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Adapting to Climate Change

for Facility Management Professionals

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Abbreviations and Acronyms

- CC Climate change
- FM Facility Management or Facility Manager
- GHG Greenhouse gases
- IFMA International Facility Management Association
- ISO International Standards Organization
- UN United Nations



Executive Summary

A primary goal of this report is to assist Facility Managers (FMs) in reducing vulnerability to the effects of [climate change](#) for the organizations they support. It provides resources for additional reference and identifies ways that FM can gain support to implement needed adaptations due to climate change.

IFMA's 2019 report, [Climate Change Fundamentals for Facility Management Professionals](#) is a pre-requisite to full comprehension and the utilization of this report. Climate change is global, and while it is unlikely that any region of the Earth will escape its effects, some regions may experience more drastic consequences than others. Regions will have differing impacts and need differing adaptations. Preparation for potential climate change impacts is vital to adaptation and survivability of the organization. This report helps the FM to learn the language and skills associated with risk management and adaptation.

A focus is provided on assessing climate risk for a specific property or geography, and then providing resources to learn about potential adaptations for the assessed risk. With the presumption that the science explaining climate change is settled, the

report moves into assessing, planning and adapting to the impacts of climate change. However, the full impacts of climate change remain uncertain as humans continue to contribute large amounts of CO2 into the atmosphere. While climate models have vastly improved, there are still uncertainties to the extent of these impacts in the model predictions as the current climate/[GHG](#) conditions have not been previously observed or unearthed through archaeological evidence.

Facility Management professionals will need to address two aspects of climate change – impacts to the business they support as well as reduction of their business' impacts onto the Earth. In some cases, these two may overlap, but it is important to look at both aspects since assessments and action plans may differ for each.

Action now is critical since dramatic action today can assist in mitigating the difficulty and cost of adaptation in the future. The [latest United Nations \(UN\) report](#) from the Intergovernmental Panel on Climate Change (IPCC) reports that, "There is alarming evidence that important tipping points, leading to irreversible changes in major ecosystems and the planetary climate system, may already have been reached or passed. Ecosystems as diverse as the Amazon rainforest and the Arctic tundra, may



Action now is critical since dramatic action today can assist in mitigating the difficulty and cost of adaptation in the future.

be approaching thresholds of dramatic change through warming and drying. Mountain glaciers are in alarming retreat and the downstream effects of reduced water supply in the driest months will have repercussions that transcend generations.” (UN 2019)

As stated by the Global Commission on Adaptation, “Both the public and private sectors need to learn to better incorporate high levels of uncertainty in their decision-making, as choices will need to be made soon between radically different options—long before we know if the world will actually be on a 1.5°C or a 4°C pathway.” (Global Commission on Adaptation, 2019)

A 2019 report of financial impacts due to climate change notes several major findings, including that expanded analysis is needed from companies identifying risks; the finance sector sees more implications than the overall economy; opportunities are being found to be larger than risks; and relatedly, possible wins far outweigh the costs of management. “The majority of these opportunities are linked to new products and services, affecting both the customer and direct operational parts of the supply chain. Resource efficiency and energy source drivers affecting direction operations are the next highest identified.” (CDP, 2019) This implies that climate

change poses great costs due to risks but the opportunities that adaptations may provide could be even larger. This does not eliminate all the risks but may mitigate the overall impact. Some sectors or products will decline, such as oil and coal, but far more will grow and offer opportunity. These include opportunities in solar, wind and new alternative energy generation, as well as innovations that reduce or absorb carbon, and crazy ideas such as plastic-eating enzymes.

In addition to climate change, the current pandemic of COVID-19 requires new ways of working and managing day-to-day life. The World Health Organization (WHO) and U.S. Centers for Disease Control and Prevention (CDC) have updated and reliable information and guidelines to follow. Visit the [supplemental resources section](#) at the end of this report for links directly to these sources.

Introduction

This report covers the major topics of risk management, how to conduct a climate change **risk assessment**, relevant climate change components, mitigation techniques associated with components, factors that impact mitigation, and supplemental resources available to the reader.

As outlined in IFMA's initial climate change report, *Fundamentals of Climate Change for Facility Management Professionals*, the major impacts of climate change are to air quality, agriculture, health and poverty issues, rising sea levels, water, and weather patterns. These have worldwide impacts to the Earth overall. System impacts around the world cause interrelated secondary issues globally. The primary system impacts are shown in Figure 1.

These system impacts have direct impacts to the organizations we support. As FM's providing workplace support, these system impacts cause organizational impacts. These could range from new policies to conserve energy, water or other resources, as far as to the relocation of the facility due to expected rising sea level or damage from extreme weather events such as wildfires or flooding. The FM must understand the system impacts that affect the geography in order to plan appropriately for adaptations required at the organizational level. Both levels, worldwide systems and the organization, must be considered by the FM in assessing risk and planning for, gaining approval of, and implementing adaptations caused by climate change.

A recent McKinsey Report, *Climate risk and response – Physical hazards and socioeconomic impacts*, states, "The likelihood of extreme precipitation could grow fourfold in parts of Central Africa, China and the east coast of North America compared with 1950-1981." Another quote, "By 2030, every country could see an increase in one of our six indicators* of potential impacts from a changing climate, with emerging economies facing the biggest increase." (McKinsey,

2020) This report confirms that businesses around the globe must consider and implement adaptations due to climate change worldwide. Adaptations will vary based on geography as well as the type of industry; however, it is prudent to work now to develop and implement changes in both impact to the core business as well as impact on the environment.¹

1. Share of population that live in areas experiencing a non-zero annual probability of lethal heat waves
2. Annual share of effective outdoor working hours affected by extreme heat and humidity
3. Water stress measured as the annual demand of water as a share of annual supply of water
4. Annual share of capital stock at risk of riverine flood damage
5. Share of time spent in drought over a decade, as a measure of food systems
6. Share of land surface changing climate classification (from McKinsey 2020)

