

Tendering Guideline for Climate Resilience Planning

Asia-Pacific and Middle East Airports

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Acknowledgement

This guideline builds on airport operators' understanding of the key elements of a climate risk assessment, which helps to identify an airport's sensitivity to adverse impacts and adaptive capacity to climate hazards. The assessment can be used to inform the development of possible adaptation actions to improve resilience and manage the impacts of a changing climate at an airport. This guideline provides sample contract clauses which can be used in the tendering process to commission a climate resilience study.

ACI Asia-Pacific would like to express its gratitude to the Climate Change Adaptation Working Group members, guided by the ACI Asia-Pacific Regional Environment Committee, for their time and efforts in drafting the guideline amid their busy daily work schedule at their airports.

Special thanks to the Working Group Leader, Airport Authority Hong Kong, for leading and steering the development of the new tendering guidance framework to enhance airports' climate resilience.

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- Kaohsiung International Airport, CAA
- Cam-Macau International Airport Company Limited
- Malaysia Airports Holdings Berhad
- Maldives Airports Company Limited
- Mumbai International Airport Limited
- Narita International Airport Corporation
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Executive Summary

Airports bear a significant risk from a changing climate which are likely to become more severe and dangerous in the future. The negative impacts caused by climate change are disruptive and have serious potential consequences for airport safety, asset management and operational resilience. Climate change impacts range from an increase in frequency of extreme weather events and flooding to heatwaves and public health concerns. Airports in low-elevation coastal zones, for instance, face the combined threat of sea-level rise and storm surges. The specific impacts on each airport will depend on the actual changes in climate experienced (for example, higher temperatures or increased rainfall), which will vary from place to place.

Climate change adaptation is the process of preparing for, and adjusting proactively to, climate change – both negative impacts as well as potential opportunities. As airports are dynamic systems that face unique climate impacts, their adaptation must be location specific and tailored to local circumstances. The recommended starting point in managing risks and building long-term resilience for an airport is to gain an understanding of its exposure and sensitivity to a given set of anticipated impacts, in order to develop responsive measures and investments that address these vulnerabilities.

An increasing number of airports around the world have begun to plan for climate change by conducting a climate risk assessment and developing standalone climate plans or incorporating climate considerations into existing plans, policies, and projects. In 2018, Airport Council International (ACI) produced a *Policy Brief: [Airports' resilience and adaptation to changing climate](#)*¹ to encourage airports to conduct risk assessments, consider various adaptation measures, and develop mitigation measures for the potential impact of climate change on infrastructure and operations.

Conducting a climate risk assessment could be highly technical and resource-intensive, and it is likely that airport operators may require collaboration with external experts or consultants to perform the task unless the airport is well-resourced with sufficient in-house technical expertise and capacity. While the focus of the guideline is to provide tendering guidance to support airports to commission their own climate risk assessment for climate resilience planning, further information has been provided in each section to educate Airport Sustainability Managers on the climate risk assessment process. This will help Airport Sustainability Managers to become more informed as they commence the process. The Tendering Guideline provides more information on physical risk assessment, with supplementary guidance provided on transition risk assessment and alignment with the Taskforce on Climate-related Financial Disclosures for airports interested in taking further steps – the contents of the guideline are shown below.

¹ Airports' resilience and adaptation to changing climate: <https://store.aci.aero/product/policy-brief-airports-resilience-and-adaptation-to-changing-climate/>

Section	Task
1	Building the core team and stakeholder engagement
2	Climate scenario analysis
3	Physical risk assessment
4	Transition risk assessment (optional)
5	Climate action plan
6	Aligning with TCFD recommendations (optional)
7	Suggestion on tender evaluation

In conclusion, adaptation is not a one-off event, but a continuous cycle of preparation, response, and revision. It is a dynamic process that should be revised over time based on new information. The strongest adaptation processes will be driven by leadership and commitment to measuring progress and assessing effectiveness. The airports that are able to effectively integrate adaptation, including a broad spectrum of existing controls and planned measures, will be best positioned to thrive in the era of climate change.

