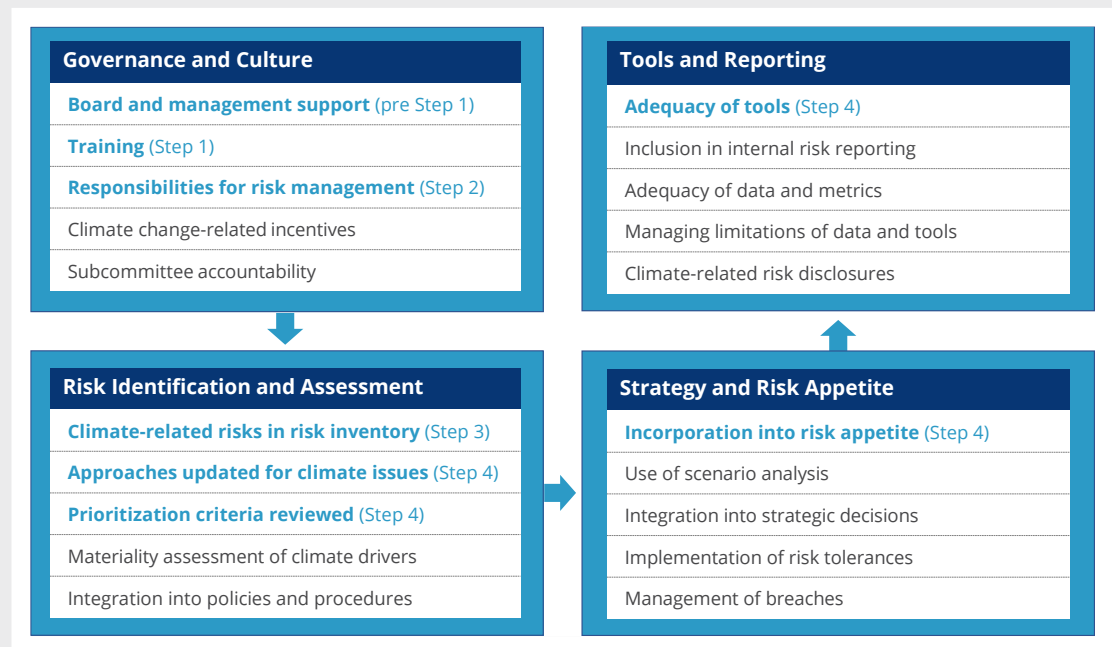
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Figure D2

Examples of Considerations Related to Integration



Text in bold, blue font represents considerations described in this guidance, while text in regular font represents examples of other considerations a company may need to explore as part of integration. These examples are not exhaustive.

¹⁴ COSO’s *Creating and Protecting Value: Understanding and Implementing Enterprise Risk Management* (thought paper) provides an approach and steps for implementing enterprise risk management that could be adapted for integrating climate-related risks into existing risk management processes. The approach and steps “are based on successful practices that companies have used to take an incremental, step-by-step approach to implementing enterprise risk management.” The thought paper provides initial steps a company could take, including forming a management working group to oversee integration and inventorying the company’s existing risk management practices.

¹⁵ COSO and WBCSD, *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

Importantly, before undertaking an effort as significant as integrating climate-related risks into existing risk management processes, it is important to have board and senior management support. The board and senior management not only set the strategy of the company, they also set the “tone at the top” and

culture of the company. Support from the board and senior management is probably the single most important success factor for an effort such as this.¹⁶ Without this support, it may be difficult to engage the people across the company as well as other resources needed to work through the issues associated with integration.

1. UNDERSTAND CLIMATE CHANGE CONCEPTS

Foundational

For companies where climate-related risks have not traditionally been discussed or explicitly addressed as part of existing risk management processes, it is important to ensure there is a basic level of understanding across the company of climate change concepts and its potential impacts. For example, it may be helpful to define key terms and outline some of the significant climate change hazards and general impacts to allow management and others involved in managing risk to connect the general effects of climate change to more specific implications for the company. [Figure D3](#) provides a sample of climate change hazards, key vulnerabilities, and key risks based upon the IPCC’s Fifth Assessment Report.¹⁷

Figure D3

Sample of Climate Change Hazards

Sea level rise, coastal flooding

Key Vulnerabilities: High exposure of people, economic activity, and infrastructure in low-lying coastal zones

Key Risks: Death, injury, and disruption to livelihoods, food supplies, and water

Extreme heat

Key Vulnerabilities: Increasing urban populations of the elderly, very young, and people with chronic health problems subject to higher temperatures

Key Risks: Increased mortality and morbidity during periods of extreme heat

Drought

Key Vulnerabilities: Existing water shortages and constraints on increasing supply

Key Risks: Insufficient water supply, yielding severe harm and economic impacts

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¹⁶ COSO, *Creating and Protecting Value: Understanding and Implementing Enterprise Risk Management*, January 2020.

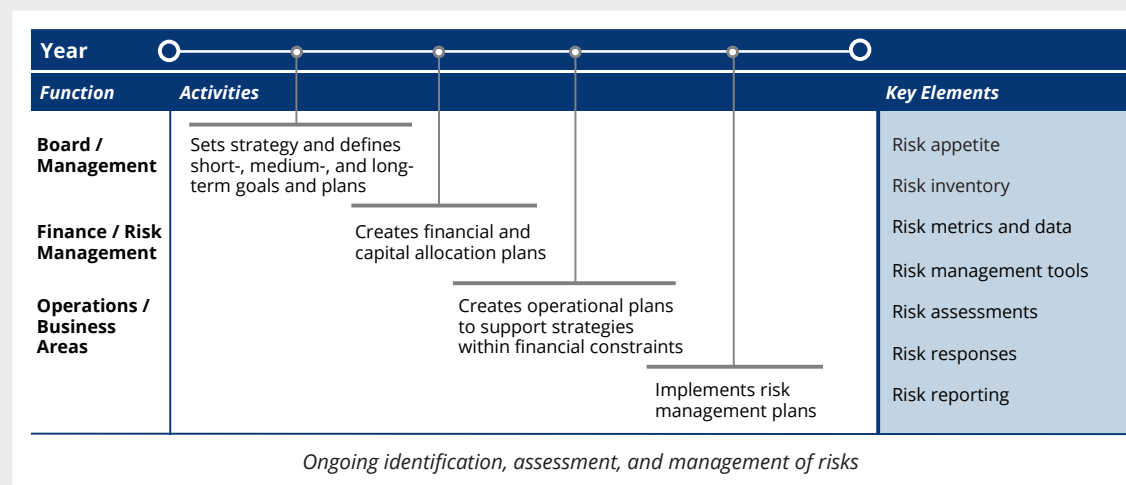
¹⁷ IPCC, *Emergent Risks and Key Vulnerabilities*, 2014.

2. IDENTIFY PROCESSES AND FUNCTIONS

Key Principle 

An important aspect of integrating climate-related risks into existing processes is to understand how risk management and strategic planning tie together and who the key stakeholders are. In this regard, it may be helpful to review key governance, strategy setting, and risk management elements (Figure D1, p. 6) and then identify the various functions involved in risk management activities that support strategic planning (Figure D4).¹⁸

Figure D4
Illustrative Strategic Planning Cycle



This type of information may help a company in identifying key risk management elements and the functions and departments responsible for various aspects of the company's risk management process. Such information is useful for determining the key stakeholders needed for risk identification, assessment, and management processes.

3. UPDATE RISK TAXONOMY

Key Principle  

Using a common risk taxonomy — a set of consistently defined risk categories and sub-categories — helps companies identify, assess, and manage their risks.¹⁹ Part of integrating climate-related risks into existing processes involves determining whether such risks will be treated as stand-alone risks, cross-cutting drivers of existing risks, or a combination of both and then appropriately incorporating the risks into the company's risk taxonomy. The way in which climate-related risks are integrated into existing risk management processes may depend in part on the risk categories or sub-categories that have already been defined. Commonly used risk categories include financial, operational, and strategic; however, most companies have additional risk categories as well.

¹⁸ Figure D4 is adapted from the COSO-WBCSD guidance (see p. 19).

¹⁹ A risk taxonomy refers to how a company organizes risks consistently across the company and establishes "parent-child" relationships between broad risk categories and specific sub-categories.

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The Task Force believes, in most situations, climate-related risks are drivers of existing risks (i.e., risk factors) and focuses on such treatment in this guidance. To start, companies may benefit from mapping climate-related risks to their existing risk categories. For example, events associated with climate change may increase the cost of raw materials, which is an existing risk for many companies (see [Figure D5](#)).

Figure D5
Sample of Risk Categories, Risk Types, and Climate-Related Risks

Category	Type (Sub-Category)	Climate-Related Risks
Financial	<ul style="list-style-type: none"> • Credit Risk • Liquidity Risk • Tax Strategy 	<ul style="list-style-type: none"> • Creditworthiness is eroded and interest rates rise as lenders consider escalating business risks related to climate change • Costs increase from taxes or fees on carbon emissions
Operational	<ul style="list-style-type: none"> • Supply Chain • Raw Material Availability • Business Continuity 	<ul style="list-style-type: none"> • Supply chain disruptions occur because of droughts or extreme weather impacts in supplier regions • Costs increase on raw materials due to sustainable forestry practice requirements • Changing weather patterns and increased natural disasters disrupt operations
Strategic	<ul style="list-style-type: none"> • Competition • Changing Customer Preferences 	<ul style="list-style-type: none"> • Shift in customer preferences toward products that are produced with lower emissions or that produce lower emissions

Once a company has determined how climate-related risks fit into the existing risk taxonomy and risk categories, it should consider updating its risk inventory, which lists the risks the company faces and generally includes the major risk categories along with standard definitions of the risks.²⁰ A risk inventory may also include a description of the impact of each risk, possible risk responses, and a risk owner. As a company works through integration and staff become more familiar with climate-related risks, updating the risk inventory may occur more frequently than usual in the beginning stages.

4. ADJUST RISK MANAGEMENT ELEMENTS *Key Principle*

The fourth step is to adapt existing risk management processes and associated elements based on knowledge gained through the previous steps and on the unique characteristics of climate-related risks. To provide a general idea of how a company might begin the process of adjusting its risk management processes and associated elements, the Task Force outlines considerations related to risk appetite, risk identification and assessment, and risk management tools.

Risk Appetite

Risk appetite refers to the types and amount of risk, on a broad level, a company is willing to accept in pursuit of value. Risk tolerance is defined as the boundaries of acceptable variation in performance related to achieving business objectives. Once set, risk appetite and risk tolerance become the

²⁰ COSO and WBCSD, *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

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boundaries for acceptable decision-making. Boards and management typically set the risk appetite for a company when considering strategy and business plans, as the two are often intertwined.²¹ Figure D6 outlines important aspects of a company's risk appetite that should be considered when integrating climate-related risks.²² For example, consideration of climate-related risks and opportunities may affect a company's strategic plans in terms of the types and amounts of risks it is willing to accept as well as new products and services it plans to develop. Adjusting a company's risk appetite may be an iterative process as the board and management become more familiar with climate-related risks and opportunities and how those issues factor into their strategic thinking.

Risk Identification and Assessment: Time Horizons

A key consideration in integrating climate-related risks into existing risk management processes relates to the time horizon over which risks are identified and assessed and whether that time horizon is sufficiently long-term to take account of the range of climate-related risks. Under its Strategy recommendation, the Task Force asks companies to describe the climate-related risks and opportunities they have identified over the short, medium, and long term. As a result, a company's risk management process should support the identification of risks that may arise in the long term as well as the short and medium term. However, based on a 2017 WBCSD study, the time horizon for many companies' risk identification and assessment processes is typically two to five years, with some companies using a longer time horizon of five to ten years given their longer investment time frames.²³

Recognizing some climate-related risks may have implications for a company beyond five or ten years, the Task Force encourages companies to consider the appropriate time frames when identifying and assessing climate-related risks as well as potential approaches to support the identification and assessment of longer-term climate-related risks (as described in Table D2, p. 13, and Table D3, p. 14).

Risk Identification and Assessment: Approaches

A company's existing approaches to identifying and assessing risks may warrant adjustment to ensure those approaches sufficiently address the unique characteristics of climate-related risks. For example, in companies where risk identification is performed separately by individual business and operations areas, such an approach may miss certain climate-related risks, especially ones that are interconnected across socioeconomic and financial systems. To surface these types of risks, a company may want to consider bringing together multidisciplinary teams to work together.

To help companies think about possible adjustments to their identification and assessment approaches, the Task Force outlines some of the unique characteristics of climate-related transition (Table D2, p. 13) and physical risks (Table D3, p. 14), respectively, as defined in its 2017 report and describes possible approaches and metrics companies may want to consider when incorporating climate-related risks into their existing processes.²⁴ Many of the characteristics included in the tables below tie back to those described in Table C1 (p. 5).

Figure D6 Considerations for Adjusting Risk Appetite

Approach to Setting Risk Appetite

Risk appetite is defined at a high level (top down), based on a company's core values and strategic ambition, and **rooted in the business context**.