FIGURE 1

Primary System Impacts to Climate Change



Climate Change Risk Assessment Management

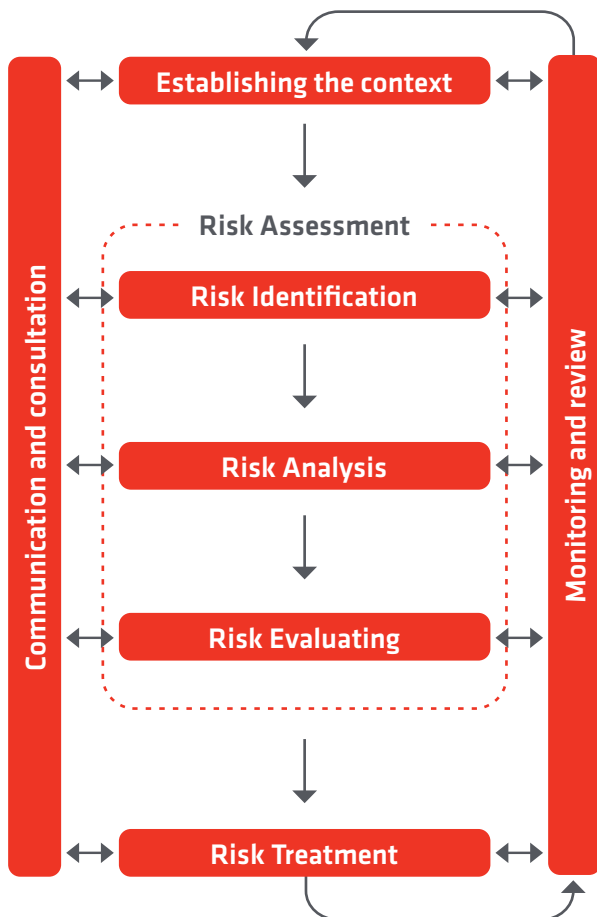
Most FM's are familiar with [facility condition assessments](#). A climate change risk assessment is performed in a similar manner beginning with project preparation, data gathering, analysis, reporting, and finally, planning the program to prioritize, develop and implement needed changes or adaptations. Organizations will vary due to geography, industry, profitability/funding, and management appetite for risk. However, developing a plan and recommending adaptations based on facility needs will fall to the FM. It is the responsibility of the FM to recommend adaptations and related business impacts so that ongoing operations and employee productivity will not be severely hampered or damaged.

Risk assessment is a standard management tool that is used across numerous applications to determine how an organization will evaluate decisions for future business plans. Assessing climate change risks can be used in the same manner and in most cases, with the same methods.

FIGURE 2

Risk Management Process as defined by ISO

This is coordinated activities to direct and control an organization's risk, defined as a combination of an event's consequences and their associated likelihood.



ISO Standard 31000 model

Generally, and based on [ISO 31000](#) (Risk Management), risk assessment is expressed in the following steps:

1. Identify sources of risks
2. Identify the potential risk events
3. Identify consequences of specific risks occurring
4. Identify probability or the likelihood of a specific risk occurring
5. Identify action to be taken and steps needed for accomplish action(s)
6. Review and feedback implementations for continuous improvement of risk assessment.

The Risk Management process includes the important, but often overlooked Monitoring and Communication aspects of the process shown in the graphic above on the sides of the chart. Similar to most any “project,” the continuous monitoring and communication will ensure that nothing is overlooked and ensures that input from all stakeholders is considered and analyzed. These important aspects also help to build understanding and acceptance of the adaptations required. This is another critical component since any change is difficult.

A scholarly paper analyzed many of the important aspects of climate change risk and provides the following examples of the ISO 31000 Risk Management process applied for a specific company, as well as the table providing a checklist for degree of readiness a company may consider. (Kim and Lee, 2016)

FIGURE 3

Climate Change Risk Assessment Framework – From: Kim and Lee in Sustainability, doi.org/10.3390/su8101013

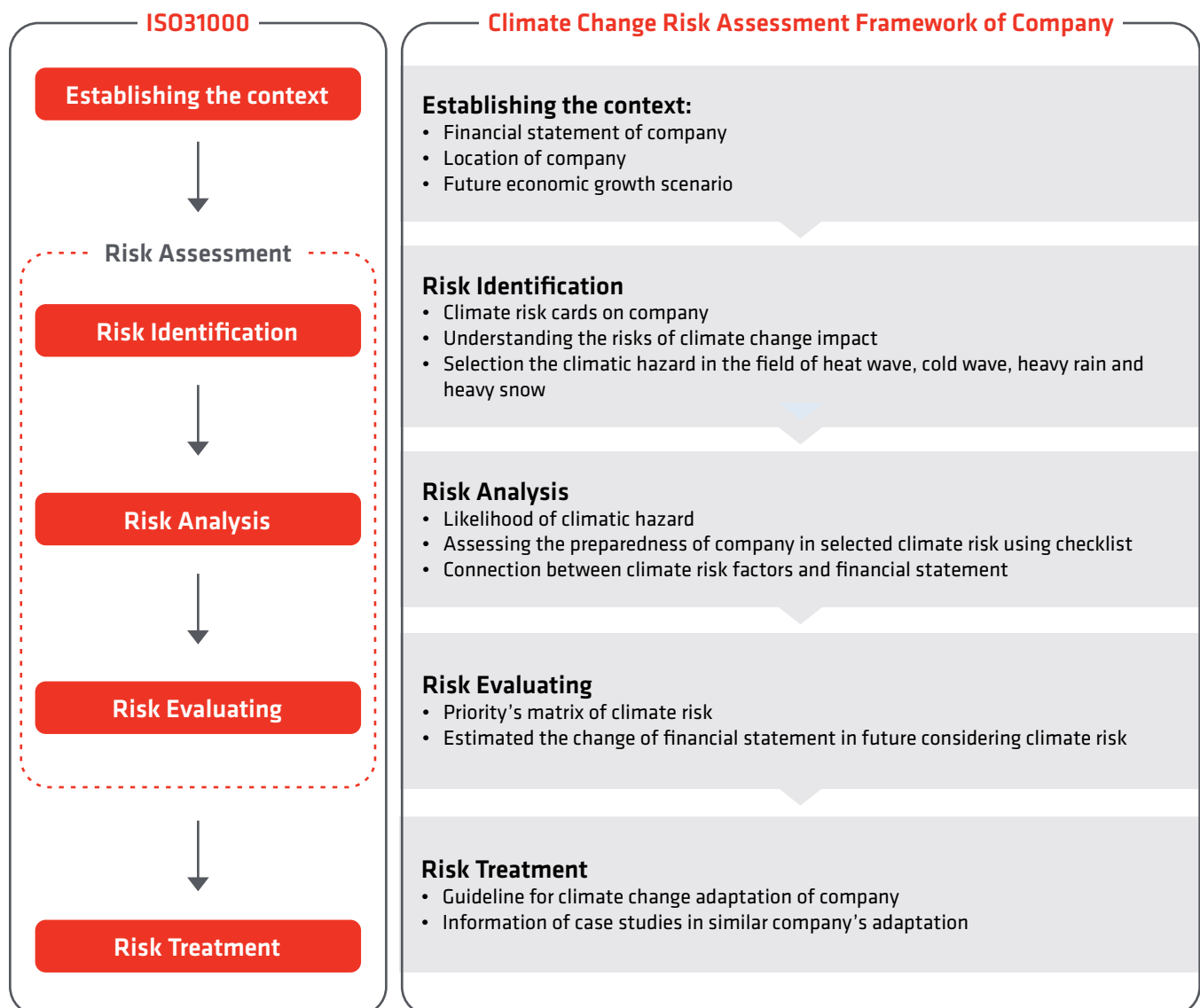


FIGURE 4

Checklist for evaluating readiness – From: Kim and Lee in Sustainability, [mdpi.com/2071-1050/8/10/1013/htm](https://doi.org/10.3390/su10101013)