Glossary of key terms

Key term	Definition
Adaptation (Climate change)	<p>Actions undertaken to manage or reduce the adverse consequences of climate change, as well as to harness any beneficial opportunities.</p> <p>Adaptation actions may include physical changes to an asset to achieve or facilitate adaptation including changes/upgrades to technology and equipment or design standards for particular project elements (e.g. flood protection designed to the Probable Maximum Flood [PMF]).</p> <p>Adaptation actions may also include changes to contracts, setting specific targets or objectives, scheduling regular reviews or inspections, developing an emergency management plan and design guidelines etc.</p>
Climate Change	Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity.
Climate hazards	'Hazard' is defined by the Intergovernmental Panel on Climate Change (IPCC) as: <i>"The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources."</i> ²
Climate projections	Scientifically derived estimations of how different variables (such as temperature, precipitation, wind, solar radiation, sea level rise) in our climate and weather will be affected by increases in greenhouse gases in the Earth's atmosphere.
Climate resilience	Climate resilience is the capacity of an organisation to plan, prepare, survive, adapt, and grow regardless of climate-related chronic stress and acute shocks they experience.
Mitigation (Climate change)	Actions taken globally, nationally and individually to limit changes caused in the global climate by human activities. Mitigation activities are designed to reduce greenhouse emissions and/or increase the amounts of greenhouse gases removed from the atmosphere by greenhouse sinks.
Paris Agreement	The global agreement to limit global warming to well below 2°C above pre-industrial levels, and pursue efforts to limit warming to 1.5°C, was reached at the United Nations Framework Convention on Climate Change 21 st Conference of the Parties (COP21) in Paris in 2015.

² Intergovernmental Panel on Climate Change, 2014. Climate Change 2014: Impacts, Adaptation and Vulnerability. Page 5. https://www.ipcc.ch/site/assets/uploads/2018/03/ar5_wgII_spm_en-1.pdf

Key term	Definition
Physical risk	<p>Physical risk is the risk of direct damage to an organisation, supply chains, market impacts or liability due to failure to foresee losses from physical impacts of climate change. Physical risks can either be:</p> <ul style="list-style-type: none"> • Acute risks – event driven (shocks) • Chronic risks – longer-term shifts in climate patterns (stresses)
Risk	<p>Risks are the effect of uncertainty on objectives. An effect is a deviation from the expected. It can be positive, negative or both, and can address, create or result in opportunities and threats.</p>
Sensitivity	<p>Responsiveness of the asset to a hazard.</p>
Task Force on Climate-related Financial Disclosures (TCFD)	<p>Developed by the Financial Stability Board, the Task Force on Climate-related Financial Disclosures (TCFD) Recommendations, released in 2017, are an important and robust framework for disclosing climate-related risks, both for physical and transition risks. Whilst disclosure is voluntary, the intent of the disclosure is to enable organisations and investors to make more informed investment decisions. TCFD has been adopted extensively by financial and non-financial organisations. To date over 3,000 global organisations have announced their support for the TCFD, supporters include Morgan Stanley, Asian Development Bank (ADB).</p>
Transition risks and opportunities	<p>The global shift toward a low carbon economy poses both risks and opportunities for airports and other organisations. These may include risks and opportunities associated with:</p> <ul style="list-style-type: none"> • Market and Technology Shifts: Relating to changes in demand for products due to policy shifts, stranding of assets due to market shifts. • Policy and Legal Changes: Cost and/or revenue impacts resulting from policy changes. Including increased liability due to failure to foresee and mitigate losses from any transition risks. • Reputation: Reputational damage resulting from an organisation’s limited response to mitigation needs.

Introduction

Why does an airport need climate risk assessments?

Global impacts of climate change are already being observed, with countries experiencing raised temperatures, more frequent extreme rainfall and rising sea levels. The United Nations Intergovernmental Panel on Climate Change (IPCC) has stated that scientists are observing changes in the Earth's climate in every region and across the whole climate system. Climate change is bringing multiple changes to different regions and in particular the frequency, intensity, spatial extent, duration and timing of extreme weather events are expected to increase³.

Many airports are already exposed to extreme weather events such as typhoons, storm surges, extreme heat and flooding. Bangkok's Don Muang Airport experienced extreme rainfall in 2011, resulting in a year-long shutdown to repair damages and enable normal operations to resume. In 2018, Kansai International Airport closed for 17 days due to damage from a severe high wave caused by Typhoon Jebi. Hong Kong International Airport experienced super typhoons in 2017 and 2018 requiring major operational plans to be implemented, e.g. Flight Rescheduling Control System (FRCS) to handle the airlines' rescheduling requests, activated the Airport Emergency Centre (AEC) for multi-agency coordination and contingency arrangement such as ramp handling, passenger crowd management.

ACI's works on climate resilience and adaptation

In 2018, Airport Council International (ACI) produced [*Policy Brief: Airports' resilience and adaptation to changing climate 4*](#) to encourage airports to conduct risk assessments, consider various adaptation measures, and develop mitigation measures for the potential impact of climate change on infrastructure and operations. The policy brief also includes case studies of best practices from airports in Norway, Australia, Hong Kong, Istanbul, Amsterdam and Singapore that airport operators can use to examine their own practices.

