

# PHYSICAL RISKS FROM CLIMATE CHANGE

A guide for companies and investors on  
disclosure and management of  
climate impacts



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# INTRODUCTION

Climate change has already started to cause a wide range of physical effects—with serious implications for investors and businesses. While weather variability and extremes have always existed, the science shows that extreme weather events are becoming more frequent and intense, that incremental climatic changes are already underway, and that the impacts of climate change are expected to grow more severe over the coming years and decades.

The year 2011 set records for economic losses and insured losses caused by natural catastrophes, with extreme weather events accounting for 90 percent of the disasters and eight of the 10 most costly, resulting in overall losses of more than \$148 billion and insured losses of more than \$55 billion.<sup>1</sup> Climate change is predicted to increase these trends. Climate impacts, such as increasing temperatures, rising sea levels, changing weather patterns, and more frequent or intense droughts, floods, and storms, can pose serious challenges for company facilities, supply chains, employees, current and potential customers, and the communities on which companies depend.

As described in this guide, companies are already experiencing business impacts from weather-related phenomena that climate change is expected to make more common and/or intense, including:

- More than 160 companies in Thailand's textile industry harmed by 2011 floods, stopping about a quarter of the country's garment production.
- Agribusiness and food company Bunge reporting a \$56 million quarterly loss in its sugar and bioenergy segments, driven primarily by droughts in 2010 in its main growing areas.
- Electric power company Constellation Energy experiencing reduced quarterly earnings of about \$0.16 per share due to the record-setting 2011 heat wave in Texas that forced it to buy incremental power at peak prices.
- Oil and gas companies' Gulf of Mexico assets (e.g., drilling rigs, production platforms, and pipelines) suffering extensive damage from Hurricane Katrina and Hurricane Rita.
- Insurance company Munich Re receiving claims worth more than \$350 million from the 2010-2011 Australian floods, contributing to a 38 percent quarterly profit decline.

Investors have been concerned about physical climate risks such as these for several years and have actively pursued better climate disclosure from the companies in which they invest—engaging companies directly, sending questionnaires, and issuing statements, such as the “Global Framework for Climate Risk Disclosure” and “Institutional Investors' Expectations of Corporate Climate Risk Management.” (See Appendix A for more details.) Some companies have been improving their overall climate disclosure, although they generally have done a better job disclosing risks related to their greenhouse gas emissions (e.g., regulatory risks) than risks from the physical impacts of climate change.

Investors and stakeholders increasingly expect companies to manage the short- and long-term physical risks (and, potentially, opportunities) posed by climate impacts—and to disclose important risks and risk management strategies, including disclosure in U.S. Securities and Exchange Commission (SEC) filings. These disclosures should also address the risks posed by climate change to the local communities in which companies operate and source, as well as the implications of the ways in which companies manage those climate impacts, including for corporate reputations and community relationships.

This document is designed as a guide to help chart a course for disclosing and managing such risks. Specifically, it provides:

- *Publicly-traded companies* with detailed and specific guidance on physical climate risk disclosure and risk management steps.
- *Investors* with guidance on the types of information they should expect of companies to manage portfolio risks related to physical climate change impacts.

This guide should also be useful for the public and policymakers seeking to better understand the critical issues concerning physical climate risks and strategies to adapt to, prepare for, and become more resilient to climate impacts.

## SIGNIFICANT WEATHER-RELATED LOSS EVENTS IN 2011

- Meteorological events (storm)
- Hydrological events (flood)
- Climatological events (extreme temperature, drought, wildfire)



Source: Adapted from Munich Re, Geo Risks Research, NatCatSERVICE, 2012

### CONTENT OF THIS GUIDE

Robust corporate risk disclosure is the hallmark of a transparent and fair marketplace in which investors can make informed decisions. Investors rely especially on filings with the SEC to learn how publicly-traded companies are evaluating and managing material risks. The guide therefore opens with a review of the February 2010 guidance from the SEC on material information on physical climate risks that companies should be disclosing to investors under existing U.S. securities laws and SEC regulations. The guide also briefly refers to other countries' disclosure guidance and requirements, such as those in Canada and the UK, as well as key voluntary disclosure vehicles utilized by investors, such as the Carbon Disclosure Project (CDP) and sustainability reporting.

This guide focuses on some of the key physical climate risks and business impacts faced by companies in the following sectors:

-  Agriculture, food, and beverage
-  Apparel
-  Electric power
-  Insurance
-  Mining
-  Oil and gas
-  Tourism

For each of these sectors, this guide includes a description of physical climate risks and business impacts, including some current real-world examples that illustrate the types of risks and impacts companies may increasingly experience because of climate change. In light of these risks, the guide provides some key questions that investors and companies in each sector should consider in the context of physical risk assessment. Some of these key questions are relevant for multiple sectors, including with regard to climate impacts on labor, operations, physical assets, supply chain, distribution chain, consumers, and stakeholders. In addition, the guide addresses questions that companies should examine involving climate change risks associated with the local communities on which companies depend for employees, supplies, natural resources, operations, services, and infrastructure, as well as the ways in which companies' reputations and community relationships may be affected by how they manage climate impacts.

The guide also provides recent examples of physical risk disclosure for each sector—not necessarily best practice examples, but rather examples that give a sense of how some companies disclose risks in this area. Some of these examples are from mandatory filings, while others are from voluntary disclosure vehicles; companies should ensure that their voluntary disclosures are consistent with their mandatory filings and that any information on physical risks that a reasonable investor might find material are included in mandatory disclosures.

The sectors highlighted in this guide are in no way the only ones that must deal with physical climate impacts. They were chosen to provide an illustrative cross-section of companies facing and managing physical climate risks. In fact, virtually every sector faces climate risks and opportunities, including those related to physical climate impacts. Accordingly, this guide concludes with some general tips for how companies can begin to manage these risks and with a checklist to help companies improve their disclosure of physical climate risks and risk management strategies.

# SEC CLIMATE RISK DISCLOSURE GUIDANCE AND OTHER DISCLOSURE TOOLS

The primary sources of information for investors seeking to learn how publicly traded companies are evaluating and managing risks material to their operations and performance are companies' filings with the SEC. The SEC requires publicly traded companies to disclose in their filings all information about their businesses—including risk factors, known trends, uncertainties, and other factors—that is reasonably likely to have a “material” impact on financial position or results.

The U.S. Supreme Court has explained that something is material “if there is a substantial likelihood that a reasonable shareholder would consider it important in deciding how to vote” or, put another way, that the information “would have been viewed by the reasonable investor as having significantly altered the ‘total mix’ of information made available.”<sup>2</sup>

In February 2010, after being petitioned by investors led by Ceres, the SEC issued its “Commission Guidance Regarding Disclosure Related to Climate Change.”<sup>3</sup> The Guidance does not create new legal requirements nor modify existing ones, but rather provides guidance on applying long-standing disclosure requirements to a range of climate-related topics.<sup>4</sup> With respect to physical climate risks, the Guidance explains that a range of physical effects can materially affect companies, including increases in storm intensity, sea-level rise, thawing permafrost, temperature extremes, changes in the availability or quality of water or other natural resources, floods, and decreased agricultural production capacity.<sup>5</sup>

The SEC Guidance serves as a reminder that climate risk disclosure is a matter of compliance with existing legal obligations.