Type	Checklist
<input checked="" type="checkbox"/> Awareness of the possible risks	<p>With regard to the selected risk, is the risk recognized as a possible risk for the company and has there been consideration placed on possible damage?</p> <p>With regard to the selected risk, have factors such as the provision of management manuals and the need for external consultation been considered?</p>
<input checked="" type="checkbox"/> Preventing and minimizing damage	<p>With regard to the selected risk, are measures prepared for factors such as the possible locations of occurrence, management, and reinforcement?</p> <p>With regard to the selected risk, are their measures related to the preparation such as recovery costs and materials?</p> <p>With regard to the selected risk, are there councils within the company to resolve matters such as repairs, construction, facility reinforcement, medical, and financial consulting?</p>
<input checked="" type="checkbox"/> Risk management organization	<p>With regard to the selected risk, are there systems in place for contact networks and appointing the right person, along with the establishment of emergency headquarters and expert committees with the company?</p> <p>With regard to the selected risk, are their procedures for decision-making such as methods for presenting clear instructions and commands?</p>
<input checked="" type="checkbox"/> Risk manuals and guidelines	<p>With regard to the selected risk, are there courses of action for the CEO to provide leadership stipulated within the company?</p> <p>With regard to the selected risk, are the manuals prepared for an active response according to the scene of the damage?</p> <p>With regard to the selected risk, are there detailed systems for delegating authority through judgments made at the scene in order to provide an immediate response?</p> <p>With regard to the selected risk, are there guidelines prepared to prevent secondary and additional damage?</p>
<input checked="" type="checkbox"/> Education and training	<p>With regard to the selected risk, is education and training conducted on how to respond immediately in the occurrence of an event?</p> <p>With regard to the selected risk, are there reviews conducted on how to increase the availability and responsiveness of the provided manuals?</p>
<input checked="" type="checkbox"/> Relief supplies and means of delivery	<p>With regard to the selected risk, is there an inspection performed on the factors such as lists of supplies and delivery means used for the relief effort?</p>
<input checked="" type="checkbox"/> Measures for rapid recover	<p>With regard to the selected risk, has there been confirmation on whether actions and measures are in place for quickly identifying the situation of the damage?</p> <p>With regard to the selected risk, are multiple transportation and distribution networks prepared?</p> <p>With regard to the selected risk, are there means of communication and transportation systems other than the public system prepared?</p> <p>With regard to the selected risk, have joint strategies with the locals been established?</p>
<input checked="" type="checkbox"/> Preparing for insurance	<p>Is the company insured with regard to the selected risk?</p> <p>Are reserve funds and recovery costs allocated with regard to the selected risk?</p>



American Society of Safety Professionals model

The American Society of Safety Professionals ([ASSP.org](https://www.assp.org)) utilizes a slightly broader approach with risk factors including:

- Tangible and intangible sources of risk
- Threats and opportunities
- Causes and events
- Consequences and their impact on objectives
- Limitations of knowledge and reliability of information
- Vulnerabilities and capabilities
- Changes in external and internal context
- Indicators of emerging risks
- Time-related factors
- Biases, assumptions and beliefs of those involved

Urban Land Institute model

The Urban Land Institute (ULI) defines the risk assessment process as:

- Step 1:** Define types of relevant hazards - Make a list of the types of hazardous events that could have a serious impact on a city or property.
- Step 2:** Define event scenarios - For each event type, develop two to four scenarios covering a range of low to high impact of that event, then assign an annual probability of occurrence for each scenario.
- Step 3:** Identify affected assets - For each event scenario, identify the physical, economic, and social assets affected.
- Step 4:** Assess the damages to each asset - For each asset, estimate damages for all the types of hazards for all scenarios across all event types.
- Step 5:** Calculate annual risk exposure - For each event type and each asset, create a risk curve, then calculate the annual risk exposure by estimating the area under the curve.
- Step 6:** Calculate cumulative risk exposure - Perform steps 2 through 5 again to estimate scenarios, probabilities, and damages for future years, then calculate the net present value of all future annual risk-exposure values to understand the total risk a city or asset faces. (ULI, 2015)

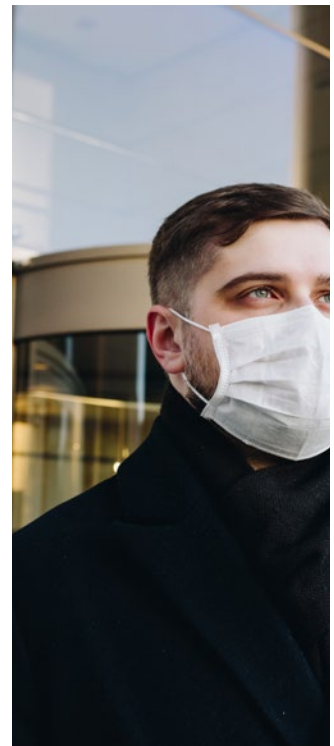
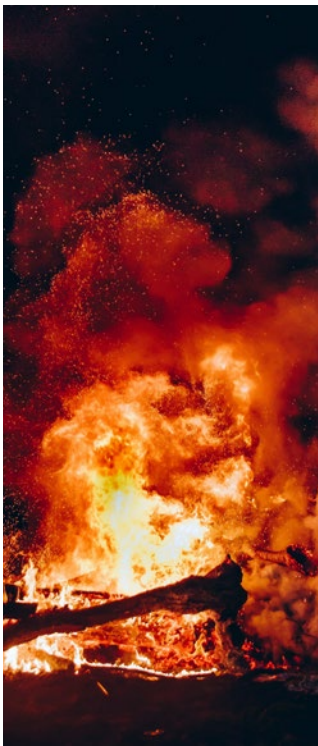
Climate Change Risk Management Recommendations for Facilities

Recommendations for the very first step in a facility climate change risk assessment include the fact that the FM will need a full and accurate inventory of assets. Identifying the facilities that may be impacted is taken from the full inventory in order to avoid leaving any building or asset out of the assessment. While this seems obvious, it is often difficult to confirm critical inventory unless these are kept accurate and timely within the organization.

The risk/**threat assessment** is then applied to each building and asset. Some assets may be determined to be outside of planning purposes. For instance, a company may have buildings in nine locations, yet only two have threats from rising sea level or flooding. Other assets may be impacted by other impacts such as wildfires. The threat assessment at the asset level should include a determination if the likely threat poses **irreparable damage** to the asset. i.e., seawater infiltrating electrical switchgear likely leaves the asset corroded beyond (safe) repair. A damaged asset that is not “on the shelf” and may take an extended period to replace is also considered a higher threat.