Risk appetite considers the types of risks (e.g., strategic, operational, financial) the company needs to take or avoid in order to achieve its strategic ambition.

A company is typically willing to take on a **net total amount of risk, which can be allocated to each category of risk** to align with the company's core values and strategy.

Risk capacity is the maximum amount of risk that a company can absorb in the pursuit of strategy and business objectives. It considers liquidity, stakeholder relationships, capabilities, and other factors.

Risk capacity provides a set of boundaries for defining meaningful risk appetite and tolerance.

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²¹ COSO and WBCSD, *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

²² Adapted from the *COSO-WBCSD guidance* (see p. 34).

²³ World Business Council for Sustainable Development, *Sustainability and Enterprise Risk Management: The First Step Towards Integration*, January 18, 2017.

²⁴ See Table A1-1 (p. 36) for the Task Force's definitions of climate-related transition and physical risks.

Table D2
**Transition Risks and Identification
 and Assessment Approaches**

Type	Characteristics	Approaches	Possible Metrics
Policy and Legal	<ul style="list-style-type: none"> • Differences in local, regional, and global requirements and incentives • Novel and uncertain effects of policy and legal actions across jurisdictions • Complex relationships connecting different regulatory developments across different actors and departments 	<ul style="list-style-type: none"> • Tracking of regulatory developments • Assessment of impact of regulation, including implications across operations, supply chains, and jurisdictions • Cross-functional, multidisciplinary collaboration to identify risks and implications • Scenario analysis focused on policy environment, sequence, timing, and relationships 	<ul style="list-style-type: none"> • Financial impact of carbon pricing and emission trading • Asset write-off, asset impairment, and retirement cost • Number of nodes of influence connecting key policy developments • Number of relevant policy measures and development timelines • Number of lawsuits brought forward
Technology	<ul style="list-style-type: none"> • Uncertain role of different solutions and technologies over time, for different uses, and in different contexts • Novel technologies, capabilities, and applications • Complex relationships among market conditions, economics, and policy environment 	<ul style="list-style-type: none"> • Technology assessment and forecasting • Maturity and readiness of technology • Cost-benefit analysis associated with key technologies • Analysis of organizational skills, knowledge, and capabilities associated with key technologies • Mapping of dependencies and enabling conditions (e.g., investment, policy) • Scenario analysis focused on technological development, use, deployment, and impact 	<ul style="list-style-type: none"> • Cost of supply, rate of return, return on investment, and payback periods for different technologies • Product development effectiveness and cost • Time to market and research and development success rate • Capabilities across peers • Number of and effectiveness of collaborative research relationships • Number of patents
Market	<ul style="list-style-type: none"> • Novel dynamics and signals from supply-demand relationships affecting raw materials, products, and services • Nonlinear relationships affecting demand and costs • Complex relationships among policy, consumers, and societal context 	<ul style="list-style-type: none"> • Analysis of trends in supply and demand for products and services • Comparison of company's position and strategy to competition • Engagement with customers and suppliers • Identification of merger and acquisition targets 	<ul style="list-style-type: none"> • Market size • Growth potential • Commodity, product, and service pricing • Market coverage and share index • Opportunity and threat index • Product portfolio index • Revenue mix and sources
Reputation	<ul style="list-style-type: none"> • Magnitude of severity and scope of impact can rapidly change, often enabled by the internet and social media • Novel nature of responses and reactions as societal awareness and understanding shifts • Interconnected issues driving impacts and actions 	<ul style="list-style-type: none"> • Use of social media, customer feedback, and market research to track customer sentiment and changing preferences • Evaluation of employee engagement and satisfaction • Identification of relationships between events and news and business and financial impacts 	<ul style="list-style-type: none"> • Share price change • Competitors' market positions • Employee satisfaction level • Customer loyalty and retention level (e.g., net promoter score) • Changes in customer satisfaction • Media and social media sentiment • Number of new customers • Independent rankings and ratings

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Table D3
Physical Risks and Identification and Assessment Approaches

Type	Characteristics	Approaches	Possible Metrics
Acute	<ul style="list-style-type: none"> • Uncertain timing, scope, and severity of impacts of extreme weather events • Different effects based on events (e.g., cyclones, hurricanes, floods, drought) and geography • Changing magnitude and nonlinear impacts associated with events • Complex relationships and interconnections between factors and variables that influence weather events 	<ul style="list-style-type: none"> • Use of expert input from meteorologists, oceanographers, and climate and atmospheric scientists • Stress testing to assess sensitivity and resilience of key business units and activities • Forecasting using historical data and lookback studies • Scenario analysis focused on frequency, intensity, and location of extreme weather events • Hazard mapping and catastrophe modeling 	<ul style="list-style-type: none"> • Number of locations, facilities, business lines, etc. exposed or affected • Duration of event • Projected or identified loss or damage to business facility, supply chain, etc. • Projected or identified cost of business interruption, repairs, etc. • Projected or identified impact on sales and consumer behavior • Insurance costs
Chronic	<ul style="list-style-type: none"> • Longer time horizons associated with certain climate changes (e.g., sea level rise) • Changing magnitude and nonlinear impacts associated with tipping points and thresholds • Different effects based on events and geography 	<ul style="list-style-type: none"> • Use of expert input from meteorologists, oceanographers, and climate and atmospheric scientists • Scenario analysis focused on potential impacts and implications of chronic physical climate change • Hazard mapping and catastrophe modeling 	<ul style="list-style-type: none"> • Projected or identified impact on revenues and expenditures • Changes in operating and capital costs • Changes in market behavior • Projected or identified impact on sales and consumer behavior • Insurance costs

As noted in the tables above, scenario analysis is a useful tool for risk identification and assessment of climate-related risks, especially for those risks where the timing is uncertain and difficult to assess. In its 2017 report, the Task Force emphasized the importance of using scenario analysis to assess potential business, strategic, and financial implications of climate-related risks.²⁵ The Task Force also issued *The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities* (technical supplement) in 2017 to provide additional guidance to companies on using climate-related scenario analysis. In 2020, the Task Force issued guidance on scenario analysis to provide practical, process-oriented ways companies may use climate-related scenario analysis — to extend and deepen the guidance in its technical supplement.²⁶ Also see [Section 3. Scenario Analysis](#) in [Appendix 3: Additional Information on Integration](#) for more information.

²⁵ See [Section D. Scenario Analysis and Climate-Related Issues](#) in the Task Force's 2017 report.

²⁶ TCFD, *Guidance on Scenario Analysis for Non-Financial Companies*, October 29, 2020.

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Risk Identification and Assessment: Prioritization Criteria

A company's assessment of its risks is fundamental to its prioritization of those risks and management of (response to) the most significant ones. Many companies use a traditional "likelihood and impact" approach to gauge the severity or materiality of their risks. To prioritize their risks, companies may use the severity of the risks as determined by the intersection of their likelihoods and impacts and then evaluate the severity of the risks relative to risk appetite.

Given some of the unique characteristics of climate-related risks, companies may want to consider expanding their prioritization criteria to include "vulnerability" and "speed of onset." These prioritization criteria are defined as follows:²⁷

- **Vulnerability** refers to the susceptibility of a company to a risk event in terms of the company's preparedness, agility, and adaptability. Vulnerability is related to impact and likelihood — the more vulnerable the company is to the risk, the higher the impact is if the event occurs. If risk controls are not in place and operating as designed, then the likelihood of an event increases.
- **Speed of onset** refers to the time that elapses between the occurrence of an event and the point at which the company first feels its effects. Knowing the speed of onset is often useful when developing risk response plans.

Using "vulnerability" as part of the prioritization criteria is relevant for climate-related risks because such risks are often unpredictable; however, a company can build in adaptability mechanisms to respond to or absorb risk. For example, in the 1980s, a large oil company (Shell) diversified its portfolio and used scenario planning to prepare and adapt to potential oil price fluctuations that were generally considered unforeseeable.²⁸ "Speed of onset" is also relevant for climate-related risks. As an example, consider the time frame in which a company's operations could be affected by severe flooding — immediately or within a matter of hours. For risks such as this, it may be important to recognize the speed of onset so that actions can be taken to mitigate the impact of these risks if they do occur.

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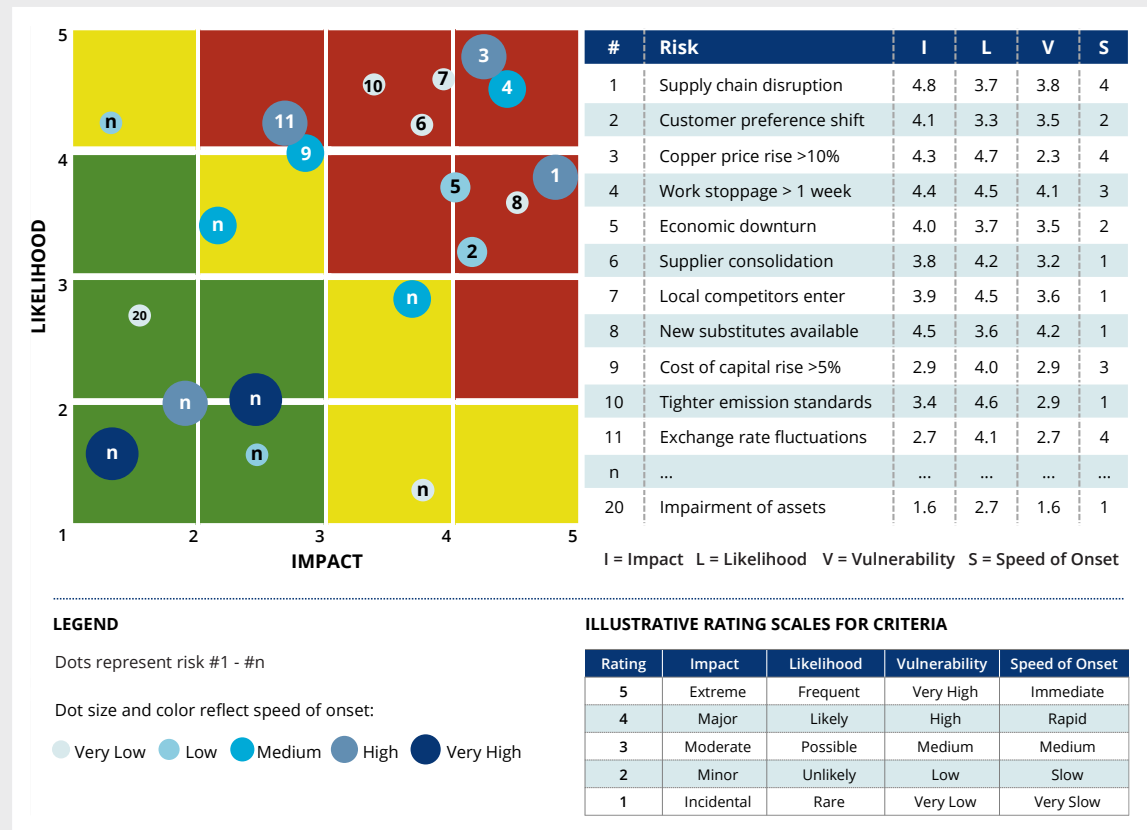
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²⁷ These definitions are based on COSO's *Risk Assessment in Practice*, pp. 6–7. In the COSO guidance, vulnerability and speed of onset are described as assessment criteria, whereas similar criteria are described in the COSO-WBCSD guidance as prioritization criteria.

²⁸ See the *COSO-WBCSD guidance*, p. 51.

Figure D7 shows an illustrative example of how a company might apply the vulnerability and speed of onset criteria, along with likelihood and impact criteria, to its risks in order to prioritize them. As shown in the figure, a company's risks are plotted based on likelihood (y-axis) and impact (x-axis), with the most likely and largest impact risks occupying the upper right quadrant. Based on the likelihood and impact scores alone, risk number 3 is the top risk facing the company — closely followed by risk number 4. However, when one considers the scores for vulnerability and speed of onset, risk number 1 becomes the top risk given the company's high vulnerability to the risk and its rapid speed of onset.

Figure D7
Illustrative Heat Map Based on Prioritization Criteria



Adapted from COSO's *Risk Assessment in Practice*, October 2012, pp. 4-7 and 16

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Risk Management Tools

Companies may need to consider whether new risk management tools are needed to support management of climate-related risks or whether existing tools can be adjusted to reflect the unique characteristics of these risks. New or adapted risk management tools could be used to support the identification, assessment, and management of (response to) climate-related risks; and examples of such tools are briefly described in [Table D4](#). [Table A3-1](#) (p. 43) in the appendix provides an expanded version of the table below, with information on additional tools.