This Tendering Guideline builds understanding of the key elements of a climate risk assessment which will help to identify an airport's sensitivity to adverse impacts and adaptive capacity to climate hazards. The assessment can be used to inform the development of possible adaptation actions to improve resilience and manage the impacts of a changing climate at an airport.

This Guideline provides sample contract clauses which could be used in a tendering process to commission a climate risk assessment.

³ Accessed IPCC website on 6 December 2021, link: <https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/>

⁴ Airports' resilience and adaptation to changing climate: <https://store.aci.aero/product/policy-brief-airports-resilience-and-adaptation-to-changing-climate/>

Objective of this tendering guideline

This tendering guideline aims to assist Airport Sustainability Managers and/or whoever is accountable for Airport Climate Resilience e.g., Airport Strategy and Planning, Enterprise Risk Managers to:

- understand the components of a climate risk assessment for the purpose of climate resilience planning;
- provide draft / example clauses to assist in commissioning a climate risk assessment and help Airport Sustainability Managers prepare procurement documents for consultancy services; and
- provide recommendations on alignment with TCFD Recommendations.

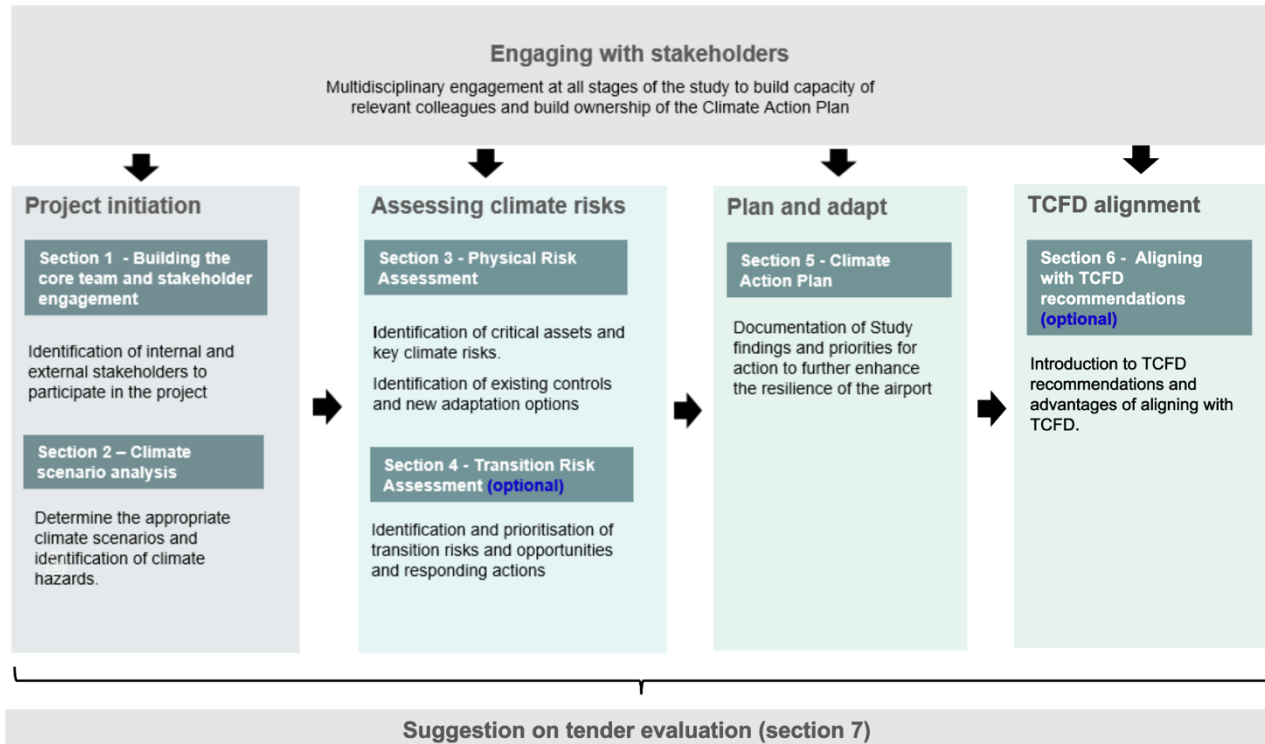
Airport Sustainability Managers may consider using some of the recommended clauses provided in this Guideline to prepare procurement documents for consultancy services (e.g. scope of work and evaluation).

This document is not intended to suit the needs of all airports, and therefore should not be indiscriminately adopted. Airport Sustainability Managers must carefully evaluate their own circumstances, needs and budget, and adjust the recommended contract specifications to their desired outcomes. Aspects to consider would include specific user requirements of a climate risk assessment and adaptation plan as well as the availability of professional representatives.