Following the risk/treat assessment, a **business impact analysis** may be required to determine possible impacts to the business. This is an analysis of operations, potential impacts, and an estimate of the risks/ costs. If no major impact is found (determination of major is also a value assessment), this asset may no longer be included in the assessment plan.

Finally, risk determination is calculated by considering both the probability/likelihood of the threat occurring and the impact to the business that would occur.



The risk assessment chart below illustrates the impact or severity of an event occurring on one axis and the probability or likelihood of it occurring on the other. By graphing visually, the existing and potential risks quickly show impact as well as identify which ones are highest priority. A risk/threat assessment table (generic) may look like Figure 5 below.

It can be helpful for quick review to utilize the green, yellow, red color system since most adults are familiar with green=go, red=stop connotations. A quick review points to most-important-to-address scenarios having high likelihood and high severity. However, details of the specific assessments will require more detailed analysis and reporting.

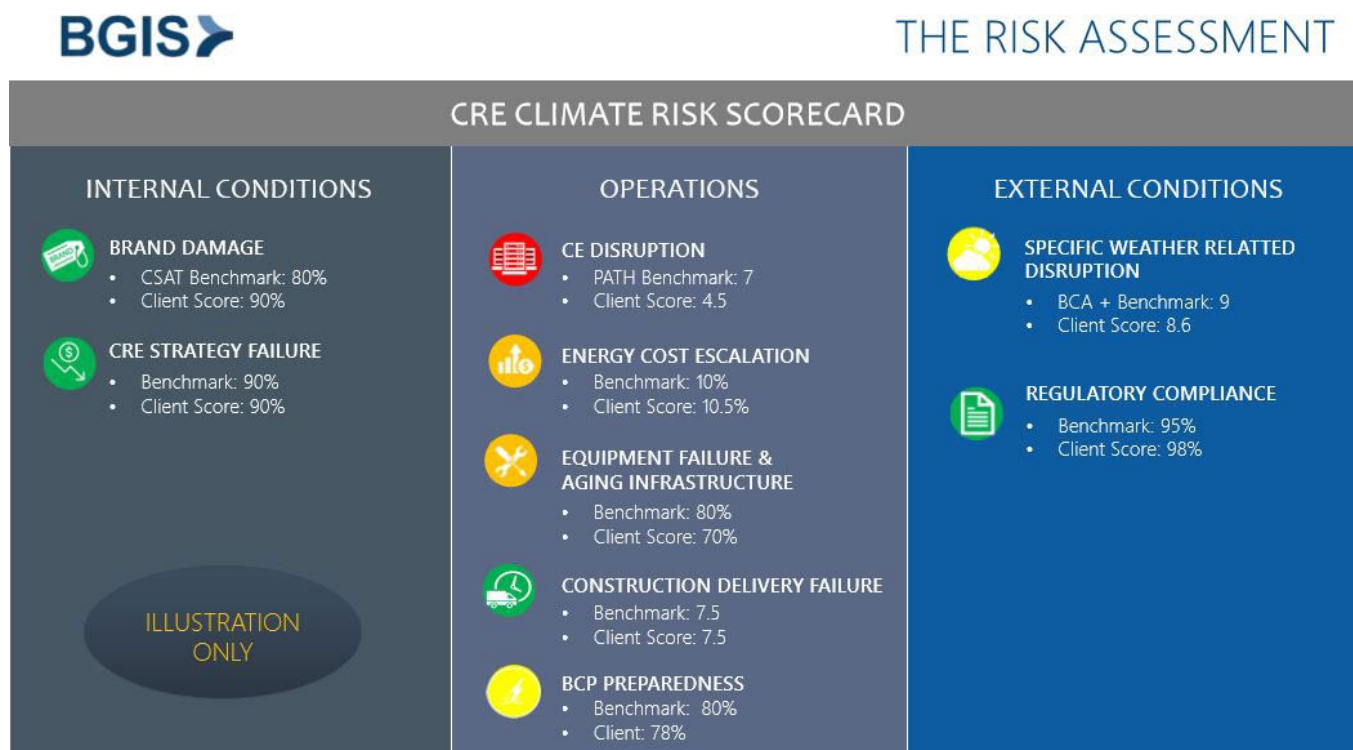
FIGURE 5

Risk Assessment Matrix (generic) – From: smartsheet.com

	SEVERITY			
	ACCEPTABLE LITTLE TO NO EFFECT ON EVENT	TOLERABLE EFFECTS ARE FELT, BUT NOT CRITICAL TO OUTCOME	UNDESIRABLE SERIOUS IMPACT TO THE COURSE OF ACTION AND OUTCOME	INTOLERABLE COULD RESULT IN DISASTER
RISK RATING KEY	LOW 0 - ACCEPTABLE OK TO PROCEED	MEDIUM 1 - ALARP (as low as reasonably practicable) TAKE MITIGATION EFFORTS	HIGH 2 - GENERALLY UNACCEPTABLE SEE SUPPORT	EXTREME 3 - INTOLERABLE PLACE EVENT ON HOLD
LIKELIHOOD				
IMPROBABLE RISK IS UNLIKELY TO OCCUR	LOW - 1 -	MEDIUM - 4 -	MEDIUM - 6 -	HIGH - 10 -
POSSIBLE RISK WILL LIKELY OCCUR	LOW - 2 -	MEDIUM - 5 -	HIGH - 8 -	EXTREME - 11 -
PROBABLE RISK WILL OCCUR	MEDIUM - 3 -	HIGH - 7 -	HIGH - 9 -	EXTREME - 12 -

FIGURE 6

BGIS Risk Assessment Scorecard



A more detailed assessment will be, stated by the U.S. National Institutes of Health that, “All formal climate change risk assessments are structured by underlying values and normative goals that are sometimes explicit and sometimes hidden.” (Adger, Brown, Suminski, 2018) Consideration of these implicit or unspoken values and goals is needed and the best communication methods, consistently applied should be used to reach out to all stakeholders, keeping them informed and gaining their input.

A graphic from this report sponsor, BGIS, (Figure 6) shows areas for risk analysis including internal, external and operational conditions. Each area may have multiple risk factors, or some may be determined to not be probable or likely enough for additional work.

Facility Management professionals will need to address two aspects of climate change – impacts to the business they support as well as reduction of their business’ impacts onto the Earth. In some cases, these two may overlap, but it is important to look at both aspects since assessments and action plans may differ for each.

An important consideration is that local governments and municipalities are mandating and regulating aspects of the built environment operations or may in the near future. Examples can be found from every region in the world, so FM’s should read local news and government updates to become aware of pending changes required. Local and regional professional associations are also good resources and often invite speakers to address pending regulatory issues at meetings and open house events.