Table D4

Overview of Various Tools and Their Application to Climate-Related Risks

Tool	Description	Application	Process
Economic Scenario Generator	Models that simulate possible future states of economies and financial markets based on risk factors to identify unexpected but plausible outcomes	Test valuation models under a broad range of possible economic and financial conditions (e.g., considering climate change and socioeconomic factors)	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment
Hazard Maps	Location-level information on the extent or severity of perils using assumptions on the frequency, severity, and location parameters of primary events and dependencies with secondary perils ²⁹	Present peril event scenarios based on current and potential future states considering the impact from climate change, which will result in different frequency and severity of events affecting certain locations	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment
Horizon Scanning	Systematic and proactive approach to risk identification based on available information	Identifying various climate-related risk types across different spatial and temporal scales	<ul style="list-style-type: none"> • Risk Identification
Probabilistic Modeling	<i>General.</i> Systems modeling that involves probabilistic inputs, processes, and outputs	Numerical weather and climate predictions that allow a representation of uncertainties, a reduction of systematic biases, and improved representation of long-term climate variability	<ul style="list-style-type: none"> • Risk Assessment
	<i>Catastrophe Models.</i> Probabilistic models based on deep understanding of the physical parameters that define a natural hazard (e.g., wind speeds) and characteristics of the exposures (e.g., location)	Estimate potential losses from natural catastrophes	<ul style="list-style-type: none"> • Risk Assessment • Risk Identification • Risk Response
Scenario Analysis	A process for identifying and assessing potential implications of a range of plausible future states under conditions of uncertainty	Explore and develop an understanding of how the climate-related risks and opportunities might plausibly impact a company over time	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment • Risk Response

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²⁹ Third-party service providers and some reinsurers provide hazard maps. For example, see Swiss Re's [CatNet](#)®.

3. KEY TAKEAWAYS

As described in the sub-sections above, integrating climate-related risks into existing risk management processes involves building a shared understanding of climate change concepts and risks across the company and adapting existing processes to account for the unique characteristics of climate-related risks. Providing an exhaustive set of steps and considerations for ensuring climate-related risks are appropriately incorporated into existing processes is beyond the scope of this guidance. Instead, this guidance is intended to help companies begin thinking about and taking initial steps toward integration.

In [Table D5](#), the Task Force highlights the key takeaways related to integrating climate-related risks into existing processes. Notably, the key principles described at the beginning of this

section are a core part of the key takeaways. The Task Force views the key principles as the basis upon which companies can confirm they have effectively integrated climate-related risks.

As highlighted in this section, identifying, assessing, and managing climate-related risks requires involvement from various functions and departments within a company given the broad implications of climate change. The Task Force believes the considerations involved in adapting existing risk management processes to address climate-related risks can serve as a catalyst to evolve a company's risk management processes in general and better deal with a range of current and emerging risks.

Table D5 Key Takeaways



Common Understanding. Before beginning efforts to integrate climate-related risks into existing processes, it is useful to ensure there is a basic level of understanding across the company of climate change concepts and its potential impacts.



Interconnections. Integrating climate-related risks into existing risk management requires analysis and collaboration across the company. The principle of interconnections means all relevant functions, departments, and experts are involved in the integration of climate-related risks into the company's risk management processes and in the ongoing management of climate-related risks.



Temporal Orientation. Climate-related physical and transition risks should be analyzed across short-, medium-, and long-term time frames for operational and strategic planning, which may require extending beyond traditional planning horizons.



Proportionality. The integration of climate-related risks into existing risk management processes should be proportionate in the context of the company's other risks, the materiality of its exposure to climate-related risks, and the implications for the company's strategy.



Consistency. The methodology used to integrate climate-related risks should be used consistently within a company's risk management processes to support clarity on analysis of developments and drivers of change over time.

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E. Disclosure of Risk Management Processes

In this section, the Task Force provides guidance on disclosing information aligned with its Risk Management recommendation as well as some examples of how different companies disclose information that addresses one or more of the recommended disclosures included under the Risk Management recommendation, as shown in Figure E1. In addition, the Task Force hopes to address a misinterpretation of its Risk Management recommendation, which surfaced as part of the work on its 2019 status report.³⁰

Figure E1
Risk Management Recommendation

Disclose how the company identifies, assesses, and manages climate-related risks.

- a) Describe the company's processes for identifying and assessing climate-related risks.
- b) Describe the company's processes for managing climate-related risks.
- c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the company's overall risk management.

As part of its 2019 status report, the Task Force conducted a survey to better understand companies' efforts to implement the TCFD recommendations and associated challenges. The top-cited issue for the Risk Management recommendation was that for companies with climate-related issues integrated into existing risk management processes, making a separate or explicit climate-related financial disclosure is challenging. In follow-up discussions on this issue, the Task Force learned some companies interpreted the recommendation as indicating that they should have separate processes for managing climate-related risks or that disclosure of these processes should be separate from the disclosure of broader risk management processes of which they

are a part.³¹ These companies also indicated examples of disclosure where a company's management of climate-related risks is embedded or integrated into overall risk management processes would be helpful.

To address companies' concerns that implementing the Risk Management recommendation requires separate processes for climate-related risks or the development of "stand-alone" disclosures, the Task Force emphasizes it did not intend for companies with comprehensive risk management processes that include climate-related risks to create separate processes or duplicate existing disclosures. If a company's disclosures clearly describe its risk management processes and it is clear those processes cover climate-related risks, then no further disclosure may be needed.

1. FEATURES OF DECISION-USEFUL RISK MANAGEMENT DISCLOSURES

As described in the annex to the Task Force's 2017 report, investors and other users of climate-related financial information are interested in companies' disclosure of the processes they use to identify, assess, and manage the climate-related risks to which they are exposed and whether those processes are integrated into existing risk management processes.³² Such information supports users in evaluating a company's overall risk profile and the adequacy of its risk management activities.

As highlighted in the previous section, the overarching *purpose of risk management* is to support a company in achieving its strategy and business objectives. The primary *purpose of disclosing risk management processes* is to provide context for how the company thinks about and addresses the most significant risks to successfully executing its business objectives and accomplishing its strategy. A company's description of the processes it uses to identify, assess, and manage risks in general and climate-related risks in particular may provide users with

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³⁰ See Section C. Adoption and Use of the TCFD Recommendations in the Task Force's 2019 status report, pp. 56–57.

³¹ See pp. 47–48 in the Task Force's 2020 status report.

³² See Risk Management Guidance for All Sectors in the Task Force's *Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures*, pp. 16–17.

some confidence that the company undertakes a rigorous approach to understanding and addressing its risks and factors the knowledge gained into its strategic and financial plans. Of course, another company's description of its risk management processes may lead a user to determine the company does not have appropriate processes in place to address climate-related risks. Either way, such information may be useful to investors and other users in evaluating a company for investment or other financial purposes.

For its 2017 report, the Task Force developed a set of principles for effective disclosure accompanied by descriptions of what the principles mean in practice.³³ The principles are intended to help companies develop high-

quality and decision-useful disclosures that enable users to understand the impact of climate change on those companies. The Task Force's disclosure principles are largely consistent with other mainstream, internationally accepted frameworks for financial reporting and are generally applicable to most providers of financial disclosures. They are informed by the qualitative and quantitative characteristics of financial information and further the overall goals of producing disclosures that are consistent, comparable, reliable, clear, and efficient. The principles, taken together, are designed to assist organizations in making clear the linkages and connections between climate-related issues and their governance, strategy, risk management, and metrics and targets. In [Figure E2](#), the Task Force provides select

Figure E2
Features of Decision-Useful (Effective) Disclosures



Disclosures should be **presented in sufficient detail** to enable users to assess the company's exposure and approach to addressing climate-related issues, while understanding that the type of information, the way in which it is presented, and the accompanying notes will differ between companies and will be subject to change over time.



Climate-related impacts can occur over the short, medium, and long term. Companies can experience chronic, gradual impacts as well as acute, abrupt disruptive impacts. A company should provide information from the perspective of the potential impact of climate-related issues on value creation, **taking into account and addressing the different time frames and types of impacts.**



A company's reporting should provide a **thorough overview** of its exposure to potential climate-related impacts; the potential nature and size of such impacts; the company's governance, strategy, processes for managing climate-related risks, and performance with respect to managing climate-related risks.



Disclosures should be written with the objective of **communicating financial information** that serves the needs of a range of financial sector users. This requires reporting at a level beyond compliance with minimum requirements. The disclosures should be **sufficiently granular to inform** sophisticated users but should also provide concise information for those who are less specialized.



Disclosures should show an appropriate **balance between qualitative and quantitative information** and use text, numbers, and graphical presentations as appropriate.



Changes in disclosures and related approaches or formats (e.g., due to shifting climate-related issues and evolution of risk practices, or accounting practices) can be expected due to the relative immaturity of climate-related disclosures. Any such **changes should be explained.**

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³³ TCFD, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures*, June 29, 2017.

descriptions — those most relevant to disclosing information on risk management processes — from its principles for effective disclosure.

In the sub-section below, the Task Force provides examples of companies' disclosures of their risk management processes in the context of climate-related risks. The examples include the following types of information:

- Descriptions of climate-related risk as being a part of a company's overall risk management processes.

- Description of the risk management processes used to identify, assess, and/or manage climate-related risks.

- Descriptions of how companies map sections in their reports to the Task Force's Risk Management recommendation where climate-related risks are embedded in existing risk management processes.

2. EXAMPLES OF RISK MANAGEMENT DISCLOSURES

As described above, this sub-section provides examples of companies' disclosures of their risk management processes. Importantly, the examples are not intended to represent "best practice" nor demonstrate disclosures that fully meet the Task Force's Risk Management recommendation. Instead, the examples are provided because they may help companies generate ideas for their own disclosures.

Climate-Related Risk Included in Overall Risk Management Processes

In the first example shown below (Figure E3), an electric utility company (Enel) describes its overall risk management processes as including climate-related risks.

Figure E3
Enel, Consolidated Annual Report 2019

Risk management

Due to the nature of its business, the Group is exposed to a variety of risks, notably financial risks, industrial and environmental risks, strategic risk connected with the evolution of markets and risks connected with sustainability and climate change.

In order to effectively deal with such risks, Enel has adopted an internal control and risk management system (ICRMS). This system is the set of rules, procedures, and organizational structures aimed at identifying, measuring, monitoring and managing the main risks applicable to the Group.

The Board of Directors performs a policy-setting role and is committed to developing guidelines to ensure that decisions at all levels of the Group are made in an informed manner consistent with the associated risks (including those connected with climate change). To this end, the Board draws on the expertise of the Control and Risk Committee, which issues prior opinions on a variety of matters, including the guidelines of the ICRMS.

The Group also has specific internal committees composed of senior management personnel that are responsible for governing and overseeing risk management, monitoring and control.

The following discusses the main types of risks and opportunities facing the Group.

Governance
Strategy & Risk Management

Enel, Consolidated Annual Report 2019, p. 57

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Figure E4 contains three excerpts from an oil and gas company's (Eni's) annual report that describe its risk management process at a high level, how the risk management process covers all the company's risks, and how risks related to climate change are a sub-category of the company's strategic risk category. Based on this information, it is clear climate-related risks are integrated into the company's overall risk management processes.

Figure E4
Eni, Annual Report 2019

Integrated Risk Management Model

The IRM Model is characterized by a structured approach, based on international best practices and considering the guidelines of the Internal Control and Risk Management System (see page 29), that is structured on three control levels. Risk Governance attributes a central role to the Board of Directors (BoD) which defines the nature and level of risk in line with the strategic targets, including in evaluation process all those risks that could be consistent for the sustainability of the business in the medium-long term. The BoD, with the support of the Control and Risk Committee, outlines the guidelines for risk management, so as to ensure that the main corporate risks are properly identified and adequately assessed, managed and monitored, determining the degree of compatibility

with company management consistent with the strategic targets. For this purpose, Eni's CEO, in particular, through the IRM process, presents every three months a review of the Eni's main risks to the Board of Directors. The analysis is based on the scope of the work and risks specific of each business area and processes aiming at defining an integrated risk management policy; the CEO also ensures the evolution of the IRM process consistently with business dynamics and the regulatory environment. Furthermore, the Risk Committee, chaired by the CEO, holds the role of consulting body for the latter with regards to major risks. For this purpose, the Risk Committee evaluates and expresses opinions, at the instance of CEO, related to the main results of the IRM process.

[...]

Integrated Risk Management Process

The IRM process ensures the detection, consolidation and analysis of all Eni's risks and supports the BoD to verify the compatibility of the risk profile with the strategic targets, also in a medium-long term approach. The IRM supports management in the decision-making process by strengthening awareness of the risk profile and the associated mitigations. The process, regulated by the "Management System Guideline (MSG) Integrated Risk Management" is continuous, dynamic and includes the following sub-processes: (i) risk governance, methodologies and instruments, (ii) risk strategy, (iii) integrated risk management, (iv) risk knowledge, training and communication. The IRM process starts from the contribution to the definition of medium and long-term plans and Eni's Strategic Plan (risk strategy) through the identification of proposals for de-risking objectives and strategic treatment actions, as well as the analysis of the risk profile and

business opportunities underlying the plan and the long-term development. The **Integrated Risk Management** sub-process includes: periodic risk assessment and monitoring cycles (Integrated Risk Assessment) in order to understand the risks taken on the basis of the strategic and medium-long term targets and the initiatives defined to achieve them; analysis and management of contractual risks (Contract Risk Management) aimed at the best allocation of the contractual responsibilities with the supplier and their adequate management in the operational phase; integrated analysis of existing risks in the Countries of presence or potential interest (Integrated Country Risk - ICR) which represents a reference for risk strategy, risk assessment and project risk analysis activities; support to the decision-making process for the authorization of investment projects and main transactions (Integrated Project Risk Management & M&A).