Less than a year after issuance of the SEC Guidance, the Canadian Securities Administrators (CSA) issued its own guidance on disclosure requirements relating to environmental matters, including climate change.<sup>6</sup> Similarly, in the UK, the Climate Change Act 2008 has led to a requirement that certain companies (e.g., in the energy, water, and transport sectors) publish a report on how they are assessing and acting on the risks posed by the impacts of a changing climate.<sup>7</sup>

Insurers also have their own requirements for climate-related disclosure. In February 2012, insurance commissioners in California, New York, and Washington announced that they will require insurance companies operating in their states (and writing policies worth more than \$300 million nationwide) to disclose how they intend to respond to the risks that their businesses and customers face from climate change impacts.<sup>8</sup>

Mandatory reporting mechanisms are the primary vehicles upon which investors rely for corporate disclosure on physical climate risks, but they are not the only relevant disclosure vehicles. Two key voluntary disclosure vehicles utilized by investors are:

- Carbon Disclosure Project (CDP)—Since 2003, the CDP has been requesting information from corporations on their greenhouse gas emissions footprint and the risks, including physical risks, related to climate change. In 2011, more than 3,700 companies responded to the CDP questionnaire.<sup>9</sup>
- Sustainability reports—Corporate sustainability reports using the Global Reporting Initiative (GRI) guidelines provide companies with the opportunity to describe in much greater detail their risks, opportunities, strategies, and actions with respect to environmental, social, and other sustainability-related issues, including those related to the physical impacts of climate change (even though these risks, unlike other sustainability issues, arise not from the impact of company operations on society but rather from the impact of the environment on the company). In 2011, over 1,700 organizations used the GRI for producing sustainability reports.<sup>10</sup>

Mandatory reporting mechanisms are usually limited to information that companies deem to be “material” to investors, often in the short-term. Companies and investors may not always agree on what information is “material,” and information related to physical climate risks (many of which occur over the long-term) may not always be included in companies' mandatory disclosures—especially not in any detail. The voluntary disclosure vehicles are therefore also very important tools for companies to use to communicate relevant climate risk information to investors and other stakeholders.

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## KEY EXCERPTS FROM THE SEC GUIDANCE:

“““

[T]here may be significant physical effects of climate change that have the potential to have a material effect on a registrant's business and operations. These effects can impact a registrant's personnel, physical assets, supply chain and distribution chain.  
*(Page 6)*

“““

Registrants whose businesses may be vulnerable to severe weather or climate related events should consider disclosing material risks of, or consequences from, such events in their publicly filed disclosure documents.  
*(Page 27)*

“““

[S]evere weather can cause catastrophic harm to physical plants and facilities and can disrupt manufacturing and distribution processes... Possible consequences of severe weather could include:

- For registrants with operations concentrated on coastlines, property damage and disruptions to operations, including manufacturing operations or the transport of manufactured products;
- Indirect financial and operational impacts from disruptions to the operations of major customers or suppliers from severe weather, such as hurricanes or floods;
- Increased insurance claims and liabilities for insurance and reinsurance companies;
- Decreased agricultural production capacity in areas affected by drought or other weather-related changes; and
- Increased insurance premiums and deductibles, or a decrease in the availability of coverage, for registrants with plants or operations in areas subject to severe weather.



*(Pages 26-27)*

# PHYSICAL CLIMATE RISKS ACROSS SECTORS AND VALUE CHAINS

Virtually every sector of the economy faces risks from the short- and long-term physical effects of climate change—impacts across the entire business value chain, from raw materials through to the end users.

Climate impacts can affect labor and operations, physical assets, supply chain, distribution chain, consumers, and the communities on which companies depend. Some impacts will be direct (e.g., property damage due to flooding), while others will be indirect (e.g., reduced water availability due to increased demand from others). Some will be due to extreme weather events (e.g., stronger storms), while others will be due to incremental climatic changes (e.g., rising ambient air temperatures).

The table below summarizes some of the relevant physical climate impacts and value chain risks (and, in some instances, opportunities) for key sectors, with more information on each sector in the sections that follow.

BUSINESS SECTOR	RELEVANT SHORT- AND LONG-TERM PHYSICAL CLIMATE IMPACTS	ILLUSTRATIVE EFFECTS ON VALUE CHAIN
<p><b>AGRICULTURE, FOOD, AND BEVERAGE</b></p> 	<ul style="list-style-type: none"> <li>• Water scarcity and droughts</li> <li>• Increased frequency and severity of floods and storms</li> <li>• Changing rainfall patterns and increased rainfall intensity</li> <li>• Increased weather extremes and variability</li> <li>• Rising average temperatures</li> <li>• Shifts in seasons</li> <li>• Rising sea level and increased saline intrusion</li> <li>• Changes in pest and disease distribution and prevalence</li> <li>• Loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Decreased crop yield and potential crop failures</li> <li>• Loss of productive land (e.g., due to increased soil salinity)</li> <li>• Altered growing conditions and seasons</li> <li>• Increased exposure to pests and diseases</li> <li>• Increased irrigation demand and costs</li> <li>• Commodity price volatility</li> <li>• Distribution network problems</li> <li>• Disruptions to farmers and labor force</li> <li>• Water conflicts with communities and other users (and damaged corporate reputation)</li> </ul>
<p><b>APPAREL</b></p> 	<ul style="list-style-type: none"> <li>• Water scarcity and droughts</li> <li>• Increased frequency and severity of floods and storms</li> <li>• Changing rainfall patterns and increased rainfall intensity</li> <li>• Increased weather extremes and variability</li> <li>• Rising average temperatures</li> <li>• Rising sea level</li> <li>• Changes in pest and disease distribution and prevalence</li> </ul>	<ul style="list-style-type: none"> <li>• Fluctuating availability, quality, and cost of agricultural raw materials</li> <li>• Disruptions for operations and workers at manufacturing facilities</li> <li>• Disruptions in supply chain and distribution network, including transport, warehouses, and stores</li> <li>• Shifting consumer preferences (e.g., less reliable seasonal cycles and temperatures)</li> </ul>



BUSINESS SECTOR	RELEVANT SHORT- AND LONG-TERM PHYSICAL CLIMATE IMPACTS	ILLUSTRATIVE EFFECTS ON VALUE CHAIN
<b>ELECTRIC POWER</b> 	<ul style="list-style-type: none"> <li>• Increased intensity and duration of extreme weather events, such as heat waves, storms, and floods</li> <li>• Warmer average temperatures</li> <li>• Storm surge</li> <li>• Rising sea level</li> <li>• Water scarcity and overall variability in water supply and precipitation patterns</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced output (e.g., inadequate quantity and quality of water for hydroelectric plants or to cool nuclear and fossil fuel plants)</li> <li>• Damage to infrastructure and facilities</li> <li>• Changing seasonal power demand and increased peak demand during extreme heat or other conditions</li> <li>• Increased electricity losses in transmission and distribution systems due to heat load</li> </ul>
<b>INSURANCE</b> 	<ul style="list-style-type: none"> <li>• Virtually all physical effects, including hurricanes and storms, wildfires, floods, droughts, sea-level rise, thawing permafrost, and increased exposure to diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Increased claims, losses, and liabilities</li> <li>• More difficulty pricing physical perils</li> <li>• Reduced availability and affordability of some types of insurance</li> <li>• Potential need for new products to address physical climate risks</li> <li>• Reduced value of investment portfolio</li> </ul>
<b>MINING</b> 	<ul style="list-style-type: none"> <li>• Water scarcity and drought</li> <li>• Precipitation extremes and flooding</li> <li>• Increased intensity and duration of extreme weather events, such as storms</li> <li>• Rising sea level</li> <li>• Rising temperatures</li> <li>• Thawing permafrost and land ice</li> <li>• Increased wildfires</li> <li>• Increased exposure to diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Constrained exploration, processing, refining, and site rehabilitation</li> <li>• Damage to infrastructure and facilities</li> <li>• Higher decommissioning costs</li> <li>• Altered access to mining deposits and coastal facilities</li> <li>• Disrupted transportation routes and reduced port availability</li> <li>• Risks to worker health and safety</li> <li>• Water conflicts with communities (and damaged corporate reputation)</li> </ul>
<b>OIL AND GAS</b> 	<ul style="list-style-type: none"> <li>• Increased intensity and duration of extreme weather events, such as storms and floods</li> <li>• Rising sea level, higher storm surges, and increased coastal erosion</li> <li>• Land and sea ice melting and permafrost thawing</li> <li>• Water scarcity and droughts</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to infrastructure and facilities</li> <li>• Rising risks to employee safety and health</li> <li>• Altered access to fossil fuel reserves</li> <li>• Constrained production of water-intensive oil and gas resources, such as oil sands, and water conflicts with communities and other users (and damaged corporate reputation)</li> <li>• Disruption of transport and distribution systems</li> </ul>
<b>TOURISM</b> 	<ul style="list-style-type: none"> <li>• Increased weather extremes and variability</li> <li>• Increased frequency and severity of floods and storms</li> <li>• Rising temperatures</li> <li>• Rising sea level and coastal erosion</li> <li>• Droughts</li> <li>• Increased wildfires</li> <li>• Changes in precipitation patterns and snow reliability</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to infrastructure and facilities</li> <li>• Decreased attractiveness of tourism destinations</li> <li>• Disruptions of transportation (e.g., flights and cruises)</li> <li>• Loss of ski trails, coral reefs, and other natural tourism attractions</li> <li>• Altered tourist seasons</li> <li>• Conflicts with communities over coastal and other development</li> </ul>