The ability to adapt locally is a requirement for effective facility management professionals. Resources abound and it is often overwhelming to read international or even national information and decide how to apply it locally. Fortunately, many municipalities have already completed work to access local impacts. A good first step is to search for “LOCATION, climate change plans” or “LOCATION NAME sea level rise” to determine what is already known and expected for your specific location. Learning what and when to expect specific impacts and having local resources and support can improve planning and credibility for your business case to senior management. It may also provide local contacts for assessment and/or assistance.

Fortunately, many municipalities have already completed work to access local impacts.



Business impacts of climate change – reiliency on core business

- Facility impacts – mitigate, reinforce, relocate
- Employee impacts – understanding, mitigation, participation
- Marketing and sales impacts – perception, brand, alliances

Climate impacts from the business

- Emissions
- Waste
- Carbon offset or capture
- Other programs (i.e., alternative transportation, smart city linkages, etc.)

One good example was found in the U.S. Space Coast, Florida region. In the *Space Coast Transportation Planning Organization Sea Level Rise Vulnerability Assessment*, published research indicates that, “The facility analysis analyzes sea level rise risk posed to 152 buildings that contribute to transportation operations, administration, incident response and overall safety and evacuation needs within Brevard County. This includes airports, city halls, emergency operation centers, fire stations, fleet storage facilities, hospitals, police stations, transportation administration buildings, shelters, Port Canaveral and Federal Facilities.” (Space Coast, 2018) Finding these local assessments can provide a short-cut for FM’s to understand their organization’s vulnerability and begin planning for mitigation.

The sponsor of this report, BGIS uses a similar four-step process to assess climate change risks. These steps are:

Discover

define and identify potential specific risks

Understand

validate risks, explore risk controls, and generate preliminary gap analysis

Assess

deep dive risk assessment on select risk areas

Scorecard

develop benchmarks for assessed risk to client appetite and industry standard, generate risk scorecard and recommendations (mitigation plan).

Citi in Asia has recently increased the processes around **resilience** to seismic activity. With a clear process to follow for seismic risk as to whether to occupy a building or not and if the proposed or current building does not meet our seismic standards, action will be taken to upgrade/exit or not occupy the site. Similar adaptations may be needed in various areas such as water availability, heat and humidity, or for water intrusion.

FIGURE 7

Sample BGIS Climate Change Risk Assessment



Climate Change Risk Assessment

Climate Risk Model: Criticality Data Sources

- Stakeholder interviews (understanding of the role of sites/portfolio to business)
- Stakeholder research (e.g. MD&A, rating agency reporting)
- **Criticality Factors** rated on 1 – 5 scale

Site Criticality		Site System Criticality		Climate Impact to Systems						
Rating	Level	System	Rating	Climate Risk / System Impact	Extreme Weather Events	Changes in Seasonal Temperatures	Changes in Seasonal Precipitation	Changes in Tidal Zones, Flood Plains and Sea Levels	Other Natural Disasters	
5	Critical to Life Safety or Critical to Client	Transportation Infrastructure	2	Transportation Infrastructure	5	0	2	3	1	
4		Site Structural Integrity	4	Site Structural Integrity	4	0	2	1	1	
3	Important to Client	Electrical Service	4	Electrical Service	2	2	1	1	1	
2	Minor Impact to client	HVAC Service	3	HVAC Service	2	4	2	1	1	
1	Little to No Impact to	Communications / IT Service	4	Communications / IT Service	2	0	1	1	1	
	Impact to	Integrity/ Viability of Work Environment (IAQ)	3	Integrity/ Viability of Work Environment (IAQ)	2	0	1	2	1	
Rating (A)		4.00		Avg. Rating (C)						1.57
OVERALL VULNERABILITY FACTOR										2.97
										Avg (A,B,C)

Mitigation

Mitigation implies that the severity or impact will be lessened (not completely eliminated). Climate change has been underway for too long to naively believe that a few changes now will eliminate potential risks. However, action now is required to lessen and mitigate the future damaging impacts.

There are four typical methods to deal with risk: accept, avoid, transfer, reduce. Each organization will need to determine their “appetite” for dealing with specific risks and the FM will need to understand the organization’s preferences in addition to providing facility recommendations for adaptation. This can be determined by working with senior managers and discussing risks to gain insight on how to make recommendations.

Accepting a risk means that the organization either feels that it is not highly probable and/or does not have a great enough risk to expend further resources. It is basically a, “we will deal with it if and when it happens” approach, nothing more. This can be referred to as tolerance of the risk.

Avoiding risk requires analysis and focus on the risks in question. It is more probable and/or has a greater impact to the organization, therefore, efforts are made to change practices, or engage new methods to change the possible impacts. Relocation or new equipment could be examples of adaptations to avoid risks.

Transferring risk is moving the responsibility of the risk to others. Insurance is the typical example of risk transfer, such that if the risk occurs, financial options are available to reduce or eliminate impact to the business. In climate change adaptation, there is little real transfer available, although some organizations use carbon credits or offsets to change the reported impacts from an organization.

Reducing risk is similar to avoidance, although acknowledgement is made that it is a lesser risk rather than a complete avoidance. Reduction is the case with much of climate change risk, since one organization alone cannot eliminate or avoid the global impacts but help to reduce the impact.

“Climate change risk management approaches generally fall into four broad categories: 1) mitigation—efforts to reduce greenhouse gas emissions; 2) adaptation—increasing society’s capacity to cope with changes in climate; 3) geoengineering or climate engineering—additional, deliberate manipulation of the earth system that is intended to counteract at least some of the impacts of greenhouse gas emissions; and 4) knowledgebase expansion—efforts to learn and understand more about the climate system, which can help support proactive risk management.” (*Climate Change Risk Management An American Meteorological Society AMS Policy Program Study, 2014*)

FIGURE 8

Methods of dealing with risk



The matrix below provides a good example of how an organization utilized a risk assessment for planning and design for new construction considering climate change as well as other factors. Also note that the red, yellow, green formatting has been overlaid to efficiently note critical and less important alternatives. (Andersson-Sköld, Y. et. al., 2015)

FIGURE 9

Sample Risk Assessment form utilizing stop-light coloring

Estimated impacts of vegetation, building density, height and facade color in the Retreat alternative. All individual aspects/impacts are normalized to the semi quantitative scale ranging from 3 (very negative contribution) to +3 (very positive contribution).