[...]

STRATEGIC RISK





	SCENARIO 	CLIMATE CHANGE   
MAIN RISK EVENTS	Risk of unfavourable fluctuations in Brent and other commodities prices compared to planning assumptions.	Climate change referred to the possibility of change in scenario/climatic conditions which may generate physical and connected to energy transition risks (legislative, market, technological and reputational risks) on Eni's businesses in the short, medium and long term.
TREATMENT MEASURES	<ul style="list-style-type: none"> Efficiency (capex and costs); Upstream projects portfolio with a low break even price and reduced time-to-market; Hedging/coverage strategy for gas, power and LNG exposures aimed at maximizing the portfolio value; Ramp-up of green refineries, diversification of feedstocks and end markets; Chemical portfolio diversification addressed to specialties and integration with the downstream supply chain; Renewable chemical and recycling. <p>→ Ref. pages 88-89</p>	<ul style="list-style-type: none"> Adoption of a new Company's mission based on the UN SDGs and definition of strategic guidelines and targets for the energy transition in the short, medium and long term; Structured governance on climate with a central role of the Board in managing main issues connected with climate change; presence of specific committees; establishment of the Advisory Board and Eni's programs focused on climate change issues; Inclusion of targets related to the energy transition in management incentive plan, consistent with the medium and long term plans; Leadership on climate-related financial disclosures and participation in different initiatives at international level. <p>→ Ref. pages 93-95</p>

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The example in Figure E5 shows how a packaging and paper company (Mondi Group) highlights its management of climate-related risks (and opportunities) in particular and indicates it uses its group-wide risk management framework to identify and assess such risks.

Figure E5
Mondi Group, Financial Filing 2019

Our commitments to 2025 and 2050	2019 performance in brief	Status
Reduce Scope 1 and 2 GHG emissions 34% per tonne of saleable production by 2025 and 72% per tonne of saleable production by 2050, from a 2014 baseline	15.5% reduction of specific Scope 1 and 2 CO ₂ e emissions against the 2014 baseline	
Reduce Scope 2 GHG emissions 39% per MWh by 2025 and 86% per MWh by 2050 from a 2014 baseline	6.1% reduction of specific Scope 2 CO ₂ e emissions per MWh against the 2014 baseline	

Our customers are increasingly concerned about the consequences of climate change and are looking to us for more sustainable solutions. We are taking action and managing our impacts by transitioning to low carbon energy technologies, reducing the carbon footprint of our products and refining our approach to sustainable fibre and forest management. In 2019 our science-based greenhouse gas reduction targets to address the climate crisis were approved by the Science Based Targets initiative and we updated our commitments accordingly.

Producing pulp, paper and packaging is energy-intensive and energy generation is the major source of our greenhouse gas (GHG) emissions. In addition, fibre is the main raw material for our products and forests are an important carbon store, with sustainably managed forests having the opportunity to support a circular bioeconomy. We combine strategic energy-related investments across our pulp and paper mills with good management and best-practice sharing. We invest in optimising energy and process efficiencies and replacing fossil fuel-based energy with renewable biomass sources.

Sustainable Development report
www.mondigroup.com/sd19

Managing climate-related risks and opportunities

We identify and assess climate-related risks using our group-wide risk management framework. It includes pre-determined risk tolerance limits, established by the Board, based on the likelihood and severity of risk factors.

Climate change has the potential to affect our business in various ways. While these may not be severe in the short term, we believe climate-related risks are likely to have a medium and long-term impact on our business. We have identified both transition and physical risks. Governments and regulators are likely to take action to curb carbon emissions that may impact our business, such as the introduction of carbon taxes. Changes in precipitation patterns and extreme weather conditions such as floods, storms, droughts and fires may impact our plantations and the forests we source wood from and could result in fibre supply chain interruptions and higher fibre costs. Higher temperatures may also increase the vulnerability of forests to pests and disease. Increased severity of extreme weather events may also interrupt our operations. In water-scarce countries, we may see an impact on our production process as a result of limited water availability.

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In [Figure E6](#), a financial institution (Société Générale Group) describes its use of the TCFD definitions for climate-related transition and physical risks, explains how climate-related risks are a driver of existing risks, and then indicates the “existing risk management governance framework and processes have simply been updated to include climate risk factors.”

Figure E6
Société Générale Group, Financial Filing 2020

Managing climate risks

In terms of transition risks, physical risks and litigation and legal risks, Societe Generale has adopted the definitions given by the Task Force on Climate-related Financial Disclosures (TCFD). The Group does not view the risks associated with climate change as a new risk category but rather an aggravating factor for the categories already covered by the Bank's risk management system (credit risks, operational risks, market risks, etc.). Accordingly, the existing risk management governance framework and processes have simply been updated to include climate risk factors; work in such respect continues to ensure that the increasing relevance of such factors is properly taken into account.

Two of the three core themes of the Group's climate strategy directly relate to risk management: the implementation of policies to manage the social and environmental impact of the Group's activities (see: *E&S risk management in the businesses to promote fair and responsible growth*, page 277) and greater consideration of climate-change risks within Societe Generale's credit policy.

The climate vulnerability indicator and the impact of transition risks on customers' credit risk are detailed in Chapter 4.5.5 *Risk measurement and internal ratings*, paragraph: *Climate risk - Measuring sensitivity to transition risk*, page 199.

IDENTIFICATION OF PHYSICAL RISKS FOR THE INSURANCE BUSINESS

The Insurance activity's sensitivity to climate risks varies depending on the type of product. Life-insurance assets are mainly invested in bond securities, predominantly issued by States and sectors that are relatively sheltered from climate risks (*i.e.* European countries and the financial services sector). Similarly, the assets held *via* property investment solutions are mainly office properties and are located in France.

The climate risk in respect of non-life insurance (cover for storms, hail, snow and natural disasters under home insurance, professional property insurance and auto insurance) is monitored and managed through underwriting and reserving and reinsurance policies, which are reviewed annually and approved by the Board of Directors. Lastly, the Company's equity levels take into account the potential occurrence of a certain number of climate-related events. Climate risks are in particular taken into account as part of the annual Own Risk and Solvency Assessment (ORSA) conducted in accordance with the Solvency 2 Directive.

Société Générale Group, [Universal Registration Document 2020](#), p. 284

The example shown in [Figure E7](#) describes how a metals and mining company (Gold Fields) integrates climate-related risks into its risk management systems and business strategy.

Figure E7
Gold Fields, 2019 Climate Change Report

Understanding the risks and adapting to climate change

The long-term risks posed by climate change to the Group's operations, projects and surrounding communities could impact our ability to operate our mines sustainably as they are set to increase both operational and capital costs. At the same time though, opportunities have also emerged through improved water and energy consumption efficiencies and transitioning towards lower carbon energy sources, with associated financial benefits. Unless managed appropriately, the negative impacts of climate change could create resource tensions with host communities, thus affecting our social licence to operate.

The processes for identifying and assessing climate-related risks are integrated into Gold Fields' risk management systems. These risks and mitigating actions are integrated into business strategy – from planning through to operations.

Business planning includes consideration of the following risks: water availability, shifts in rainfall patterns, higher temperatures, changing legislative landscapes pertaining to carbon emissions management, the increasing need to find alternatives to traditional energy provision, and improved energy and water efficiencies. Our regional offices monitor regulatory changes, including climate change-related ones. We have also included climate-related risk assessments in our capital projects studies.

Gold Fields, [Our 2019 Climate Change Report](#), p. 2

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Identification, Assessment, and Management of Climate-Related Risks

The examples below show how different companies disclose information about how they identify, assess, and manage climate-related risks. In the first example (Figure E8), Australia and New Zealand (ANZ) Banking Group Limited describes how climate-related risks fit into its risk management framework and how these risks are included in the Group and Institutional Risk Appetite Statements to ensure they are appropriately identified and assessed.

Figure E8

ANZ Banking Group Ltd, 2019 Climate-Related Financial Disclosures

Risk Management

Climate Risk Management

We have disclosed our most material social and environmental risks in our 2019 Annual Report (see page 46) on anz.com/annualreport in accordance with the *ASX Corporate Governance Principles and Recommendations*. Our most material climate-related risks and opportunities result from our lending to business and retail customers, including credit-related losses incurred as a result of a customer being unable to repay debt.

Under our risk management framework, our material risk category of Credit Risk incorporates the risks associated with lending to customers that could be impacted by climate change or by changes to laws, regulations, or other policies such as carbon pricing and climate change adaptation or mitigation policies. It also includes changes to the cost and level of insurance cover available to our customers.

We also specifically include climate change as one of our Principal Risks and Uncertainties (available on anz.com/annualreport). Climate change risk is included in the Group and Institutional Risk Appetite Statements to ensure the risk is appropriately identified and assessed.

We continue to develop an organisational culture that encourages regular discussion and consideration of emerging climate-related risks. Our Risk team is working with our bankers, encouraging them to talk with customers about managing the risks and opportunities associated with climate change, assisting us to progress our low carbon transition target focused on our largest emitting customers.

Australia and New Zealand Banking Group Limited, *2019 Climate-Related Financial Disclosures*, p. 5

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Figure E9 from Allianz Group describes how the insurer addresses climate-related risk as part of an overarching qualitative and quantitative risk “reporting and controlling framework” that senior management uses to decide on the risk management strategy. Toward the second half of the example, Allianz describes the key tools used to assess climate-related risks.

Figure E9
Allianz Group, Sustainability Report 2019

01	Introduction
02	Sustainability strategy and governance
03	Sustainability in core business activities
04	Sustainability in operations
05	Allianz’s climate-related financial disclosure
	05.1 Highlights
	05.2 Governance
	Overarching and board-level governance
	Business and management-level governance
	Remuneration and climate competence
	05.3 Strategy
	Our strategic response to climate change
	Climate-related risks and opportunities
	Our response
	05.4 Strategy resilience, stress tests and climate scenario analysis
	05.5 Risk and opportunity management
	Overarching risk governance
	Natural catastrophe risk governance
	Climate and ESG governance
	05.6 Metrics and targets
	Metrics
	Business operations
06	Data and performance

05.5.1 OVERARCHING RISK GOVERNANCE

As a general principle at Allianz, the responsibility for the ‘First Line of Defense’ rests with business managers in the related undertaking. They are responsible for both the risks taken and the returns from their decisions. Our ‘Second Line of Defense’ consists of independent global oversight functions. These are Risk, Actuarial, Compliance and Legal, which support the Board in defining the risk frameworks within which the business can operate. Group Audit forms the ‘Third Line of Defense’, independently and regularly reviewing risk governance implementation and compliance with risk principles, performing quality reviews of risk processes, and testing adherence to business standards, including the internal control framework.

Climate-related risks are addressed as part of an overarching qualitative and quantitative risk reporting and controlling framework. Early-warning indicators are monitored and regularly reported to senior management through risk dashboards, risk capital allocation and limit consumption reports, where climate aspects become material. Supplemented by quarterly updates, senior management decides on a risk management strategy and related actions.

One key tool is the Allianz Risk Capital Model, which amongst others, assesses natural catastrophe events for the upcoming year on subsidiary and Group level.

Another instrument is the yearly Top Risk Assessment with the goal to identify and remediate significant threats to financial results, operational viability, reputation and the delivery of key strategic objectives, regardless of whether they can be quantified or not. Not only does this include immediate risks for the company, but also emerging risks, which may arise from technological development, new or changing environmental risks or socio-demographic changes. Climate-related factors are included in Top Risk Assessments conducted both on the level of operating entities as well as the Group.

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Allianz Group, Sustainability Report 2019, p. 75

Figure E10 provides an excerpt from Citigroup's 2019 10K (financial filing) that describes some of the factors Citigroup includes in its credit underwriting practices to assess climate-related risks. It also describes ongoing work Citigroup is doing to better measure and assess climate-related risks.

Figure E10
Citigroup, Financial Filing 2019

SUPERVISION, REGULATION AND OTHER

[...]

CLIMATE CHANGE

Climate change presents immediate and long-term risks to Citi and to its clients and customers, with the risks potentially increasing over time. Climate risk can arise from physical risks (risks related to the physical effects of climate change) and transition risks (risks related to regulatory, legal, technological and market changes from a transition to a low-carbon economy).