# AGRICULTURE, FOOD, AND BEVERAGE SECTORS

Companies in the agriculture, food, and beverage sectors rely on water and other raw materials sensitive to weather and the natural environment, which means climate change increases the unpredictability these companies face in terms of availability, quality, and price and introduces long-term changes in growing conditions.<sup>11</sup>

Climate change affects temperature averages and extremes, water availability, the range of pests and diseases, extreme weather events, and precipitation volumes, timing, and geographical patterns, among other things.<sup>12</sup> The net effect of these climate impacts will generally be negative (e.g., droughts causing reduced crop yields or crop failures), though they may be positive in some instances (e.g., warmer springs, longer growing seasons).<sup>13</sup> In water-stressed regions—and by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity and two-thirds of the global population could be under stress conditions<sup>14</sup>—the additional pressures climate change places on scarce water supplies can also lead to conflicts between companies, local communities, and other water users, damaging corporate reputations and potentially disrupting operations.<sup>15</sup>

## REAL-WORLD EXAMPLES OF RISKS

- Agribusiness and food company Bunge reported a Q4 2010 loss of \$56 million in its sugar and bioenergy segments, driven primarily by droughts in its main growing areas in Brazil.<sup>16</sup>
- Fresh Del Monte Produce suffered a \$4 million loss in its banana operations in Guatemala in Q2 2010 due to heavy rains, strong winds, and flooding, and the loss in volume was expected to negatively impact profits by about \$9 million in the second half of 2010.<sup>17</sup>
- Brown Brothers Wineries in Australia, whose vineyards had all been located in Victoria, purchased the Tamar Ridge Estates vineyard in Tasmania in 2010 as part of its strategy to reduce climate risks (e.g., drought, high temperatures, and water scarcity) by sourcing grapes from areas that provide cooler growing temperatures.<sup>18</sup>
- GlaxoSmithKline, which owns the Ribena soft drink brand in the UK, has found that the more extreme and variable weather caused by climate change is having a major impact on British blackcurrant harvests, leading the company to work on developing more-resilient varieties.<sup>19</sup>

## KEY QUESTIONS FOR THE AGRICULTURE, FOOD, AND BEVERAGE SECTORS<sup>20</sup>

- Value Chain:** What steps is the company taking to understand and evaluate the physical impacts of climate change (short- and long-term, direct and indirect, from incremental and extreme changes) on its value chain?
- Systems and Processes:** How does senior management engage in building climate resilience into the company? Have physical climate risks and adaptation been incorporated into existing strategic, business planning, management, enterprise risk management, and internal reporting processes?
- Vulnerable Regions:** Does the company have operations in, source from, or distribute in regions that are particularly vulnerable to climate impacts?
- No-Regrets Actions:** What no-regrets actions (i.e., actions that will benefit the company under any plausible climate change scenario) could the company take to manage/reduce physical climate impacts on labor, operations, physical assets, supply chain, distribution chain, and consumers?
- Disaster Risk Management Strategies:** Does the company have, or is it developing, disaster risk management strategies to address the increased risk of disruptions due to severe climate-related events such as floods or droughts, including effects on the labor force and supply chains?
- Climate-Resilient Strategies:** What steps is the company taking to develop or implement strategies to promote climate-resilient agriculture throughout its supply chain?
- Water Risks:** What steps is the company taking to address climate-exacerbated water risks in its agricultural supply chain? Has the company considered the potential for water conflicts with local communities or other water users (e.g., other industries in the same watershed)?
- Stakeholders and Communities:** Is the company examining the ways in which climate impacts and the company's risk management strategies to address them may affect relevant local communities, especially farmers and other local producers? Is the company considering how these impacts and the company's responses may affect its supply chain and corporate reputation? What actions has the company taken to engage with local communities to address shared climate risks? Has the company identified stakeholders—including in civil society and local communities—to work with on preparing for climate impacts? What are the company's plans for ongoing community and stakeholder engagement?

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### EXAMPLE: PEPSICO DISCLOSES SOME PHYSICAL CLIMATE RISKS



*There is growing concern that carbon dioxide and other greenhouse gases in the atmosphere may have an adverse impact on global temperatures, weather patterns and the frequency and severity of extreme weather and natural disasters. In the event that such climate change has a negative effect on agricultural productivity, we may be subject to decreased availability or less favorable pricing for certain commodities that are necessary for our products, such as sugar cane, corn, wheat, rice, oats, pota-*

*toes and various fruits. We may also be subjected to decreased availability or less favorable pricing for water as a result of such change, which could impact our manufacturing and distribution operations. In addition, natural disasters and extreme weather conditions may disrupt the productivity of our facilities or the operation of our supply chain.*

—PepsiCo 2011 10-K<sup>21</sup>



## APPAREL SECTOR

As in the agriculture, food, and beverage sectors, companies in the apparel sector rely on water and other raw materials (e.g., cotton) sensitive to weather and the natural environment, which means climate change increases the unpredictability these companies face in terms of availability, quality, and price and introduces long-term changes in growing conditions.

Climate change will likely bring warmer temperatures, erratic rainfall, floods, drought, wildfires, extreme weather events, and altered ranges for pests and diseases, which can cause apparel companies to experience reduced availability of agricultural inputs, increased water stress, disrupted distribution systems (e.g., transport and stores), and damaged manufacturing facilities. Climate change may also affect what consumers buy and where and when they buy it, so apparel companies that base their products on traditional seasonal cycles may need to adjust to fluctuating consumer needs and tastes (e.g., due to less distinct changes between seasons, warmer winters, and hotter summers).<sup>22</sup>

### REAL-WORLD EXAMPLES OF RISKS

- VF Corporation, which owns brands such as The North Face and Lee, noted that the 2010 once-in-a-century floods in Pakistan and Australia, coupled with wet weather and freezes, “ravaged cotton crops resulting in drastic increases in the price of cotton,” which had “a material effect on our business as we sought a balance between absorbing the cost and raising prices on our cotton goods.”<sup>23</sup>
- Under Armour, a maker of athletic apparel, has seen elevated retail inventory levels for the 2011-2012 winter due to “the impact of unseasonably warm weather,” accounting for about two percentage points of growth coming out of the fourth quarter 2011 into 2012, which is part of the reason the company plans for 2012 net revenues to come in at the low end of its long-term-growth target.<sup>24</sup> Similarly, Guess experienced a lower than expected growth rate in Asia during Q3 of fiscal year 2012 due in part to reduced outerwear sales in South Korea caused by “weather that was much warmer than we had anticipated” (i.e., the warmest fall in South Korea in decades).<sup>25</sup>
- The widespread flooding in Thailand in 2011—the country’s worst floods in at least 50 years—harmed more than 160 companies in the textile industry and stopped about a quarter of the country’s garment production; Thong Thai Textile expected to lose \$1.3 to \$1.6 million, or about one month of sales, from the flood.<sup>26</sup>