Impact category	Design alternatives (rating in relation to compact, mid-rise, no vegetation zero alternative)								
	a Compact, mid-rise, no vegetation	b Compact, mid-rise with park/large areas with vegetation and trees near building	c Open, lowrise, no vegetation (need of commuting)	d Open, lowrise, with park/ large areas with vegetation and trees near buildings (need of commuting)	e Open, midrise, no vegetation (some need of commuting)	f Compact, low-rise, no vegetation (some need of commuting)	g Compact mid- rise, light, no vegetation,	h Compact mid-rise, light colored facades with park/large areas with vegetation and trees near building	i Compact mid-rise, dark colored facades, no vegetation
Flood risk mitigation									
Short term	0	1	0	1	0	0	0	1	0
Long term	-2	2	-2	2	-1	-1	-2	2	-2
Urban heat stress (day and night)									
Short term	0	3	-3	1	-2	-1	0	3	0
Long term	0	3	-3	1	-2	-1	0	3	0
Local urban air quality									
Short term	0	1	0	1	0	0	0	1	0
Long term	0	1	0	1	0	0	0	1	0
Climate change									
Short term	0	0	-1	-1	0	0	0	0	0
Long term	0	1	-2	-1	-1	-1	0	1	0
Emissions to air									
Short term	0	0	-1	-1	0	0	0	0	0
Long term	0	0	-3	-3	-1	-1	0	0	0
Soil and water quality*									
Short term	0	2	0	2	0	0	0	2	0
Long term	0	2	0	2	0	0	0	2	0
Energy and raw material consumption									
Short term	0	0	-1	-1	0	0	0	0	0
Long term	0	0	-3	-3	-1	-1	0	0	0
Land use value									
	0	1	-1	0	0	0	0	1	0
Wellbeing and perceived welfare**									
	0	1	1	2	0	1	1	2	0
Social economic impacts**									
	0	1	1	2	0	0	0	1	0

*Environmental and ecological status, biodiversity. ** The values are based on interviews therefore only one value provided.

Climate Risk Mitigation Resources

As with impacts, the mitigation resources are vast. They deal with specific risks ranging from air quality, drought, extreme weather, flooding, to wildfires. Each risk may not apply to every location. Even within geographic locations, all facilities will not have identical risk factors due to the unique operational, and policy procedures within the organization. Through risk assessment, determining the mitigation need then leads to a resulting need to find mitigation resources and possibilities.

Examples include adaptations such as electrification of buildings to reduce natural and propane gas consumption (reduced air quality problems, safety). Plans and tools to abandon lower and first floors in buildings such as in [Boston Harbor](#), or external fire precautions, etc. Another more extreme example of air quality mitigation is the potential air capture of carbon dioxide, turning it into fuel as an idea out of Canada's Carbon Engineering company, www.cnet.com/news/this-co2-machine-could-transform-the-way-we-fight-climate-change/.

Other technologies are being researched and more will become available in coming years. To stay abreast of new technologies one good source is the World Economic Forum which has focused areas related to climate change and adaptations, www.weforum.org.

Another innovation center is the [Breakthrough Energy venture](#), sponsored by major corporations and CEO's. Their coalition is "committed to building new technologies that change the way we live, eat, work, travel and make things so we can stop the devastating impacts of climate change." Their first report is available: www.b-t.energy/wp-content/uploads/2019/02/Report_-Advancing-the-Landscape-of-Clean-Energy-Innovation_2019.pdf.

New technological development is an innovation industry, especially in the building sector. Perceiving mitigation technologies and practices as opportunities instead as additional requirements to the typical practice in the building sector, can contribute to overall sustainable development within countries, cities, and communities.

In addition to service providers or consultants available to provide risk analysis, the following links may help to educate and provide guidance for in-house analysis.

- [Agile Recovery: The Current State of Business Interruption](#)
- [Australian Government: Climate Change Impacts & Risk Management, A Guide for Business and Government](#)
- [BOMA: Resilience in the Commercial Real Estate Industry](#)
- [Central Asia Climate Change Report](#)
- [European Climate Change Assessment Report](#)
- [Russian Climate Change on Buildings, Structures and Infrastructure](#)
- [Insurance Institute for Business and Home Safety](#)
- [Actuaries Climate Index](#)
- [Assessment of climate change impacts on buildings, structures and infrastructure in the Russian regions on permafrost](#)
- [ClimateLinks West Africa](#)
- [Worldbank: Climate and Disaster Risk Screening Tools](#)
- [U.S. Climate Resilience Toolkit](#)

"Selling" Adaptations within the Organization

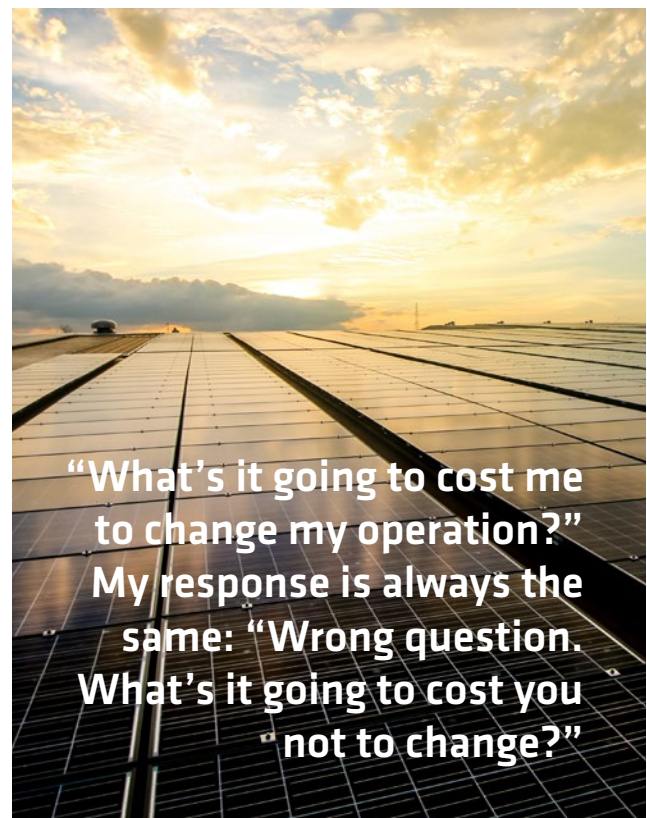
An important step for Facility Management organizations is to make sure that recommended adaptations for climate change are approved and executed. Developing a business case to demonstrate financial and other impacts to the organization will be required in most organizations. It could seem extremely difficult in some organizations highly focused on profits and financial reporting to justify expenses for climate change adaptation. However, societal changes in dealing with companies who look beyond profits is also changing. The reputation and environmental impact that organizations make is becoming more and more important to profitability and this trend is expected to continue to become more important as climate changes are more widely acknowledged and even potential changes and adaptation to operations are mandated by local and global governments. Important indexes indicate that being "sustainable" is a business requirement. One index: www.nasdaq.com/solutions/green-equity-indexes.

The dual impacts to the business, as well as to the environment can contribute to "softer" measures for a business analysis, such as business reputation, recruiting capability, marketability, and employee productivity. Although difficult to place hard costs on these impacts, if considered in the evaluation, they can have a strong impact to bring needed funding for adaptations.