Citi's Environmental and Social Risk Management Policy incorporates climate risk assessment for credit underwriting purposes and reporting criteria for certain corporate obligors and transactions. Factors evaluated include consideration of climate risk to an obligor's business and physical assets and, when relevant, consideration of cost-effective options to reduce greenhouse gas (GHG) emissions. Citi engages clients to support their low-carbon transition, including through Citi's growing environmental finance offerings.

To manage the risks of climate change to Citi's own operations and facilities, Citi assesses its exposure to climate hazards to inform business continuity and resilience planning. In addition, Citi has developed programs for its properties to achieve long-term energy efficiency objectives and reduce its GHG emissions to lessen its impact on climate change.

Citi has adopted the Taskforce on Climate-related Financial Disclosures (TCFD) recommendations and published its first TCFD report, Finance for a Climate Resilient Future, in 2018. As detailed in that report, Citi participated in the United Nations Environment Finance Initiative Banking Sector TCFD Project in 2017-2018 and piloted climate scenario analyses on Citi's North America oil and gas exploration and production and U.S. power portfolios, to understand their exposure to climate risk under select scenarios. Citi continues to participate in financial industry collaborations to develop and pilot new methodologies and approaches for measuring and assessing the potential financial risks of climate change. Citi is also closely monitoring regulatory developments on climate risk and sustainable finance, and actively engaging with regulators on these topics.

Citigroup, Form 10-K 2019, pp. 294-295

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In [Figure E11](#), Enel describes assessing such risks using physical risk and transition risk scenarios. Enel also refers to opportunities that arise from the transition to a lower-carbon economy and the company's decision to seize those opportunities.

Figure E11
Enel, Annual Report 2019

Strategic risks and opportunities connected with climate change

The identification and management of risks connected with climate change

Climate change and the energy transition will impact Group activities in a variety of ways.

In order to identify the main types of risk and opportunity and their impact on the business associated with them in a structured manner consistent with the TCFD, we have adopted a framework that explicitly represents the main relationships between scenario variables and types of risk and opportunity, specifying the strategic and operational approaches to managing them, comprising mitigation and adaptation measures.

There are two main macro-categories of risks/opportunities: those connected with developments in physical variables and those linked to the evolution of the transition scenarios.

Physical risks are divided in turn between acute (i.e. extreme events) and chronic, with the former linked to extremely intense meteorological conditions and the latter to more gradual but structural changes in climate conditions.

Extreme events expose the Group to the risk of prolonged unavailability of assets and infrastructure, the cost of restoring service, customer disruptions and so on. Chronic changes in climate conditions expose the Group to other risks or opportunities: for example, structural changes in temperature could cause changes in electricity demand and have an impact on

output, while alterations in rainfall or wind conditions could impact the Group's business by increasing or decreasing potential electricity generation.

The energy transition towards a more sustainable model characterized by a gradual reduction of CO₂ emissions has risks and opportunities connected both with changes in the regulatory and legal context and trends in technology development, electrification and the consequent market developments.

Consistent with the climate and transition scenarios used by Enel to determine risks and opportunities, the main transition-related phenomena are beginning to emerge in relation to customer behavior, industrial strategies being adopted in all economic sectors and regulatory policies. Between 2020 and 2030, the transition trends will become visible in response to the evolution of the context: the Enel Group has decided to facilitate the transition, and is therefore ready to seize all the opportunities that may arise from an acceleration in that transition. As discussed previously, our strategic choices, which are already strongly oriented towards the energy transition, to which we have dedicated more than 90% of investments, enable us to incorporate risk mitigation and opportunity maximization "by design," adopting a positioning that takes account of the medium and long-term phenomena we have identified. The strategic choices are accompanied by the operating best practices adopted by the Group.

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Outlook

Enel, [Consolidated Annual Report 2019](#), p. 63

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As another example of risk identification and assessment processes, [Figure E12](#) shows how a telecommunications company (Verizon) considers short-term and longer-term risk identification and assessment.

Figure E12
Verizon, 2019 TCFD Report

Risk management

Overview

Verizon recognizes that climate change risk is a global issue that may impact how we run our business and network, both today and in the future. As such, we continue to look for ways to improve our understanding of climate-related risks. We are working to integrate climate risk variables into our overall risk management process and establish formal multi-disciplinary processes that engage both our Board and management team.

Section	Our risk management
 Risk identification and assessment processes	<p>Verizon recognizes that physical climate impacts can be both short- and long-term in nature. For this reason we have a comprehensive business continuity planning approach, our BCIEM framework, that focuses on business preparedness to identify and assess natural and man-made events around the globe that could adversely impact our business operations.</p> <p>Short-term risk identification and assessment Each year we conduct a formal Business Impact Analysis (BIA), an assessment that helps us determine the operational impact resulting from a major disruption of services. The BIA identifies, reviews, and prioritizes the biggest threats to our employees, network, and business operations based on known and predicted natural disasters that may impact the business. The assessment prioritizes risk based on the level of impact to our network and business operations. Priority risks are those with the most direct and immediate impact to our network and customers.</p> <p>We evaluate five climate-related events during the assessment: storm surge from hurricanes, flooding, wildfire, high straight-line wind, and tornadoes. We are in the process of formally overlaying short-term weather and environmental data from multiple sources onto our existing operational and network model in order to improve these risk assessments geographically, and to enhance planning activities.</p> <p>The BIA highlights necessary investments to harden infrastructure and helps inform network build decisions and the selection and design of future and current sites. High priority risks we identify are first discussed with management and then directly integrated into our annual planning, business continuity planning, and capital allocation decisions. The BIA process also helps inform the Business Continuity Executive Steering Committee on climate-related issues when it reviews and guides enterprise-wide risk management and business continuity plans.</p> <p>Longer-term risk identification and assessment In addition to our inclement weather monitoring tools and processes, we are also integrating longer-term climate-related risks into our planning tools given that historical and current weather patterns are not always indicators of future conditions. Using geospatial analysis, we overlay long-term climate projections from third-party sources onto our current and future operational and network models. This analysis covers multi-year projections and probabilities over multiple climate scenarios. The models provide us with a view of the risk of the occurrence of climate-related events, including storm surge associated with hurricanes, flooding, wildfire, tornadoes and high straight-line winds. The models are periodically updated to account for changes in precipitation patterns, increasing temperatures, and sea level rise.</p>

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An example of how a food and agri-business company (Olam International) evaluates, monitors, and manages risks is shown in [Figure E13](#). Olam International treats climate-related risk as a cross-cutting risk that impacts its existing agricultural and reputational risks.

Figure E13
Olam International Limited, Annual Report 2019

How does Olam manage risk?

Effective risk management is an integral part of Olam’s business model and a key success factor for realising our strategic objectives. Olam has implemented a rigorous risk management framework that identifies and assesses the likelihood and impact of risks, and the actions needed to mitigate the impact across the entire business. The framework defines individual risks across 11 categories.

Overall responsibility in monitoring and assessing risk lies with the independent risk function (Risk Office), and oversight of each risk is divided among the five Board Committees – Risk Committee, Audit Committee, Capital & Investment Committee, Corporate Responsibility & Sustainability Committee and Human Resources & Compensation Committee. The Group’s Chief Risk & Compliance Officer (CRCO) is also a member of the Executive Committee and reports to both the CEO and the Chair of the Risk Committee.

The Company’s Risk Appetite Framework (RAF) provides periodic updates on the magnitude of the risks being run across the businesses and regions set against Board-approved boundary conditions.

Fifty risks are evaluated and monitored, 16 on a quantitative basis (12 at the Business Unit level and four at the corporate level) and the remainder qualitatively. These 16 quantitative risks are reported in the Company’s Group Risk Dashboard (GRD). In addition, the Enterprise Risk Scorecard (ERS) assesses the likelihood of each of the risks occurring and their potential impact. In conjunction with the GRD, the ERS assists the Board with examining the effectiveness of the risk management systems and procedures and reviewing risk exposure and risk treatment plans. The RAF, GRD and ERS are updated and presented to the Board quarterly.

Olam continually upgrades its risk measurement methodology and focuses on the measurement of outright, basis, structure and arbitrage risk, currency risk, diversified value-at-risk (VaR) and stress testing to determine potential impact of adverse events on the books.

How do you manage agricultural risks?

Every year we assess the risks that could impact achievement of our strategic objectives at a consolidated level (top-down approach) and on a segment level (bottom-up approach). Among the key risks that escalated in 2019 – and our efforts to mitigate them – include:

Agricultural Risk: as climate change becomes more prominent, its impact on agriculture will increase in the future. Many of the 50 risks which are tracked concern agricultural risks e.g. yield risk, and mitigation measures are being put in place accordingly such as drip irrigation on our palm plantation in Gabon. As well as working with farmers on mitigation and adaptation measures, we are exploring other ways to measure climate risk, e.g. climate VaR.

Hurricane/Typhoon/Storm risk: Mozambique endured two cyclones in 2019 – Idai and Kenneth. Cyclone Idai impacted the Beira edible oils operations but the team were able to implement business continuity plans quickly and all employees were safe. Under our insurance programme there was also enough cover to ensure we were fully compensated.

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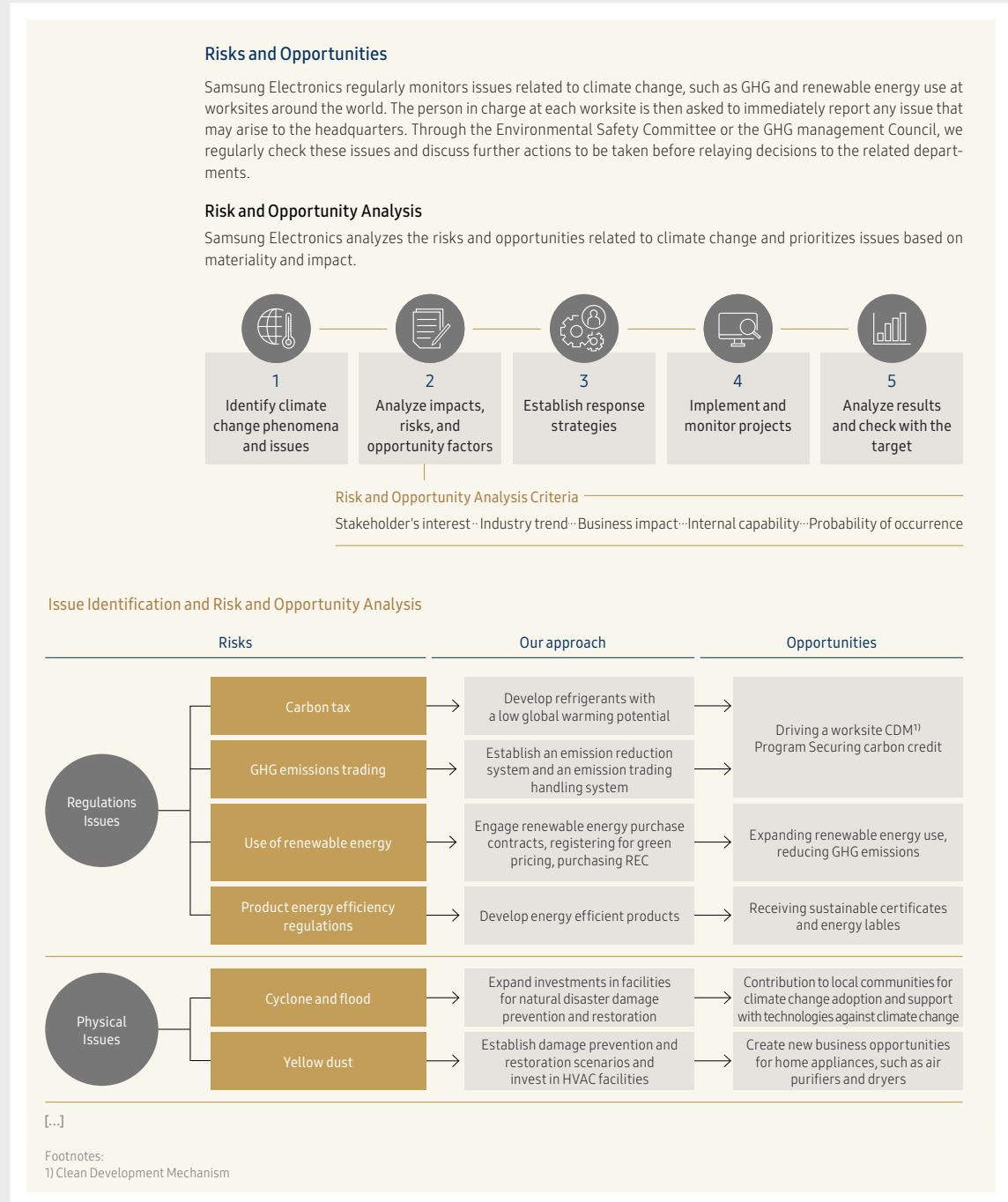
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In Figure E14, an electronics company (Samsung Electronics) provides an overview of its process for identifying and analyzing climate-related risks and opportunities.