## KEY QUESTIONS FOR THE APPAREL SECTOR<sup>27</sup>

- Value Chain:** What steps is the company taking to understand and evaluate the physical impacts of climate change (short- and long-term, direct and indirect, from incremental and extreme changes) on its value chain?
- Systems and Processes:** How does senior management engage in building climate resilience into the company? Have physical climate risks and adaptation been incorporated into existing strategic, business planning, management, enterprise risk management, and internal reporting processes?
- Vulnerable Regions:** Does the company have operations in, source from, or distribute in regions that are particularly vulnerable to climate impacts?
- No-Regrets Actions:** What no-regrets actions (i.e., actions that will benefit the company under any plausible climate change scenario) could the company take to manage/reduce physical climate impacts on labor, operations, physical assets, supply chain, distribution chain, and consumers?
- Disaster Risk Management Strategies:** Does the company have, or is it developing, disaster risk management strategies to address the increased risk of disruptions due to severe climate-related events such as floods or droughts, including effects on the labor force and supply chains?
- Climate-Resilient Strategies:** What steps is the company taking to develop or implement strategies to promote climate-resilient agriculture throughout its supply chain?
- Water Risks:** What steps is the company taking to address climate-exacerbated water risks in its agricultural supply chain? Has the company considered the potential for water conflicts with local communities or other water users (e.g., other industries in the same watershed)?
- Changing Consumer Tastes:** What steps is the company taking to accommodate changing consumer tastes and preferences due to warmer temperatures and other physical effects of climate change?
- Stakeholders and Communities:** Is the company examining the ways in which climate impacts and the company's risk management strategies to address them may affect relevant local communities, including workers and farmers? Is the company considering how these impacts and the company's responses may affect its supply chain and corporate reputation? What actions has the company taken to engage with local communities to address shared climate risks? Has the company identified stakeholders—including in civil society and local communities—to work with on preparing for climate impacts? What are the company's plans for ongoing community and stakeholder engagement?

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### EXAMPLE: NIKE DISCLOSES SOME PHYSICAL CLIMATE RISKS & RISK MANAGEMENT STRATEGIES



*Climate change may impact Nike's global supply chain and our ability to deliver the right product to the right place at the right time. Changing climate patterns could cause disruptions across our supply chain, which includes both Nike-owned/operated and contracted operations. These events could impact our ability to acquire the raw materials necessary to build our product, secure manufacturing capacity with manufacturers that produce our products in a given location, transport products from one location to another and/or sell products in a given retail location. These risks have been considered to be immaterial to the overall operations of our business but are rising in prominence.*

*To mitigate these risks, Nike builds redundancy or develops contingency strategies for identified critical business operations. In addition, we have an active global property protection program that reduces and minimizes the impact of weather-related events on our physical assets. This includes locating facilities outside of flood plains. ...*

*Other potential physical risks include the availability of raw materials and water scarcity. Supply, quality and availability of raw materials, including cotton and leather, could be impacted by changing climate conditions. Water scarcity and quality, by-products of climate change, could substantially increase costs of textile manufacturing.*

—Nike 2011 CDP Response<sup>28</sup>



## ELECTRIC POWER SECTOR

While the focus for electric power companies with respect to climate risk is usually on regulatory risks and greenhouse gas emissions, the physical impacts of climate change also create significant risks.<sup>29</sup>

Companies in this sector have large fixed assets with long lifetimes—assets that are vulnerable to climate impacts predicted to become increasingly severe over time.<sup>30</sup> For instance, water scarcity, changing precipitation patterns, warmer average temperatures, and greater variability in water supply pose particular risks to hydroelectric generation and to nuclear and fossil fuel power plants (which require high quality and quantities of water for cooling).<sup>31</sup> Warmer average air temperatures and more frequent and severe heat waves will lead to greater use of air conditioning, increased power demand (particularly peak power) in summer, and reduced winter power demand; increased air temperatures also lead to greater losses in transmission and distribution systems, as well as decreased gas turbine efficiency.<sup>32</sup> Flooding, storm surge, sea-level rise, and extreme weather events can cause physical damage to power generation, transmission, and distribution facilities and related infrastructure.<sup>33</sup> (Whether ratepayers or shareholders bear the costs from climate impacts will likely depend on whether the company is a regulated electric utility or is a load-serving entity or independent power producer.)

### REAL-WORLD EXAMPLES OF RISKS

- The record-setting heat wave in Texas during the summer of 2011 led to unprecedented electricity demand and contributed to price spikes, forcing Constellation Energy to purchase incremental power in the real-time market at peak prices; the after-tax impact on third quarter earnings was a reduction of about \$0.16 per share.<sup>34</sup>
- Due to wind storms in the Carolinas and Indiana and severe thunderstorms and tornadoes in Ohio, Duke Energy, as of Q3 2011, had incurred about \$75 million in storm restoration costs during the year; storm costs for Q2 were about \$53 million higher than in the same quarter of 2010.<sup>35</sup>
- The 2007-2008 drought in the southeastern U.S. reduced Southern Company's low-cost hydroelectric power generation in 2008 by about 50 percent, forcing the company to meet demand from other generating sources at a replacement cost of about \$200 million.<sup>36</sup>
- In 2005, hurricanes Katrina and Rita forced Entergy to incur approximately \$1.5 billion in restoration costs, repair more than 75,000 miles of transmission lines and distribution circuits, coordinate and maintain more than 23,000 workers, and relocate its New Orleans headquarters.<sup>37</sup>
- In 2003, an extreme heat wave in Europe caused a loss of €335 million for Électricité de France when it had to limit or suspend operation of several nuclear plants due to elevated river temperatures and so had to purchase high-cost power on the open market.<sup>38</sup> Scientists estimate that human influence on the climate system has at least doubled the risk of a heat wave of this magnitude.<sup>39</sup>

## KEY QUESTIONS FOR THE ELECTRIC POWER SECTOR<sup>40</sup>

- Systems and Processes:** What is the company's process for understanding and assessing physical climate change risks and opportunities, as well as adaptation strategies? How does senior management engage in building climate resilience into the company? Have physical climate risks and adaptation been incorporated into existing strategic, business planning, management, enterprise risk management, and internal reporting processes?<sup>41</sup>
- Extreme Weather Events:** How have extreme weather events (e.g., flooding, droughts, heat waves, storms) affected, and how may they in the future affect, generating capacity, production, transmission, and distribution, and with what financial implications?
- Generating Capacity:** What impacts will other changing climatic conditions have on the company's generating capacity (e.g., effects of rising temperatures on the efficiency and performance of plant and equipment such as compressors, pumps, and generators), and with what implications for energy consumption, emissions, and maintenance requirements?
- Temperature and Demand:** How have long-term changes in temperature affected, and how may they in the future affect, demand, including peak load and changes in seasonal demand, and with what financial implications?
- Climate Resilience Measures:** What measures are in place for dealing with changes in weather conditions (e.g., insurance, hedging, investments in new technologies, changed siting priorities)? If the company is not undertaking specific adaptation measures for fixed assets during the design stage, what steps is it taking to adapt its assets at a later time? Has the company assessed how climate change may affect the decommissioning of existing and planned assets?
- Stakeholders and Communities:** Is the company examining the ways in which climate impacts and the company's risk management strategies to address them may affect consumers and relevant local communities—and thus corporate reputation? Has the company identified stakeholders—including customers and local communities—to work with on preparing for climate impacts? What are the company's plans for ongoing community and stakeholder engagement?