Beyond the information provided in this document, Airport Sustainability Managers may consider hiring a consultant to perform a climate risk assessment due to the complexity of climate risk as a multidisciplinary technical topic. Engaging with a consultancy firm with climate specialists and multidisciplinary technical engineering experts enables airports to stay informed on the latest projections for their region or city and enables access to a wide range of technical experts required to support the development of a meaningful adaptation plan.

How to use this Guideline

In this Guideline, the climate risk assessment process has been broken down into different tasks, with a section dedicated to each task (Section 1 to Section 6). Though the objective of this Guideline focuses primarily on assisting the Airport Sustainability Managers to tender for a physical risk assessment, sections on transition risk assessment and TCFD alignment have been included for airports who are interested in taking further steps. Section 7 provides suggestions to the Airport Sustainability Managers on tender evaluation for a study based on climate risk assessment.



1. Building the core team and stakeholder engagement

1.1 Building the core team

For Airport Sustainability Managers, starting to consider climate resilience, it is helpful to establish a core team with diverse perspectives on the airport’s operation and infrastructure (assets) to support the development of strategies in response to climate change impacts. Once team members understand the risks and opportunities relevant to their assets and operations, they will be better equipped to make decisions that enhance organisational climate resilience.

The project team assembled should represent the full scope of an airport’s diverse functions, such as asset maintenance and landside, terminal and airfield operations. Each representative is expected to bring diverse expertise to help identify risks and inform adaptation measures.

The following personnel and departments are recommended to provide input to the risk assessment.

Personnel / Departments	Relevance to climate risk assessment
Executive management	<ul style="list-style-type: none"> ▪ Exercise oversight of the development and implementation of the airport’s climate change strategy and action plan. ▪ Ensure climate change considerations are embedded into its strategy and business model, with a clear path to address the company’s climate-related risks and opportunities. ▪ Ensure that the necessary resources are available to develop and implement the action plan.
Engineering and maintenance	<ul style="list-style-type: none"> ▪ Identify critical infrastructure and systems that are vulnerable to climate change impacts. ▪ Support the climate risk assessment and provide inputs on the development of adaptation actions. For example, assess the flood risks under multiple climate scenarios and to develop appropriate flood management actions accordingly.
Planning	<ul style="list-style-type: none"> ▪ In collaboration with the engineering team, ensure climate change considerations are integrated into future infrastructure /building development and asset renewal.
Operations	<ul style="list-style-type: none"> ▪ Provide knowledge and experience to enhance or improve operational procedures to cope with the disruptions of airport operations brought about by climate hazards. For example, stranding of passengers in terminal buildings due to typhoons or extreme rainfall.
Environmental / Sustainability	<ul style="list-style-type: none"> ▪ Lead study and coordinate inputs from different relevant departments to conduct the study.

	<ul style="list-style-type: none">▪ Raise awareness of why inputs are needed for the climate risk assessment.▪ Track and monitor the implementation of the climate adaptation actions identified.▪ Track updates on climate projections and other relevant data.
Finance / Insurance	<ul style="list-style-type: none">▪ Determine the financial implications resulting from climate change. For example, an increase in insurance premiums to protect against loss and damage due to extreme weather events.▪ Identify available funding and financing sources for the implementation of climate-related actions.
Legal	<ul style="list-style-type: none">▪ Identify litigation and regulatory risks associated with the transition to a low carbon economy and to develop actions to address those risks.
Safety and business continuity	<ul style="list-style-type: none">▪ Identify the health and safety risks brought by climate change and develop actions to address those risks. For example, risk of heat-related health issues for workers during extreme heat events.▪ Develop plans to ensure business continuity under future climate scenarios. For example, identify alternative transport modes when ground transport services are disrupted.▪ Identify aviation safety risks related to flight safety brought about by climate change and develop actions to address those risks
Human Resources	<ul style="list-style-type: none">▪ Support Airport Sustainability Managers to organise and provide the necessary training/workshops to enhance awareness among staff.

Early and ongoing engagement and capacity building with interdisciplinary stakeholders will help raise awareness and enhance knowledge on climate change. This will ensure that climate resilience planning is incorporated into business planning and strategy, creating a culture of climate resilience across the organisation.

1.2 Engagement with external stakeholders

It is recommended that Airport Sustainability Managers engage with providers of major interconnected services that support the airport's operations to inform the risk assessment. For example, risks related to power provision, access routes and other key utility provisions should be considered through consultation with power, transportation, telecommunications, waste and water companies. The consultant shall be able to provide stakeholder mapping and engagement tools to support this process of mapping interdependencies within the system. Additionally, Airport Sustainability Managers are also encouraged to seek the most up-to-date guidance from

government agencies and regulators in relation to climate projections and anticipated climate-related risks to ensure compliance with design standards and legislation where relevant.