The Global Commission on Adaptation urges "Government officials and business leaders need to radically rethink how they make decisions. We need a revolution in understanding, planning, and finance that makes climate risks visible, incorporates these risks into all decisions, and releases public and private financial flows. Adaptation can bring out bold ideas and inspire innovation beyond what people currently think is possible. Most of all, we

need political leadership that shakes people out of their collective slumber." ([Global Commission on Adaptation, 2019](#))

A related resource comes from the agriculture field. In discussing the true cause of bee decline, Jonathan Lundgren states, "When I present on the benefits of regenerative agriculture to farming audiences, I'm often asked, "What's it going to cost me to change my operation?" My response is always the same: "Wrong question. What's it going to cost you not to change?" The investment in facilities, owned or leased, result in similar comparisons - What will it cost not to plan for and begin mitigation processes? This longer-range viewpoint is fairly well understood in today's world of management for [risk avoidance](#).



For business case details McKinsey's research has found that "companies that ignore climate-related risks are likely to feel the consequences. Those that identify the most pertinent risks, think through how they relate to one another, and then put in place appropriate measures can begin to manage the challenges ahead. These companies will not only put themselves in position to ride out the storm; they could rise above it." (McKinsey, 2019)

Another difficult change for organizations is the employee and occupant changes required to adapt to new policies and procedures that FM implements related to climate change. If new policies require that temperatures be set at rigid standards within a facility, there will inevitably be people who are uncomfortable with the change. As with almost any change, a rigorous change management process can help to provide understanding and acceptance of changes.

IFMA's Knowledge Library provides a thorough [white paper on Change Management](#).

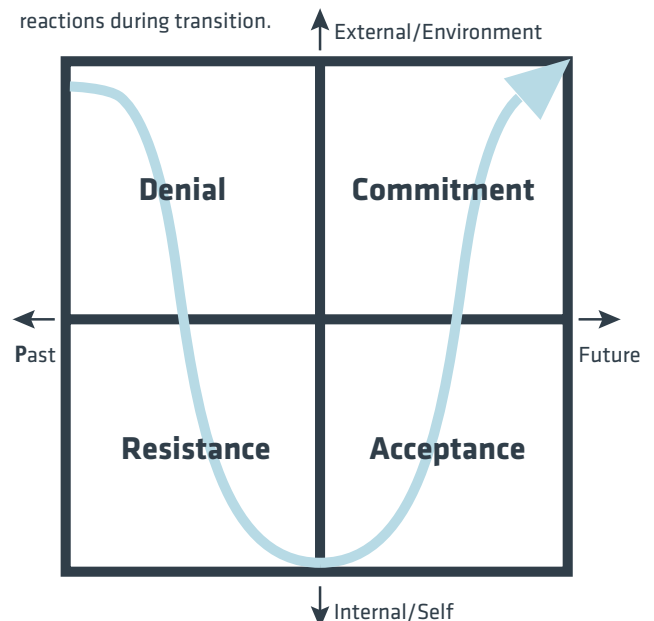
One of the critical features of change management is helping occupants to move through the change process. Providing time for normal reactions and giving key information to occupants concerning why changes are taking place builds understanding which speeds commitment.

"Companies that ignore climate-related risks are likely to feel the consequences."



FIGURE 10

Change Management chart – From: IFMA's white paper



Examples of Successful Adaptations

According to Mayor Buddy Dyer, of the City of Orlando, Florida, “lower operating costs save taxpayer dollars that would have been spent on rising utility costs.

This led to the establishment of a revolving energy fund. This dedicated fund allows our administration to appropriate funds here to be used specifically for City energy efficiency upgrades. The savings from those upgrades are used to pay off the initial investment and savings can be reallocated to fund additional energy efficiency improvements in other City-owned buildings or for future sustainable building improvements.”

“The city is also expanding renewable energy across our municipal operations, including the use of a 420 KW rooftop solar array at the city’s Fleet & Facilities headquarters, a 12 KW solar array at Orlando’s downtown Lake Eola Park, and a 114 KW on the rooftop of our Inspection Services facility. The latter project helped this become the first net-zero building in the city, meaning it produces enough energy to offset the energy used. Another piece of our renewable energy pie is our recent

purchase of 5.2 MW of solar energy from the Orlando Utilities Commission (OUC) Community Solar Farm. Through this, we are able to offset energy use at Orlando City Hall, our Orlando Police headquarters and all 17 of our fire stations. Just this past October, we hit a benchmark of meeting 10 percent of our total municipal energy demand through the use of solar energy.” From americaninfrastructuremag.com/city-orlando-leads-example-sustainable-investments.

David Dunn, CFM, Division Manager at City of Orlando also noted that the mayor has appointed a task force to refine its strategies toward 2040 goals. Participating in the Green Works, Smart City and City Beautiful efforts in Orlando has given David insight into details of climate change adaptation. His advice to colleagues is to “look around and find a plan that actually works and then find some place to start that gets traction in your organization.” He also encourages FM’s to reach out to people like him as advisors to help move your adaptability plans forward.



“Lower operating costs save taxpayer dollars that would have been spent on rising utility costs.”

The Hong Kong Jockey Club has successfully integrated environment commitments into their operations for staff, contractors, members and horse owners by utilizing six core commitments to environmental issues.

Raymond A.K. Koh, Head of Property Facilities Management at Hong Kong Jockey Club also noted that having a formal committee with all departments represented and participating has been one of the helpful measures taken by senior management to ensure that sustainability and climate change adaptations are taken seriously by all within the club. This even extends to contractors, vendors, members and horse owners who are informed of policies and given direct access to a Customer Relations department that can assist in providing additional information or answering

questions. The club's [Environmental Report 2019](#) has good examples of programs and reporting.

Hongkong Land's Kenneth Foo, Executive Director, provides some additional advice regarding gaining acceptance from senior management as well as with the employee base undergoing changes. For senior managers, the key Foo has found is to relate needed adaptations to the risk management perspective, which always gains management attention and to be sure to address each area with specific justifications. For the entire employee base, Foo has found that training is the primary focus to help employees understand and more quickly accept changes. Hongkong Land utilizes a series of training modules that require employees to become familiar with policies and adaptations in the workplace.

FIGURE 11

Hong Kong Jockey Club – From: corporate.hkjc.com/corporate/common/english/pdf/HKJC_ER19_eng.pdf

The Club's Core Environmental Commitments

Six areas outlined in our Environmental Policy are aligned with the Club's core environmental objectives.