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### EXAMPLE: AES DISCLOSES SOME PHYSICAL CLIMATE RISKS



*Physical impacts may have the potential to significantly affect the Company's business and operations, and any such potential impact may render it more difficult for our businesses to obtain financing. For example, extreme weather events could result in increased downtime and operation and maintenance costs at the electric power generation facilities and support facilities of the Company's subsidiaries. Variations in weather conditions, primarily temperature and humidity also would be expected to affect the energy needs of customers . . . In addition, while revenues would be expected to increase if the energy consumption of customers increased, such increase could prompt the need for additional investment in generation capacity. Changes in the temperature of lakes and rivers and changes in precipitation that*

*result in drought could adversely affect the operations of the fossil-fuel fired electric power generation facilities of the Company's subsidiaries. Changes in temperature, precipitation and snow pack conditions also could affect the amount and timing of hydroelectric generation. . . .*

*If any of the foregoing risks materialize, costs may increase or revenues may decrease and there could be a material adverse effect on the electric power generation businesses of the Company's subsidiaries and on the Company's consolidated results of operations, financial condition and cash flows.*

—AES 2011 10-K<sup>42</sup>



## INSURANCE SECTOR

The insurance sector has a unique—and extensive—vulnerability to physical climate change impacts, not so much because of the risks climate change poses to insurance companies' facilities or employees, but rather because the industry pays the bill for insured losses caused by weather-related perils, such as floods, storms, and wildfires.

In 2011, insured losses for such perils exceeded \$55 billion.<sup>43</sup> In a business that relies on past events to price future risks, climate change confronts insurers with dramatically changing weather patterns and more frequent and severe extreme weather events—challenging insurance companies' abilities to underwrite and price physical risks, creating new types of liability exposures, and posing a threat to insurance availability and affordability.<sup>44</sup> Property and casualty insurers are already seeing more claims due to severe weather, health insurers may start to see more claims due to the increased spread of disease, and reinsurers are exposed to all of these losses (including paying a large portion of losses from catastrophic events).<sup>45</sup> Insurers' sizable investment portfolios may also be affected by physical climate impacts on companies, countries, and infrastructure.<sup>46</sup> At the same time, insurance can be a key component of climate adaptation solutions for many sectors, governmental bodies, and private individuals.<sup>47</sup>

### REAL-WORLD EXAMPLES OF RISKS (AND OPPORTUNITIES)

- Allstate, the largest publicly traded U.S. insurer, has significantly reduced its exposure in hurricane-prone areas. As its CEO stated, "you see a lot more severe weather. We are acting and running our Homeowners business as if that is a permanent change as opposed to an anomaly."<sup>48</sup>
- The 2010-2011 Australian floods led to more than \$2 billion in insurance claims, including more than \$350 million in claims that were partly responsible for Munich Re's fourth quarter 2010 profit decline of 38 percent.<sup>49</sup>
- In 2011, Axis Capital suffered a range of catastrophe losses, including \$20 million in its insurance segment and \$10 million in its reinsurance segment from Hurricane Irene; \$18 million in insurance from Tropical Storm Lee; and a similar amount in reinsurance from the Danish floods.<sup>50</sup>
- Swiss Re is a founding sponsor, along with Oxfam America and the World Food Program, of the R4 Rural Resilience Initiative to help poor rural communities protect their crops and livelihoods from the impacts of climate change by offering weather-indexed insurance paid for with work on local climate adaptation projects. Swiss Re aims, in part, to develop a model that will create effective markets and become commercially viable.<sup>51</sup>



## KEY QUESTIONS FOR THE INSURANCE SECTOR<sup>52</sup>

- Climate and Risk Management:** Does the company have a risk management policy with respect to physical climate change impacts? If not, how does the company account for climate change in risk management?
- Investment Strategies:** Does the company have a strategy to account for the potential impacts on its investment portfolio from physical climate impacts on companies, countries, and infrastructure?
- Market Segments:** Which market segments (e.g., homeowners and/or marine) does the company anticipate being most affected by climate change? In which geographies?
- Pricing and Capital:** What effect will climate change and the accompanying extreme weather variability have on the company's pricing, capital adequacy, and reinsurance requirements? What actionable steps is the company taking to manage those risks?
- Opportunities:** In what ways, if any, is the company positioning itself to capture opportunities related to insurance as a component of others' responses to physical climate risks?
- Coastal and Non-Coastal Analyses:** To what extent do the company's analyses account for implications of climate change for both coastal extreme weather (e.g., hurricanes) and non-coastal extreme weather (e.g., floods, tornadoes, wildfires)?
- Catastrophe Models:** Do the catastrophe models on which the company relies (third-party or internal) meaningfully integrate changing extreme weather?
- Policyholders:** What steps has the company taken to encourage policyholders to build resilience against, and thus reduce losses from, climate-related events?
- Stakeholders and Communities:** What steps has the company taken to engage key stakeholders and local communities on the risks from climate impacts?

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### EXAMPLE: TRAVELERS DISCLOSES SOME PHYSICAL CLIMATE RISKS



*Severe weather events over the last several years have underscored the unpredictability of future climate trends and created uncertainty regarding insurers' exposures to financial loss as a result of catastrophe and other weather-related events. Some scientists believe that, in recent years, changing climate conditions have added to the unpredictability, frequency and severity of natural disasters. Accordingly, if climate conditions change in the future, the Company's catastrophe models may be less reliable...*

*Increasingly unpredictable and severe weather conditions could result in increased frequency and severity of claims under policies issued by the Company...*

*Changing climate conditions could also impact the creditworthiness of issuers of securities in which the Company invests. For example, water supply adequacy could impact the creditworthiness of bond issuers in the Southwestern United States, and more frequent and/or severe hurricanes could impact the creditworthiness of issuers in the Southeastern United States, among other areas.*

—Travelers 2011 10-K<sup>53</sup>



## MINING SECTOR

Mining companies face potentially significant risks from the physical effects of climate change, largely because the sector is very water- and energy-intensive and operates in some very politically challenging countries.

The mining sector relies on large amounts of water (for exploration, processing, refining, site rehabilitation, and other uses), which makes the sector vulnerable to climate-influenced droughts and changes in precipitation patterns and levels.<sup>54</sup> Changes in local water availability in water-stressed regions can also lead to conflicts with communities over water resources, threatening companies' operations and reputations.<sup>55</sup> Aluminum processing can be particularly energy intensive, making it vulnerable to drought-induced reductions in energy production.<sup>56</sup> In addition, climate impacts, such as extreme weather events, floods, and increased exposure to diseases, can damage infrastructure and equipment, disrupt transportation routes, and affect employee health and safety.<sup>57</sup> As in the oil and gas sector, warmer temperatures and thawing permafrost can create challenges for mine operations in the Arctic that rely on seasonal ice roads and infrastructure like pipelines and airstrips.<sup>58</sup> Mining companies also face unique risks related to potential climate-related liabilities over the course of mining assets' lives; for instance, tailings ponds and dams may fail and costs for decommissioning assets may increase due to impacts such as changing precipitation levels, increased floods, and higher temperatures.<sup>59</sup>

### REAL-WORLD EXAMPLES OF RISKS

- In the first half of 2011, Rio Tinto's operations in Australia were hit by cyclones, heavy rains, widespread flooding, and a related train derailment, leading to a five percent decline in iron ore shipments from its Pilbara operations, restricted production at its Argyle diamond mine, and a six-month shutdown of ERA's processing plant at the Ranger uranium mine. Overall, the weather extremes reduced Rio Tinto's earnings by \$245 million.<sup>60</sup>
- Anglo American's copper production for the first half of 2011 was down eight percent, due in part to severe disruptions to its Collahuasi mine in Chile caused by rainfall four to five times the annual average.<sup>61</sup>
- In late 2011, Newmont suspended construction activities at the Conga mine in Peru, which contains more than six million attributable ounces of gold and 1.6 billion attributable pounds of copper reserves, due to ongoing protests in the region about perceived impacts on local water supplies.<sup>62</sup> Similar protests in 2004 led Newmont to abandon plans to expand its Yanacocha gold mine to Cerro Quilish.<sup>63</sup>
- A very warm winter in 2006 forced early closure of the ice roads that provide inexpensive transport of fuel and other supplies to Canadian diamond mines. This had a "major impact on operational plans" for Rio Tinto's Diavik mine and led the company to instead use cargo airlifts "at some cost,"<sup>64</sup> sharply reduced De Beers' winter drill program at its Gahcho Kue project and led to increased labor and supply costs at the Snap Lake project,<sup>65</sup> and contributed to the bankruptcy of Tahera Diamond and the closing of its Jericho mine.<sup>66</sup>