Figure E14
Samsung Electronics, Sustainability Report 2020



Samsung Electronics, Sustainability Report 2020, p. 26

Note: Some content was excluded, denoted by [..].

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Lastly, as an example of risk response, [Figure E15](#) shows actions taken by a financial institution (Royal Bank of Canada) to mitigate climate-related risk.

Figure E15
Royal Bank of Canada, TCFD Report 2019

Identification and assessment of climate risks

[..]

RBC may be exposed to climate risk through emerging regulatory and legal requirements, disruptions to our operations and services, and the products and services we provide to our clients. We regularly review the risks that we face and the actions to mitigate these risks. The table below highlights potential climate risks we faced in 2019 and actions we are taking to mitigate those risks.

Potential risk	Actions to mitigate risk
Emerging regulatory and legal requirements	<ul style="list-style-type: none"> Climate change regulations, frameworks, and guidance that apply to banks, insurers and asset managers are rapidly evolving. The Bank of Canada and European Central Bank Financial Systems Reviews were published in May 2019 and address the financial and economic risks of climate change. While no specific requirements have been released, we will continue to monitor development. RBC Europe Limited established a Senior Management Function responsible for the financial risk from climate change, and has developed an initial plan for meeting the Bank of England Prudential Regulation Authority’s Supervisory Statement SS3/19 and Policy Statement PS11/19. For clients in sectors categorized as medium and high environmental risk, such as those in carbon intensive sectors, we evaluate whether clients have assessed and quantified the regulatory impacts of climate change
Disruptions to operations and client services	<ul style="list-style-type: none"> We identify properties that we lease or own, which contain business processes and supporting applications that require enhanced facility infrastructure to mitigate site disruptions, such as those caused by extreme weather events. We classify critical environment sites based on our business risk tolerance for site-specific downtime and, among other things, site location, power supply, exposure to flooding, geological stability and other hazards. We take steps to mitigate and adapt to climate change through our building design and purchasing decisions. As required, we assess the impact of climate-related events (e.g. floods, hurricanes) on our businesses and client operations.
Products and services we provide	<ul style="list-style-type: none"> We provide products, services and advice to assist clients in responding to climate-related risks and opportunities (e.g., carbon trading services, green bond underwriting, clean technology lending and advisory services, and responsible investing). We maintain a diversified lending portfolio, which improves our resilience to geographic or sectoral downturns and minimizes concentrations of credit exposure. Each business segment is responsible for identifying material climate-related risks and opportunities, which are integrated into risk management processes as necessary. We have conducted climate scenario analyses on parts of our portfolio to assess the impact of the transition and physical risk drivers under different scenarios, including a 2°C scenario. Our asset management businesses integrate ESG issues into their investment process when doing so may have a material impact on investment risk or return. RBC Insurance® provides policy administration for property and casualty products sold through Aviva Canada Inc., and is therefore not directly exposed to climate-related risks associated with these products. The insurance industry as a whole has exposure to longer-term shifts in climate patterns, such as rising temperatures and hurricanes, which may indirectly impact our Insurance business results.

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Royal Bank of Canada, [Task Force on Climate-related Financial Disclosures Report 2019](#), pp. 9 and 11

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Mapping to the TCFD Recommendations

Some organizations provide tables and charts that map sections of their reports to the Task Force’s recommendations to direct users to where they can find their TCFD-aligned disclosures. [Figure E16](#) shows a company’s (BASF’s) mapping of where in its integrated report a user can find information that addresses the recommended disclosures under the Risk Management recommendation.

Figure E16
BASF, Integrated Report 2019

About This Report 1 To Our Shareholders 2 Management's Report Overview 3 Corporate Governance 4 Consolidated Financial Statements 5 Overview			
Recommendations of the Task Force on Climate-related Financial Disclosures in the relevant chapters of the integrated report			
Topic	Recommended disclosures	Section	Page
[...]			
Risk management	Describe the organization's processes for identifying and assessing climate-related risks.*	Opportunities and Risks – Risk management process	Page 140–142 Page 103
Disclose how the organization identifies, assesses, and manages climate-related risks	Describe the organization's processes for managing climate-related risks.	Supplier Management – Training and partnerships	
		Opportunities and Risks – Risk management process	Page 140–142 Page 145–147
	Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	Opportunities and Risks – Long-term opportunities and risks Opportunities and Risks – Risk management process	Page 140–142

* Climate-related risks are identified, assessed, and managed as part of the general risk management process.

BASF, [BASF Report 2019](#), p. 18

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Similar to the figure above, [Figure E17](#) shows EnBW's mapping of the Risk Management recommendation to sections of its annual report.

Figure E17
EnBW, Integrated Annual Report 2019

Task Force on Climate-related Financial Disclosures (TCFD)			
TCFD element	Themes	Section	Page reference
Governance	› Corporate management	› Corporate governance	page 48
	› Materiality analysis	› In dialogue with our stakeholders	page 51 f.
	› Investment guidelines	› The EnBW Group	page 76
	› Climate protection initiatives	› In dialogue with our stakeholders, General conditions	pages 52 and 63
	› Overall assessment by the management	› Overall assessment of the economic situation of the Group	page 95
	› Board of Management remuneration	› Remuneration report	page 110 ff.
Strategy	› Robustness of business model/scenario analysis	› Business model	page 33
	› Strategy, strategic development	› Strategy, goals and performance management system	page 41 ff.
	› Interdependencies	› Strategy, goals and performance management system	page 46 f.
	› Materiality analysis	› In dialogue with our stakeholders	page 51 f.
	› Green bonds	› The EnBW Group	page 74
	› General conditions, climate protection	› General conditions	page 63
Risk management	› Integrated opportunity and risk management including opportunity and risk map	› Report on opportunities and risks	page 100 ff.
	› Environment goal dimension: opportunities and risks	› Report on opportunities and risks	page 104
Performance indicators and targets	› Sustainability ratings	› In dialogue with our stakeholders	page 53
	› Key performance indicators and long-term targets	› Strategy, goals and performance management system	page 44 ff.
	› Environment goal dimension: key performance indicators and other performance indicators	› The EnBW Group	page 87 ff.

EnBW, [Integrated Annual Report 2019](#), p. 122

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Appendix 1: Climate-Related Risks and Potential Financial Impacts

In its 2017 report, the Task Force divided climate-related risks into two major categories: (1) risks related to the *transition* to a lower-carbon economy and (2) risks related to the *physical* impacts of climate change (see [Table A1-1](#), p. 36).

1. TRANSITION RISKS

Transitioning to a lower-carbon economy may entail extensive policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to companies.

Policy and Legal Risks

Policy actions around climate change continue to evolve. Their objectives generally fall into two categories — policy actions that attempt to constrain actions that contribute to the adverse effects of climate change or policy actions that seek to promote adaptation to climate change. Some examples include implementing carbon-pricing mechanisms to reduce GHG emissions, shifting energy use toward lower emission sources, adopting energy-efficiency solutions, encouraging greater water efficiency measures, and promoting more sustainable land-use practices. The risk associated with and financial impact of policy changes depend on the nature and timing of the policy change.³⁴

Another important risk is litigation or legal risk. Recent years have seen an increase in climate-related litigation claims being brought before the courts by property owners, municipalities, states, insurers, shareholders, and public interest organizations.³⁵ Reasons for such litigation include the failure of companies to mitigate impacts of climate change, failure to adapt to climate change, and the insufficiency of disclosure around material financial risks. As the value of loss and damage arising from climate change grows, litigation risk is also likely to increase.

Technology Risk

Technological improvements or innovations that support the transition to a lower-carbon, energy-efficient economic system can have a significant impact on companies. For example, the development and use of emerging technologies such as renewable energy, battery storage, energy efficiency, and carbon capture and storage will affect the competitiveness of certain companies, their production and distribution costs, and ultimately the demand for their products and services from end users. To the extent that new technology displaces old systems and disrupts some parts of the existing economic system, winners and losers will emerge from this “creative destruction” process. The timing of technology development and deployment, however, is a key uncertainty in assessing technology risk.

Market Risk

While the ways in which markets could be affected by climate change are varied and complex, one of the major ways is through shifts in supply and demand for certain commodities, products, and services as climate-related risks and opportunities are increasingly taken into account.

Reputation Risk

Climate change has been identified as a potential source of reputational risk tied to changing customer or community perceptions of a company’s contribution to or detraction from the transition to a lower-carbon economy.

A key aspect in assessing transition risks is the speed and magnitude of transition, as well as the policy instruments used to effect change, which jurisdictions are undertaking such changes, and the amount of coordination across jurisdictions. A rapid, disorderly transition to a lower-carbon economy may present significant risks and adjustment costs to companies, especially those operating in multiple jurisdictions. For example, some companies may face “stranded assets” across a variety of asset types. Stranded assets can be caused by changing policy or regulation, reputational impacts, or shifts in markets and technology. Asset stranding could affect a variety of infrastructure assets, such as resources in the ground, physical facilities, or technology patents.

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³⁴ Organizations should assess not only the potential direct effects of policy actions on their operations, but also the potential second and third order effects on their supply and distribution chains.

³⁵ Peter Seley, “Emerging Trends in Climate Change Litigation,” *Law 360*, March 7, 2016.

2. PHYSICAL RISKS

Physical risks resulting from climate change can be event driven (acute) or longer-term shifts (chronic) in climate patterns.³⁶ Physical risks may have financial implications for companies, such as direct damage to assets and indirect impacts from supply chain disruption. Companies' financial performance may also be affected by changes in water availability, sourcing, and quality; food security; and extreme temperature changes affecting companies' premises, operations, supply chain, transport needs, and employee safety.

Acute Risk

Acute physical risks refer to those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.

Chronic Risk

Chronic physical risks refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves.

The most common climate-related physical risks identified by companies include the following:³⁷

- Risks from the increased severity of extreme weather;
- Changes to precipitation and weather patterns; and
- Rising mean temperatures.

Physical risks will vary by region and locality and are influenced by geographic and topological aspects of a location. Physical risks from climate change can impact businesses directly, indirectly, or through cascading or interrelated effects. Such risks may directly damage or disrupt a company's operations, supply chains, or labor productivity; and they may indirectly affect food systems, social stability, biodiversity, and habitat more generally. Through feedback loops and interactions, physical risks also may combine or cascade, such as through rising sea levels combined with extreme weather (hurricanes) resulting in historically high and damaging storm surges.

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Table A1-1

Climate-Related Risks and Potential Financial Impacts

Type	Climate-Related Risks ³⁸	Potential Financial Impacts
Transition Risks	Policy and Legal <ul style="list-style-type: none"> • Increased pricing of GHG emissions • Enhanced emissions-reporting obligations • Mandates on and regulation of existing products and services • Exposure to litigation 	<ul style="list-style-type: none"> • Increased operating costs (e.g., higher compliance costs, increased insurance premiums) • Write-offs, asset impairment, and early retirement of existing assets due to policy changes • Increased costs and/or reduced demand for products and services resulting from fines and judgments
	Technology <ul style="list-style-type: none"> • Substitution of existing products and services with lower-emissions options • Unsuccessful investment in new technologies • Costs to transition to lower-emissions technology 	<ul style="list-style-type: none"> • Write-offs and early retirement of existing assets • Reduced demand for products and services • Research and development (R&D) expenditures in new and alternative technologies • Capital investments in technology development • Costs to adopt/deploy new practices and processes

³⁶ For more information on physical risks and hazards, see the IPCC's 2012 [special report](#) and its [Working Group I](#) and [Working Group II](#) contributions to its Fifth Assessment Report.

³⁷ CDP, *Major Risk or Rosy Opportunity: Are Companies Ready for Climate Change*, 2019.

³⁸ The sub-category risks described under each major category are not mutually exclusive, and some overlap exists.

Table A1-1: Climate-Related Risks and Potential Financial Impacts
(Continued)

Type	Climate-Related Risks ³⁸	Potential Financial Impacts
Transition Risks	Market <ul style="list-style-type: none"> • Changing customer behavior • Uncertainty in market signals • Increased cost of raw materials 	<ul style="list-style-type: none"> • Reduced demand for goods and services due to shift in consumer preferences • Increased production costs due to changing input prices (e.g., energy, water) and output requirements (e.g., waste treatment) • Abrupt and unexpected shifts in energy costs • Change in revenue mix and sources, resulting in decreased revenues • Repricing of assets (e.g., fossil fuel reserves, land valuations, securities valuations)
	Reputation <ul style="list-style-type: none"> • Shifts in consumer preferences • Stigmatization of sector • Increased stakeholder concern or negative stakeholder feedback 	<ul style="list-style-type: none"> • Reduced revenue from decreased demand for goods/services • Reduced revenue from decreased production capacity (e.g., delayed planning approvals, supply chain interruptions) • Reduced revenue from negative impacts on workforce management and planning (e.g., employee attraction and retention) • Reduction in capital availability
Physical Risks	Acute <ul style="list-style-type: none"> • Increased severity of extreme weather events such as cyclones and floods 	<ul style="list-style-type: none"> • Reduced revenue from decreased production capacity (e.g., transport difficulties, supply chain interruptions) • Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism)
	Chronic <ul style="list-style-type: none"> • Changes in precipitation patterns and extreme variability in weather patterns • Rising mean temperatures • Rising sea levels 	<ul style="list-style-type: none"> • Write-offs and early retirement of existing assets (e.g., damage to property and assets in “high-risk” locations) • Increased operating costs (e.g., inadequate water supply for hydroelectric plants or to cool nuclear and fossil fuel plants) • Increased capital costs (e.g., damage to facilities) • Reduced revenues from lower sales/output • Increased insurance premiums and potential for reduced availability of insurance on assets in “high-risk” locations

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³⁸ The sub-category risks described under each major category are not mutually exclusive, and some overlap exists.