As Citi develops a firm-wide strategy concerning climate risk, a number of internal experts will be leading that charge. Citi has recently created a Global Head of Crisis Risk Management and Climate Risk, who has significant expertise in risk management. In addition, Citi has a Chief Sustainability Officer and Global Head of Environmental and Social Risk Management, who have spearheaded the firm's efforts to conduct climate scenario analysis and led on producing Citi's first Task Force on Climate-related Financial Disclosures (TCFD) report (<https://www.citigroup.com/citi/sustainability/data/finance-for-a-climate-resilient-future.pdf>). Citi is also "seeing increasing requirements from regulators to evaluate the potential impact on Citi's properties and in 2019, Citi formalized a broader Climate Risk Working Group bringing in functions across Risk, Banking, Legal, and Sustainability & ESG to explore how Citi should further integrate governance and management of climate risk across our global footprint. In 2018 Citi's first TCFD report focused on how climate change might impact the financial services that we provide to clients. Citi has managed this through a dedicated Environmental and Social Risk Management unit (ESRM) in the Risk department since 2003, which looks at climate change risks to the financial services Citi provides. Following our first TCFD report we are now currently undertaking scenario planning at key strategic Citi locations across the world for how climate change impacts might affect Citi locations." (K. Roper, personal communication, February 21, 2020)

The city of Dundee in Scotland went 'all in' on battery electric vehicle (BEV) charging. View their video: www.youtube.com/watch?v=uDpblnu9xUE&t=12s.

An additional example comes from the recent IFMA/BGIS's [Hacking Climate Change 2020](#) competition where Canadian students submitted proposals to accelerate progress regarding climate change. This link provides information on the program as well as winners of the competition.



Supplemental Resources

There are many resources available to assist in the phases of assessment and planning for climate change adaptations. The following list provides live links to more detailed information in several categories as noted below.



General Adaptation

The U.K. Ministry of Defence has published a wide-ranging assessment of future issues sorted thematically and geographically. [Global Strategic Trends The Future Starts Today, Sixth Edition](#), provides guidance for “those tasked with developing long-term policies, strategies and capabilities to think about the future, allowing them to make the necessary choices today to better prepare for tomorrow, seize opportunities and mitigate risks.” (GST 6, 2018) An EU site for “sharing adaptation information across Europe”: climate-adapt.eea.europa.eu/knowledge/tools/adaptation-support-tool/step-2/risk-vulnerability-assessment

The Climate Disclosure Project (CDP) provides guidance for specific regions, available at: www.cdp.net/en/guidance/guidance-for-companies. CDP provides insight and background for making the case that opportunities outstrip risks. The site also has a link to accredited solutions providers: www.cdp.net/en/info/accredited-solutions-providers.

Resilience is another term used to assure that organizations are prepared and can maintain business in changing climates. A good U.S. source focused on resilience is toolkit.climate.gov/, as well as the National Institute of Building Sciences’ (U.S.) Whole Building Design Guide resource: www.wbdg.org/resources/hazard-specific-building-resilience-considerations. Stockholm University has a robust Resilience Centre with additional resources and information: www.stockholmresilience.org/research/research-news/2015-02-19-what-is-resilience.html

The Task Force on Climate-related Financial Disclosures (TCFD) states that, “Increasing transparency makes markets more efficient, and economies more stable and resilient.” Organizations such as Citi (and over 1,000 others) are utilizing TCFD’s formats for reporting and sharing data to establish appropriate benchmarks for financial and governance policies around climate change. www.fsb-tcfd.org/

Risk

The Insurance Institute for Business and Home Safety (ibhs.org or disastersafety.org) provides information on:

- Business Continuity Planning
- Construction Standards
- Emergency Preparedness & Response Planning
- Flood Guidance
- Hail Guidance
- Roofing Best Practice Guidance
- Water-Intrusion Guidance
- Wildfire Guidance
- Wind Guidance
- Winter Weather

A detailed report from the U.S. National Center for Biotechnology Information, with supplemental links to specific risks, can be found at: www.ncbi.nlm.nih.gov/pmc/articles/PMC5938640/

For business risk, Bloomberg Maps offers insight for various industries into tracking specific issues, locations and topics: www.fsb-tcfd.org/wp-content/uploads/2018/03/Presentation-Bloomberg-MAPS.pdf

www.mckinsey.com/business-functions/sustainability/our-insights/climate-risk-and-response-physical-hazards-and-socioeconomic-impacts

The World Health Organization (WHO) and U.S. Centers for Disease Control and Prevention (CDC) are the primary resources offering health and pandemic guidelines:

<https://www.who.int/influenza/preparedness/pandemic/en/>

<https://www.cdc.gov/coronavirus/2019-ncov/php/pandemic-preparedness-resources.html>

Technologies

Innovations are expanding the response to climate change challenges. In the energy sector, especially, the contributions come from many different modes and methods. Many cities are pursuing strategic electrification; not just for CO2 reductions, but to provide less dependence by providing multiple energy sources. Anyone in fault zones can be impacted if natural gas lines are damaged. The same goes for cities that still utilize municipal steam. Even the hospitality sector is accomplishing innovation to reduce dependence on traditional methods. See how the Sinclair Hotel in Ft. Worth, Texas, U.S. is changing their power source to power over ethernet (POE) in this Architectural Digest article, www.architecturaldigest.com/story/the-sinclair-hotel-is-the-first-in-the-world-to-power-itself-with-this-new-technology.

Buildings contribution to energy use is being dramatically reduced in this example, more than 20% one year ahead of scheduled 2020 reductions, www.environmentalleader.com/2019/10/atlanta-cuts-use-of-energy-in-buildings-by-more-than-20-one-year-ahead-of-schedule/.

The recently formed Breakthrough Energy Coalition (BEC) has corporate and CEO members such as Jeff Bezos and Richard Branson who have committed to investing more than \$1 billion (US) in new technologies over the next 20 years. These innovations could transform the current state of mitigation and should be watched for news.



Definitions

Business impact analysis (BIA) – a process to identify and evaluate the potential effects of natural and man-made events on business operations. Impacts typically include financial, life-safety, regulatory, legal, contractual, reputation, and brand, as well as others which may be determined to be critical to the operation of the organization.

Climate change – a broad term meaning that carbon emissions not only warm the Earth, carbon emissions are also changing rain and snow patterns, as well as increasing the intensity of storms and droughts throughout the world.

Global warming – the long-term trend of rising average global temperatures.

Greenhouse gases (GHG) – any gaseous compounds such as carbon dioxide or methane that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect.

Irreparable damage – typically a legal term meaning that no amount of repair could return the damaged party or property to its original condition. For facilities and operations this normally means that equipment cannot be repaired to a serviceable condition.

Resilience – wide meanings depending on industry but generally means “the capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance,” from the Resilient Design Institute (RDI).

Risk assessment – a systematic process to evaluate potential risks that may occur in the future or for a planned activity or undertaking.

Risk avoidance – elimination of hazards, activities and exposures that can negatively affect an organization's assets. Whereas risk management aims to control the damages and financial consequences of threatening events, risk avoidance seeks to avoid compromising events entirely.

Threat assessment – a process like risk assessment, although typically applied to behavior and law enforcement.

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