## KEY QUESTIONS FOR THE MINING SECTOR<sup>67</sup>

- Systems and Processes:** What is the company's process for understanding and assessing physical climate change risks and opportunities, as well as adaptation strategies? How does senior management engage in building climate resilience into the company? Have physical climate risks and adaptation been incorporated into existing strategic, business planning, management, enterprise risk management, and internal reporting processes?
- Extreme Weather Events:** How have extreme weather events (e.g., storms) affected, and how may they in the future affect, production capacity and downtime, and with what financial implications? What are the value of assets and quantity of reserves located in areas exposed to extreme weather events? What methodology is the company using to integrate preparedness for extreme weather events into company strategy and risk management? Are the company's revenue forecasts at risk as a consequence of an increase in extreme events?
- Changing Weather Patterns:** What are the risks that incremental changes in weather patterns (e.g., thawing permafrost, rising sea levels, increased water shortages, seasonal shifts) may pose to the company's operations? Which regions of current or future operation are most exposed?
- GeoPolitical Risk:** Has the company assessed the consequences for assets in locations where water availability and other climate impacts may create geopolitical risks? Does the company have any strategic plans in place to reduce its exposure to geopolitical risks driven by climate change?
- Climate Resilience Assessment and Strategies:** Is the company taking steps to assess the vulnerability of existing and future assets to climate risks? How are climate adaptation strategies integrated into the existing risk management process and project management cycle?
- Stakeholders and Communities:** Is the company examining the ways in which climate impacts and the company's risk management strategies to address them may affect relevant communities—and thus corporate reputation and operations? What actions has the company taken to engage with local communities, especially in areas of future water stress or where mining development may affect ecosystems needed for climate resilience? Has the company identified stakeholders—including in civil society and local communities—to work with on preparing for climate impacts? What are the company's plans for ongoing community and stakeholder engagement?

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### EXAMPLE: KINROSS DISCLOSES SOME PHYSICAL CLIMATE RISKS



*Severe weather conditions, including those resulting from global climate change, may adversely impact Kinross' operations. For example, a significant and prolonged increase in temperatures near Kinross' Kupol mine could result in the melting of the ice road which leads in and out of the Kupol mine or could cause ground instability at the mining operations. At the Paracatu*

*mine, a significant increase in rainfall could result in flooding, which may disrupt mining operations.*

—Kinross Gold Corporation  
2010 40-F / Annual Information Form<sup>68</sup>



## OIL AND GAS SECTOR

Like electric power companies, companies in the oil and gas sector have large fixed assets with long lifetimes—upstream and downstream assets that are vulnerable to climate impacts predicted to become increasingly severe over time.

Even more than electric companies, however, oil and gas companies often operate in extreme conditions (e.g., deepwater and the Arctic Ocean), at the leading edge of engineering and technical knowledge, and in locations—such as the U.S. Gulf Coast and the North Sea—that are prone to extreme weather events.<sup>69</sup> This means that these companies have major operations worldwide particularly at risk from extreme weather, sea-level rise, and other climate impacts.<sup>70</sup> Apart from some of the obvious climate risks, such as increased frequency and severity of storms, the oil and gas sector can also be affected by droughts and water scarcity, as water availability is a significant constraint for oil sands extraction and refining, for potential oil shale production, and for oil refineries that require large amounts of process steam and cooling water.<sup>71</sup> Various climate impacts, such as thawing permafrost and erratic precipitation, can also disrupt the sector's transport, distribution, and support systems.<sup>72</sup>

### REAL-WORLD EXAMPLES OF RISKS

- In 2005, hurricanes Katrina and Rita caused extensive damage to oil and gas companies' Gulf of Mexico assets, including ripping free Diamond Offshore Drilling's Ocean Warwick drilling rig, pushing it 66 miles to Dauphin Island off the coast of Alabama, and damaging it so severely that the company declared it a constructive total loss;<sup>73</sup> destroying more than 100 production platforms and damaging more than 50 others (including capsizing and causing "catastrophic damage" to Chevron's Typhoon floating platform); damaging more than 450 subsurface oil and gas pipelines;<sup>74</sup> and taking more than a million barrels per day of refining capacity (about 8 percent of U.S. capacity) offline for months.<sup>75</sup>
- Temperatures in Alaska have risen about twice as much as the rest of the U.S., leading to a shorter oil and gas exploration season on the tundra in winter and to thawing permafrost that affects the buildings, pipelines, airfields, and coastal facilities on which oil and gas development rely.<sup>76</sup>
- The extensive Mississippi River flooding in May 2011—the type of flooding expected once every 10-25 years, though it has occurred far more frequently—restricted Rex Energy's operations and forced the company to reduce its expected quarter two daily production by about 245 barrels per day for 60 days.<sup>77</sup>

## KEY QUESTIONS FOR THE OIL AND GAS SECTOR<sup>78</sup>

- Systems and Processes:** What is the company's process for understanding and assessing physical climate change risks and opportunities, as well as adaptation strategies? How does senior management engage in building climate resilience into the company? Have physical climate risks and adaptation been incorporated into existing strategic, business planning, management, enterprise risk management, and internal reporting processes?
- Extreme Weather Events:** How have extreme weather events (e.g., storms) affected, and how may they in the future affect, production capacity, refining capacity, and downtime, and with what financial implications? What is the value of upstream and downstream assets located in areas exposed to extreme weather events? What methodology is the company using to integrate preparedness for extreme weather events into company strategy, investment decisions, and risk management? Are the company's revenue forecasts at risk as a consequence of an increase in extreme events?
- Changing Weather Patterns:** What are the risks that incremental changes in weather patterns (e.g., thawing permafrost, rising sea levels, increased water shortages, and seasonal shifts) may pose to the company's operations? Which regions of current or future operation are most exposed?
- GeoPolitical Risk:** Has the company assessed the consequences for assets in locations where water availability and other climate impacts may create geopolitical risks? Does the company have any strategic plans in place to reduce its exposure to geopolitical risks driven by climate change?
- Climate Resilience Assessment and Strategies:** Is the company taking steps to assess the vulnerability of existing and future assets to climate risks? How are climate adaptation strategies integrated into existing risk management process and project management cycle?
- Stakeholders and Communities:** Has the company assessed potential impacts on local communities if severe climate-related events or changing climatic conditions lead to oil spills or pipeline ruptures? What actions has the company taken to engage with local communities in areas of future water resource stress? Has the company identified stakeholders—including in civil society and local communities—to work with on preparing for climate impacts? What are the company's plans for ongoing community and stakeholder engagement?

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### EXAMPLE: APACHE DISCLOSES SOME PHYSICAL CLIMATE RISKS



*Weather and climate may have a significant adverse impact on our revenues and productivity.*

*Demand for oil and natural gas are, to a significant degree, dependent on weather and climate, which impact the price we receive for the commodities we produce. In addition, our exploration and development activities and equipment can be adversely affected by severe weather, such as hurricanes in the Gulf of Mexico or cyclones offshore Australia, which may cause a loss of production from temporary cessation of activity or lost or damaged equipment. Our planning for normal climatic*

*variation, insurance programs, and emergency recovery plans may inadequately mitigate the effects of such weather, and not all such effects can be predicted, eliminated or insured against.*

*In the event the predictions for rising temperatures and sea levels suggested by reports of the United Nations Intergovernmental Panel on Climate Change do transpire, we do not believe those events by themselves are likely to impact the Company's assets or operations. However, any increase in severe weather could have a material adverse effect on our assets and operations.*

*—Apache 2011 10-K<sup>79</sup>*



## TOURISM SECTOR

Climate, weather, and natural resources are key attributes of tourism destinations, so extreme weather events and long-term climate changes can create fundamental risks and opportunities for companies in the tourism sector.