Appendix 2: International Risk Management Frameworks

In researching well-recognized, international risk management frameworks, the Task Force identified two such frameworks — the Committee of Sponsoring Organizations of the Treadway Commission’s (COSO’s) enterprise risk management (ERM) framework and International Organization for Standardization

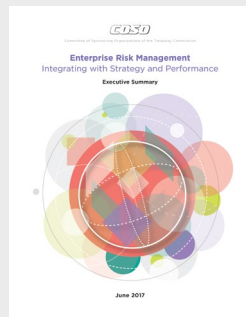
(ISO) 31000. Both are widely recognized and used around the world. For example, “nearly 70% of the world’s companies use the original COSO Framework for Enterprise Risk Management;” and 76 countries have adopted the ISO 31000 standard as their national risk management standard (see [Figure A2-1](#) below).³⁹

Figure A2-1
International Risk Management Frameworks

COSO: ERM – Integrating Strategy and Performance (2017)

COSO published its initial ERM framework in 2004, with the purpose of helping companies better protect and enhance stakeholder value.

COSO’s 2017 update of its ERM framework highlighted that “the Framework has been used successfully around the world, across industries, and in companies of all types and sizes to identify risks, manage those risks within a defined risk appetite, and support the achievement of objectives.” (COSO, 2017)



ISO 31000: Risk Management – Guidelines (2018)

ISO published its initial risk management guidelines (ISO 31000) in 2009 and updated them in 2018. ISO 31000 provides guidelines on managing risk and “a common approach to managing any type of risk and is not industry or sector specific.”

ISO 31000 also notes “[t]he application of these guidelines can be customized to any organization and its context” and the guidelines “can be used throughout the life of the organization and [...] applied to any activity, including decision-making at all levels.” (ISO, 2018)



The Task Force decided to use COSO’s Enterprise Risk Management — Integrating with Strategy and Performance as the foundation for discussing risk management processes in this guidance.⁴⁰ We leveraged COSO’s ERM framework, in part, because it is also the basis

of the COSO and World Business Council for Sustainable Development (WBCSD)-developed guidance on integrating environmental, social, and governance-related risks (ESG) into ERM processes, from which we also draw.⁴¹

³⁹ See Rodney Irwin, “Better Risk Management: It’s About Survival,” May 7, 2018; and ISO, “Why ISO 31000?” May 2017, respectively.

⁴⁰ COSO, *Executive Summary: Enterprise Risk Management — Integrating with Strategy and Performance*, September 2017.

⁴¹ COSO and WBCSD, *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

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Appendix 3: Additional Information on Integration

This appendix provides examples of information related to risk categories, tools, and scenario analysis that may help companies in integrating climate-related risks into existing processes.

help other companies think through their own risk categorization.

The example in [Figure A3-1](#) shows a bank's (Société Générale Group's) main risk categories and indicates risks associated with climate change have been identified as factors that could aggravate the existing risks. While climate-related risks do not appear in the definitions of the bank's main risk categories, such risks

1. RISK CATEGORIES

Examples of how climate-related risks are categorized by different companies may

Figure A3-1

Société Générale Group's Risk Categories

TYPES OF RISKS

The Group's risk management framework involves the following main categories:

- **Credit and counterparty risk:** risk of losses arising from the inability of the Group's customers, issuers or other counterparties to meet their financial commitments. Credit risk includes the counterparty risk linked to market transactions and securitisation activities. In addition, credit risk may be further amplified by individual, country and sector concentration risk;
- **Market risk:** risk of a loss of value on financial instruments arising from changes in market parameters, the volatility of these parameters and correlations between them. These parameters include, but are not limited to, exchange rates, interest rates, the price of securities (equity, bonds), commodities, derivatives and other assets;
- **Operational risk:** risk of losses resulting from inadequacies or failures in processes, personnel or information systems, or from external events. It includes:
 - **non-compliance risk (including legal and tax risks):** risk of court-ordered, administrative or disciplinary sanctions, or of material financial loss, due to failure to comply with the provisions governing the Group's activities,
 - **reputational risk:** risk arising from a negative perception on the part of customers, counterparties, shareholders, investors or regulators that could negatively impact the Group's ability to maintain or engage in business relationships and to sustain access to sources of financing,
 - **misconduct risk:** risk resulting from actions (or inactions) or behaviour of the Bank or its employees inconsistent with the Group's Code of Conduct, which may lead to adverse consequences for our stakeholders, or place the Bank's sustainability or reputation at risk,
 - **IT and Information Systems Security risk** (cybercrime, IT systems failures, etc.);
- **Model risk:** potential for adverse consequences from decisions based on incorrect or misused model outputs and reports.
- **Risk related to insurance activities:** through its insurance subsidiaries, the Group is also exposed to a variety of risks linked to this business. In addition to balance sheet management risks (interest rate, valuation, counterparty and exchange rate risk), these risks include premium pricing risk, mortality risk and the risk of an increase in claims;
- **Risk on private equity and related transactions:** risk of reduction in the value of our equity ownership interests;
- **Structural risk:** risk of losses in interest margin or banking book value if interest rates, exchange rates, or credit spreads change. This risk is related to the commercial and own activities of the Bank, it includes the distortion of the structural difference between assets and liabilities related to pension obligations, as well as the risk related to longer terms of future payments;
- **Liquidity and funding risk:** liquidity risk is defined as the inability of the Group to meet its financial obligations: debt repayments, collateral supply, etc. Funding risk is defined as the risk that the Group will not be able to finance its business growth on a scale consistent with its commercial objectives and at a cost that is competitive compared to its competitors;
- **Strategic/business risk:** risks resulting from the Group's inability to execute its strategy and to implement its business plan for reasons that are not attributable to the other risks in this list; for instance, the non-occurrence of the macroeconomic scenarios that were used to construct the business plan or sales performance that was below expectations;
- **Residual value risk:** through its Specialised Financial Services Division, mainly in its long-term vehicle leasing subsidiary, the Group is exposed to residual value risk (where the net resale value of an asset at the end of the leasing contract is less than expected).

In addition, **risks associated with climate change**, both physical (increase in the frequency of extreme climatic events) and transition-related (New Carbon Regulation), have been identified as factors that could aggravate the Group's existing risks.

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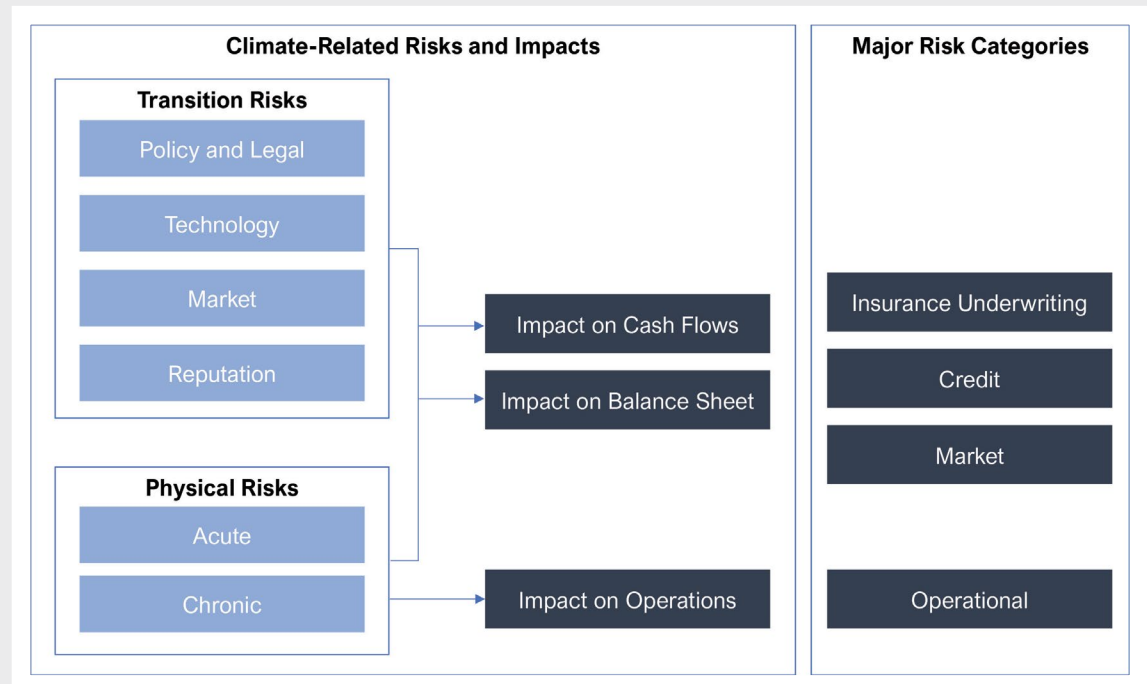
would likely appear in more detailed risk documentation (e.g., risk inventory).

The example below comes from the Climate Financial Risk Forum’s (CFRF’s) Risk Management Chapter, which provides information on approaches for managing climate-related risks (for the financial sector). The CFRF suggests financial institutions should undertake a materiality assessment of climate-related risks

to help them decide whether such risks should be treated as stand-alone risks or as drivers of existing risks. In cases where climate-related risks are treated as drivers of existing risks, [Figure A3-2](#) provides an example of how the TCFD-defined types of climate-related risks may map into risk categories commonly used by financial institutions. The CFRF also mentions litigation risk and model risk as categories financial institutions may also wish to consider.

Figure A3-2

Mapping of Climate-Related Risks to Major Risk Categories



Adapted from Climate Financial Risk Forum, CFRF Guide 2020: Risk Management Chapter, p. 16

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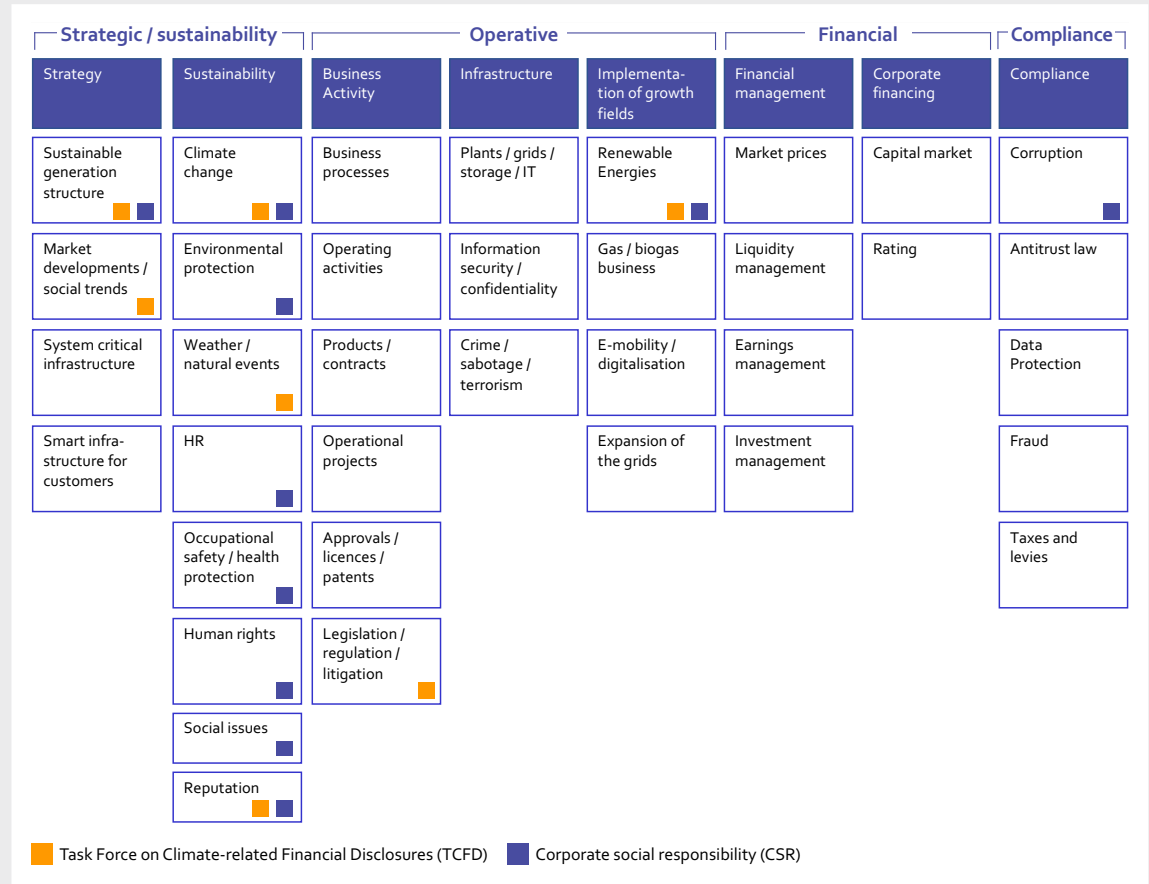
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For non-financial companies, risk categorization will vary based on many factors, such as industry, business model, and regulatory requirements. The example in Figure A3-3 shows an electric utility company's (EnBW's) opportunity and risk map,⁴² based on the internationally

established COSO II framework as a standard for risk management systems that span entire companies.⁴² The risk map shows where climate-related risks (defined by the TCFD) fit into the company's major risk categories and sub-categories — marked by a light orange square.