Climate change effects that could impact the tourism sector include flooding, drought, storms, heat waves, water shortages from precipitation changes, rising temperatures (and thus limited snow availability), coastal erosion, rising sea levels, and changes in snow reliability.<sup>80</sup> For example, extreme weather events, such as hurricanes, may pose risks for companies promoting coastal vacations (e.g., beach resorts). Melting glaciers and warmer winters may pose significant risks for companies reliant on cold weather and snow activities (e.g., skiing).<sup>81</sup> Droughts, floods, and precipitation changes could affect many natural features on which tourism relies, including lakes, rivers, and snow.<sup>82</sup> Ocean acidification could affect snorkeling and scuba diving companies (e.g., by bleaching coral reefs).<sup>83</sup> Storms could disrupt air travel to tourist destinations. On the other hand, climatic changes could also create tourism opportunities for some companies, such as warmer summers and shorter winters, extending tourist seasons in typically cold locations.<sup>84</sup>

### REAL-WORLD EXAMPLES OF RISKS

- Total skier visits to Vail Resorts' six mountain resort properties were down more than 15 percent over the 2011-2012 winter (as of early January) due to a lack of snow, making the company's earnings guidance targets more difficult to achieve. Vail's CEO noted, "For the first time in 30 years, a lack of snow has not allowed us to open the back bowls in Vail as of January 6, 2012, and, for the first time since the late 1800s, it did not snow at all in Tahoe in December."<sup>85</sup>
- Severe weather during the 2010-2011 winter—ice and snow storms across Europe, torrential rains in Southern California, and a post-Christmas blizzard in the U.S. Northeast that shut down the airports—"definitely hurt" the Walt Disney Company's revenues from parks and resorts in quarter one 2011.<sup>86</sup>
- Premium hotel and resort owner DiamondRock Hospitality experienced restrained overall profit margin improvement in quarter three 2010 due in part to the Marriott resort in St. Thomas incurring lost revenue and incremental operating costs from Hurricane Earl.<sup>87</sup>
- Strong winter storms in the U.S. Midwest and South made it hard for Boyd Gaming's customers to visit its gaming operations, costing the company nearly \$3 million in earnings before interest, taxes, depreciation, and amortization in the region during the first 60 days of 2011.<sup>88</sup>

## KEY QUESTIONS FOR THE TOURISM SECTOR<sup>89</sup>

- Systems and Processes:** What is the company's process for understanding and assessing physical climate change risks and opportunities, as well as adaptation strategies? How does senior management engage in building climate resilience into the company? Have physical climate risks and adaptation been incorporated into existing strategic, business planning, management, enterprise risk management, and internal reporting processes?
- Operations and Revenue:** How does the company expect extreme events and long-term climatic changes to affect tourism flows, operations, and revenue? Over what time horizon?
- Strategies and No-Regrets Actions:** What strategies (e.g., diversification of activities across seasons) is the company pursuing to adapt to climate risks and opportunities? What no-regrets actions (i.e., actions that will benefit the company under any plausible climate change scenario) could the company take to address physical climate impacts on labor, operations, physical assets, supply chain, and consumers?
- Changing Consumer Tastes:** What steps is the company taking to accommodate changing consumer tastes and preferences due to climate change?
- Coastal Conflicts:** Has the company examined ways in which sea-level rise and coastal erosion may lead to conflicts over coastal development or other development plans?
- Stakeholders and Communities:** Has the company identified areas where tourism development may create risks or conflicts involving local communities, such as in areas of future resource stress? Is the company considering how these impacts and the company's responses may affect its supply chain and corporate reputation? What actions has the company taken to engage with local communities? Has the company identified stakeholders—including in civil society and local communities—to work with on preparing for climate impacts? What are the company's plans for ongoing community and stakeholder engagement?

### EXAMPLE: TUI DISCLOSES SOME PHYSICAL CLIMATE RISKS



*Since TUI's business is based on sound nature and an intact environment, climate change and its consequences (flood, droughts, hurricanes, etc.) have direct and indirect effects on our business. Certain aspects are: - Re-routing of aircraft and cruise liner on account of extreme weather (hurricanes, etc.). - Damage of infrastructure in destinations so that some products (tours, day trips) cannot be conducted any more. ... - Since climate, weather and natural environment are major aspects of the attractiveness of a destination, changes of preferences for certain destinations might occur due to altered natural infrastructure*

*(e.g. melting of Alps' glaciers, tropical storms and other major natural disasters like heat waves in the Mediterranean, heavy rainfalls, mudslides, etc.) ... - Increase of operational costs for heating, cooling, irrigation, water supply and food supply. - Loss of biodiversity and extinction of certain species might reduce the attractiveness of certain destinations. ... - Induced social conflicts due to scarcity of resources, e.g. water used for tourism so that less water is available for local people.*

—TUI AG 2011 CDP Response<sup>90</sup>

# RISK MANAGEMENT STRATEGIES

The preceding sections described a range of risks (and some opportunities) related to the physical impacts of climate change. The likelihood and consequences of any particular impact vary significantly by sector, company, and location, as do the most appropriate strategies for adapting to those impacts, and companies should disclose both important risks and risk management strategies to investors. While specific adaptation strategies will vary, some general concepts for management of physical climate risks include:

## MANAGE CLIMATE RISKS LIKE OTHER BUSINESS RISKS

Physical climate risks are business risks. Enterprise risk management, business continuity planning, scenario planning, and other commonly used approaches to assessing and managing risks can help companies identify relevant climate risks from both extreme weather events and incremental climatic changes, identify elements of the risks companies can control or influence (or transfer), implement a plan to avoid the risks where possible and cost-effective, and take steps to minimize the severity of unavoidable risks.<sup>91</sup> Areas to look at may include assets (e.g., impacts on facilities), raw materials and logistics (e.g., vulnerability of supply chain and transport systems), people (e.g., implications for employees and customers), process (e.g., impacts on production processes), markets (e.g., changing demand for goods and services), and finance (e.g., insurance costs, hedging).<sup>92</sup>

## STAKEHOLDER AND COMMUNITY ENGAGEMENT IS ESSENTIAL

Businesses can be affected by impacts beyond company boundaries. Companies, whether local or global, rely on local communities for employees, suppliers, and customers, and they also depend on local resources, services, and infrastructure. Both climate impacts and actions to address those impacts (whether planned or unplanned) will affect these communities, so company approaches to addressing climate risks should involve consultations with people and governments in affected communities, and risk management strategies should aim to improve the resilience of those communities.<sup>93</sup> Companies should also regularly engage in robust dialogue with stakeholders across the value chain and integrate stakeholder feedback into strategic planning and operational decision making. Stakeholder engagement helps companies understand their key environmental and social impacts, build support for their operations, and develop innovative solutions.<sup>94</sup>

## MANAGING CLIMATE RISKS MAY REQUIRE INTERNAL CAPACITY BUILDING

Companies should raise awareness and train employees, ensure that board members are informed, engage outside experts as appropriate, integrate adaptation strategies into core business processes, work with supply chain partners, develop internal champions, and secure executive-level commitment.<sup>95</sup>

## UNCERTAINTY IS NOT A REASON FOR INACTION

Scientific uncertainties about the precise location, magnitude, timing, and consequences of climate impacts exist and are likely to continue, which can limit companies' abilities to predict and respond to physical climate risks. However, there is enough information available on climate impacts and trends to enable companies to at least begin to monitor and assess the risks, plan for reasonable contingencies, and perhaps adopt policies and practices to manage them. There may be actions companies can take, such as addressing water scarcity, that are "no regret" or "low regret" actions that will benefit the company under any plausible climate change scenario and will limit potentially unnecessary adaptation investments. Engineering measures with larger upfront costs (e.g., factoring climate impacts into infrastructure planning and design) may be more relevant for companies that rely on long-term fixed assets, depending on the cost-benefit ratio over the useful life of the assets.<sup>96</sup> For more on concrete tools for risk management and other useful resources on physical climate risks, see Appendix B.



# PHYSICAL CLIMATE RISK DISCLOSURE CHECKLIST

To date, companies have tended to disclose little about physical climate risks and adaptation strategies outside of CDP reports. Adaptation benefits tend to be local, private, and focused on helping the company instead of the world, so they may not fit neatly into a typical sustainability report narrative.<sup>97</sup> Despite the SEC's guidance, SEC disclosures tend to contain only generic statements (if any at all) about changing climate hazards, usually focused on extreme events versus incremental change.<sup>98</sup> The following checklist can help companies improve their disclosure of material physical climate risks and adaptation strategies, making their disclosures more useful to investors.<sup>99</sup>

## IDENTIFY AND ANALYZE RISKS, OPPORTUNITIES, AND STRATEGIES RELATED TO THE PHYSICAL EFFECTS OF CLIMATE CHANGE

- Identify risks, opportunities, and adaptation strategies.* Identifying physical risks requires an understanding of the varied ways in which climate change can materially affect a company, including its supply chain and siting of its facilities and infrastructure. Companies should develop a process for assessing climate change risks, opportunities, and adaptation strategies; this may or may not include commissioning reports on detailed projections of costs and other quantitative information, which can help build the business case. Where relevant, companies may also want to explore the business case for building a portfolio of climate-resilient goods and services.
- Engage with stakeholders, communities, and others.* Stakeholder engagement can help illuminate relevant risks, opportunities, and adaptation strategies. In addition, since companies rely on local communities and resources in so many ways (e.g., employees, suppliers, customers, infrastructure), companies should engage local communities and promote shared solutions in areas necessary for support of corporate value chains. The concept of "shared value" is gaining credence as a strategy for successful (i.e., sustainable) businesses.<sup>100</sup> Partnering with professional associations and peers can also enable companies to pool resources and tackle shared challenges.

## CREATE ROBUST SYSTEMS TO ADDRESS RISKS AND OPPORTUNITIES RELATED TO THE PHYSICAL EFFECTS OF CLIMATE CHANGE

- Ensure executive leadership responsibility for physical climate risks and adaptation strategies.* Understanding and responding to important physical climate risks (and opportunities) involves grappling with some challenging data and some novel and evolving multidisciplinary issues. It is important that existing (or new) high-level management teams have the expertise to tackle these issues (perhaps along with related climate and sustainability issues and/or other business risks) and that there are internal champions to develop and communicate adaptation risks and opportunities and to lead efforts to build climate resilience into their companies. Relevant key performance indicators should be established as part of management evaluation and compensation systems.

- Integrate physical climate risks and adaptation into core business processes.* To mainstream these issues throughout the business and to enable companies to gather reliable information on physical risks and related strategies (which will enable high-quality analysis and disclosure), climate risk and adaptation should be incorporated into existing strategic, business planning, management, and internal reporting processes where relevant.

## DILIGENTLY DISCLOSE RISKS AND OPPORTUNITIES RELATED TO THE PHYSICAL EFFECTS OF CLIMATE CHANGE

- Assess materiality.* Companies should carefully assess whether particular physical climate risks might materially affect operations and financial prospects. The SEC Guidance provides valuable insight for companies with respect to assessing potential materiality. Since materiality is based on whether a "reasonable investor" would consider the information important in deciding how to vote or make an investment decision, companies should take steps to understand their investors' expectations on climate risk disclosure.
- Be specific and quantify risks and opportunities when possible.* Generic "boilerplate" statements about climate risk tell investors very little. Companies should provide a specific discussion of physical climate risks and opportunities with respect to their company assets and operations. Whenever reasonably attainable, providing qualitative and quantitative information on physical climate risks, opportunities, and adaptation strategies is most helpful to investors. Clear, specific, thoughtful disclosure can provide a competitive advantage by demonstrating that a company understands and has developed strategies to address material business risks and opportunities.
- Make sure voluntary disclosures are consistent with mandatory disclosures.* Disclosures made by companies in voluntary forums (e.g., CDP), speeches, testimony, and elsewhere related to physical climate risks, opportunities, and adaptation strategies should be consistent with mandatory disclosures. If voluntary statements suggest that physical climate risks may be material while mandatory disclosures do not, investors may be confused (and liabilities may be incurred).<sup>101</sup>

# APPENDIX A: INVESTOR ENGAGEMENT ON PHYSICAL CLIMATE RISK

Many investors concerned about physical climate risk have actively pursued better disclosure from the companies in which they invest—and are utilizing tools that track and evaluate companies' climate risk disclosures.<sup>102</sup>

For instance, in 2006, a group of leading institutional investors from around the world released the "Global Framework for Climate Risk Disclosure," a statement of investor expectations for comprehensive corporate disclosure of business risks and opportunities resulting from climate change, as well as of strategies and efforts to address those risks and opportunities.<sup>103</sup> In the Framework, investors urge companies to disclose "how climate and weather generally affect their business and its operations, including their supply chain" and explain that "[a]fter identifying these risk exposures, companies should describe how they could adapt to the physical risks of climate change and estimate the potential costs of adaptation."<sup>104</sup>

Similarly, in January 2012, three global investor networks—the Investor Network on Climate Risk (INCR, North America), the Institutional Investors Group on Climate Change (IIGCC, Europe), and Investor Group on Climate Change (IGCC, Australia/New Zealand)—released a statement on "Institutional Investors' Expectations of Corporate Climate Risk Management," calling on companies to assess, manage, and disclose risks to their businesses from climate change, including physical risks.<sup>105</sup>

The Carbon Disclosure Project (CDP)—which since 2003 has been requesting information from corporations on their greenhouse gas emissions footprint and the risks, including physical risks, related to climate change—is supported by 551 institutional investors, representing \$71 trillion in assets under management, that believe that such disclosure is critical to investment decisions.<sup>106</sup> The 2012 CDP questionnaire asks companies to disclose, among other things, risks and opportunities driven by changes in physical climate parameters, the likelihood and magnitude of associated impacts, the potential financial implications, and the methods used to manage the risks.<sup>107</sup>

Investors have also been engaging companies by opening dialogues or submitting shareholder resolutions on climate risk issues. For example, in 2011, investors filed 111 resolutions concerning climate, energy, and related sustainability risks, including some resolutions asking companies to disclose how they plan to manage physical climate risks to coffee, other agricultural inputs, and farmers in the supply chain.<sup>108</sup>

In addition, long-standing concerns about climate impacts on local communities are now emerging as investor concerns with respect to corporate climate risk, including such issues as companies' reputations and community relationships, as well as the effects of climate change on employees, operations, supplies, natural resources, and other elements of the business value chain in affected communities. For instance, conflict over scarcer water could undermine a company's reputation and operations, while collaboration to strengthen local capacity to withstand and recover from severe weather events could bolster a company's reputational standing.<sup>109</sup>

Corporate disclosure of physical climate risks can be improved by examining the guidance, questions, and resolutions investors have put forth.

# APPENDIX B: RESOURCES FOR COMPANIES AND INVESTORS

Companies and investors should take advantage of the large and growing body of reports, guidance, and other resources available to help them understand and analyze physical climate risks and opportunities and to help them meet their disclosure obligations. These include the resources in the sections below.

## DISCLOSURE GUIDANCE & ANALYSES

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