Figure A3-3
Risk Map



EnBW, *Integrated Annual Report 2019*, p. 100

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⁴² EnBW, *Integrated Annual Report 2019*, March 2020, p. 100.

Another example of risk categorization for non-financial companies is shown in Figure A3-4. This example comes from the WBCSD's Construction and Building Materials TCFD Preparer Forum report and is an excerpt from a table describing climate-related transition and physical risks to help construction

and building materials companies consider which risks are most material to their respective businesses. The complete table includes each of the major risk categories defined by the TCFD (transition and physical risks) as well as the underlying sub-categories.

Figure A3-4
Transition and Physical Risks:
Construction and Building Materials

CATEGORY	SUB-CATEGORY	IMPACT TYPE	VALUE CHAIN IMPLICATIONS				INFLUENCES, CONNECTIONS AND COLLABORATION
			RAW MATERIAL EXTRACTION	BUILDING PRODUCTS AND MATERIALS MANUFACTURE	DEVELOPMENT	CONSTRUCTION	
Market	Increased cost of raw materials, shift in consumer preferences		<p>Possible impact</p> <ul style="list-style-type: none"> Changes in the cost of carbon intensive raw materials affect demand and profitability of operations. Increased energy prices affect operational costs. <p>Response</p> <ul style="list-style-type: none"> Stabilize operational costs to capitalize on raw material price increase. Adjust production outputs to reflect demand. Diversify product portfolio to reflect shifting consumer preferences. 	<p>Possible impact</p> <ul style="list-style-type: none"> Changes to input costs for construction products affect demand and profitability. Demand for substitute goods. Increased energy prices affect operational costs. <p>Response</p> <ul style="list-style-type: none"> Diversify product portfolio. Hedge price volatility of key materials. Source raw materials more widely, engage with suppliers and vertically integrate operations. Explore circular economy options. 	<p>Possible impact</p> <ul style="list-style-type: none"> Increased materials costs impact profitability and/or viability of construction projects. Ability to prioritize use of low-carbon materials jeopardized if they become too expensive. Increased energy prices affect operational costs. <p>Response</p> <ul style="list-style-type: none"> Materials price sensitivity assessment and contingency plans for procurement. 	<p>Possible impact</p> <ul style="list-style-type: none"> Increased costs if prices of energy and/or raw materials rise and are passed through the value chain. Changing customer preferences incentivize use of new materials. <p>Response</p> <ul style="list-style-type: none"> Improve capacity to satisfy consumer preferences and manage exposure to price volatility. Develop contingency plans to manage material price fluctuations. Improve efficiency of energy consumption and material use. 	<ul style="list-style-type: none"> Exposure to raw material price volatility risks could affect the value chain in different ways, influencing downstream players to seek alternative material/product options and changing the operational costs and demand for products from upstream players. Increased energy costs would cause operational costs to rise for all value chain participants. Changing demand could offer opportunities for specialization and diversification, such as the expansion of low emissions services and products.
Reputation	Changing public perceptions of the sector		<p>Possible impact</p> <ul style="list-style-type: none"> Negative public image arising from issues related to sustainability and climate change results in reduced demand for products and services. <p>Response</p> <ul style="list-style-type: none"> Maintain focus on sustainability reporting, corporate citizenship and environmental responsibility, ensuring this is well documented and transparently communicated. Maintain strategic focus on minimizing environmental impact and contributing to climate change mitigation and adaptation efforts. Explore potential for differentiation in the market based on environmental credentials. 				<ul style="list-style-type: none"> Public sentiment around sustainability and climate change issues affects all value chain players. Negative perceptions can result in reputational damage and influence customer decisions, whereas positive perceptions create opportunities to attract talent and investors. Collaboration to develop educational initiatives could help explain the sector's role in climate change adaptation and mitigation and wider societal issues.

WBCSD, Construction and Building Materials TCFD Preparer Forum, pp. 22–26

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2. RISK TOOLS

As noted in [Section D.2. Initial Steps for Integrating Climate-Related Risks into Risk Management](#), there are a range of tools

that companies may want to consider as they integrate climate-related risks into existing processes. [Table A3-1](#) expands on the tools described earlier in the guidance.

Table A3-1

Overview of Various Tools and Their Application to Climate-Related Risks

Tool	Description	Application	Process
Delphi Method	Structured communication method for eliciting information and opinions from experts	Conduct interviews or collect expert input from business leaders, actuaries, insurers, meteorologists, oceanographers, climate, and atmospheric scientists	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment
Economic Scenario Generator	Models that simulate possible future states of economies and financial markets based on risk factors to identify unexpected but plausible outcomes	Test valuation models under a broad range of possible economic and financial conditions (e.g., considering climate change and socioeconomic factors)	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment
Forecasting	An approach for predicting the impact of a future event based on past and present data	Use historical data and lookback studies to understand previous climate-related impacts to inform estimates of potential future impacts, changing key parameters (e.g., frequency, duration, intensity) within plausible ranges	<ul style="list-style-type: none"> • Risk Assessment
Hazard Maps	Location-level information on the extent or severity of perils using assumptions on the frequency, severity, and location parameters of primary events and dependencies with secondary perils ⁴³	Present peril event scenarios based on current and potential future states considering the impact from climate change, which will result in different frequency and severity of events affecting certain locations	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment
Horizon Scanning	Systematic and proactive approach to risk identification based on available information	Identify various climate-related risk types across different spatial and temporal scales	<ul style="list-style-type: none"> • Risk Identification

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⁴³ Third-party service providers and some reinsurers provide hazard maps. For example, see Swiss Re's [CatNet®](#).

Table A3-1: Overview of Various Tools and Their Application to Climate-Related Risks
(Continued)

Tool	Description	Application	Process
Probabilistic Modeling	<i>General.</i> Systems modeling that involves probabilistic inputs, processes, and outputs	Numerical weather and climate predictions that allow a representation of uncertainties, a reduction of systematic biases, and improved representation of long-term climate variability	<ul style="list-style-type: none"> • Risk Assessment
	<i>Catastrophe Models.</i> Probabilistic models based on deep understanding of the physical parameters that define a natural hazard (e.g., wind speeds) and characteristics of the exposures (e.g., location)	Estimate potential losses from natural catastrophes	<ul style="list-style-type: none"> • Risk Assessment • Risk Identification • Risk Response
Scenario Analysis	A process for identifying and assessing potential implications of a range of plausible future states under conditions of uncertainty	Explore and develop an understanding of how climate-related risks and opportunities might plausibly impact a company over time	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment • Risk Response
Sensitivity Analysis	Statistical analysis that examines the change in a desired output relative to a change in input parameters	Analyze a company's sensitivity to changing climate-related conditions (e.g., carbon or commodity prices or demand)	<ul style="list-style-type: none"> • Risk Assessment
Simulation	Use of models to imitate a situation many times in order to estimate the likelihood of various possible outcomes (e.g., Monte Carlo method)	Assess the likelihood or propensity of different climate-related scenario pathways accommodating multiple variables and parameters	<ul style="list-style-type: none"> • Risk Assessment
Stakeholder Engagement	A means of obtaining input for decision making from those parties who may be affected by the decision or have knowledge that may inform the decision	Seek insight from a range of stakeholders within and outside a company (e.g., management executives, suppliers) who can provide feedback on changing conditions and potential impacts associated with climate-related risks	<ul style="list-style-type: none"> • Risk Identification • Risk Assessment

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3. SCENARIO ANALYSIS

The Task Force considers scenario analysis as a useful tool for risk identification and assessment of climate-related risks and has been emphasizing the importance of using scenario analysis to assess potential business, strategic, and financial implications of climate-related risks since publication of the TCFD recommendations in 2017.

In particular, for firms taking a forward-looking risk assessment approach, scenarios can support the assessment of strategic risk from climate change. Scenario analysis is particularly useful for taking account of the uncertainties associated with climate change. These uncertainties arise from the way drivers of change, assumptions, and the scenario logic may play out and evolve under different assumptions; other uncertainties arise from the physical interactions and impacts of the climate as well as uncertainties in climate models. In scenario analysis, different drivers and different assumptions about those drivers lead to a wide range of potential outcomes.

Uncertainty also arises from the differing temporal and spatial scales over which climate-related risks develop. For example, acute physical risks, such as extreme weather, wildfires, and heatwaves, develop over shorter time frames (e.g., annually) and at local or subnational spatial scales. Chronic physical risks, such as long-term changes in precipitation patterns and average temperatures, are modeled on global and regional scales and decadal time periods. Scenario time horizons, therefore, should be sufficiently long for the climate-related risks of interest to emerge; thus, scenario time horizons may vary with the type of risk being evaluated (e.g., transition, acute physical, chronic physical).

In assessing forward-looking risks, scenarios should be distinctive and diverse to cover a wide range of plausible climate-related risks for the risks a company is assessing. The objective is to create scenarios that capture the historical trends and forces and how they might unfold/evolve into the future. Each scenario should focus on a different combination of the key high-impact and high-uncertainty driving forces in order to be distinct and challenging; all scenarios should have a common baseline set of conditions consisting of high-impact drivers with low-to-medium uncertainty.

For example, if a company wishes to assess its transition risks, one scenario could assume an outcome that the Paris Agreement climate targets are met, and then consider which drivers and assumptions would be required to achieve a pathway to that outcome. Other scenarios could assume outcomes at lower levels of emissions with different assumptions as to how drivers must evolve to achieve that outcome.

The range of scenarios, therefore, should reflect the key underlying drivers and assumptions relevant for the creation, amplification, or distortion of the potential climate-related risks a company wishes to assess. Each scenario should be distinct, plausible, and challenging, and the set of scenarios used should have consistent logic, be relevant to the risks being assessed, and be diverse. Scenario analysis should be consistently applied to assess strategic and financial risks, and consistent with other internal risk processes such as the valuations of assets and liabilities for financial disclosure.

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Appendix 4: Glossary

BUSINESS OBJECTIVES refer to measurable steps an organization takes to achieve its strategy.⁴⁴

CLIMATE-RELATED OPPORTUNITY refers to the potential positive impacts related to climate change on a company.

CLIMATE-RELATED RISK refers to the potential negative impacts of climate change on a company.

GOVERNANCE refers to “the system by which [a company] is directed and controlled in the interests of shareholders and other stakeholders.”⁴⁵

IMPACT refers to the extent to which a risk event might affect a company.

LIKELIHOOD represents the possibility that a given event will occur.

OPERATING STRUCTURE refers to the way [a company] organizes and carries out its day-to-day operations.⁴⁶

RISK APPETITE refers to the types and amount of risk, on a broad level, a company is willing to accept in pursuit of value.⁴⁷

RISK CATEGORIES refer to the high-level classification of specific risks. Commonly used risk categories include strategic, financial, and operational; however, most companies have additional (or other) risk categories as well.

RISK INVENTORY refers to all risks that could impact a company.⁴⁸

RISK MANAGEMENT refers to a set of processes that are carried out by a company to support the achievement of its objectives by addressing its risks and managing the combined potential impact of those risks.

RISK TAXONOMY refers to a common system to organize risks consistently across a company and establish “parent-child” relationships between broad risk categories and specific sub-categories.

RISK PROFILE refers to a composite view of the risk assumed at a particular level of a company or aspect of the business that positions management to consider the types, severity, and interdependencies of risks and how they may affect performance relative to the strategy and business objectives.⁴⁹

STRATEGY refers to a company’s desired future state. A company’s strategy establishes a foundation against which it can monitor and measure its progress in reaching that desired state.

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⁴⁴ COSO and WBCSD, *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

⁴⁵ A. Cadbury, *Report of the Committee on the Financial Aspects of Corporate Governance*, London, 1992.

⁴⁶ COSO and WBCSD, *Enterprise Risk Management—Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*, October 2018.

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