2. Climate scenario analysis

Key tasks involved:



2.1 What is climate scenario analysis?

Scenario analysis is an exercise to help organisations effectively identify and assess the potential implications of climate-related risks on the business from a range of plausible future conditions. Scenarios are hypothetical pathways of development that consider how the future might look if certain trends continue or certain conditions are met. Plausible scenarios have been developed by industry and scientific groups, local government agencies, based on robust scientific data and climate modelling, to outline projected changes to the climate and anticipated responses from the public and private sectors. It is an important and useful tool for companies to understand and develop flexible and robust strategic plans that are resilient to climate change.

Did you know?

Climate risks are typically classified into two major categories:

1. Physical risks

Risks related to physical impacts of climate change, which can be driven by events such as floods and typhoons (acute risks) or longer-term shifts in climate patterns such as sustained high temperatures and rise in sea level (chronic risks).

2. Transition risks

Risks emanating from the transition to a lower-carbon economy, which may entail policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change.

More details about physical risks and transition risks are provided in section 3 and 4 respectively.

2.2 Scope and boundaries of scenario analysis

The scope and boundaries of a scenario analysis should represent an airport's material business operation. This includes airport operation, building and infrastructure assets within the airport's control. The study could also take into account interdependencies arising from the supply chain, for example business partners supporting airport operation, transport and utility providers.

2.3 Publicly available scenarios

There are a number of publicly available scenarios which can be adopted. The table below sets out publicly available scenarios that airports may use to conduct analysis. Other available tools and data are also listed in Appendix 4 of the Task Force on Climate-related Financial Disclosures (TCFD)'s technical supplement 5. While publicly available scenarios often refer to global or country-level data, airports may refine their scenarios with the latest qualitative and quantitative climate projection data published by international organisations, academics or local governments. The Airport Sustainability Managers may consider adopting climate scenarios aligned with those of national or local government.

Source	Characteristics	Pathways
Intergovernmental Panel on Climate Change (IPCC)	IPCC Fifth Assessment Report (AR5) <ul style="list-style-type: none"> Focuses on physical impacts Simulates future scenarios based on varying levels of GHG concentration 	Representative Concentration Pathways (RCP)⁶ <ul style="list-style-type: none"> RCP 2.6: Accelerated transition RCP 4.5: Low-moderate transition RCP 6.0: High-moderate transition RCP 8.5: Business as usual
	IPCC Sixth Assessment Report (AR6) <ul style="list-style-type: none"> Focuses on socio-economic impacts Provides narrative descriptions of alternative futures as a result of varying socio-economic challenges to adaptation and mitigation 	Shared Socioeconomic Pathways (SSP)⁷ <ul style="list-style-type: none"> SSP1-1.9: Very ambitious scenario to represent the 1.5°C goal of the Paris Agreement SSP1-2.6: Sustainable development scenario SSP2-4.5: Intermediate scenario SSP3-7.0: Regional rivalry scenario SSP5-8.5: Fossil-fuel based development
International Energy Agency (IEA) ⁸	<ul style="list-style-type: none"> Focuses on energy and emissions scenarios describing the future energy mix 	<ul style="list-style-type: none"> Stringent pathway: Sustainable Development Scenario (SDS)¹⁰ Business-as-usual pathway: Stated Policy Scenario (SPS)

⁵ TCFD, 2017, Technical supplement - the Use of Scenario Analysis in Disclosure of Climate-Related Risk and Opportunities. <https://assets.bbhub.io/company/sites/60/2021/03/FINAL-TCFD-Technical-Supplement-062917.pdf>

⁶ IPCC Fifth Assessment Report. <https://www.ipcc.ch/report/ar5/syr/>

⁷ IPCC Sixth Assessment Report. <https://www.ipcc.ch/report/ar6/wg1/>

⁸ International Energy Agency. [Understanding WEO Scenarios – World Energy Model – Analysis - IEA](https://www.iea.org/reports/understanding-weto-scenarios)

To facilitate discussions and analyses on the potential impacts of climate-related issues under different conditions, it is recommended to adopt at least two scenarios for comparison. This approach helps to identify the risk appetite of the organisation and selection of appropriate adaptation measures in the long term. Some organisations select a low emissions pathway (i.e. a scenario that strives to achieve a lower-carbon economy) and a high emissions/business-as-usual pathway, to adequately consider both physical and transition risks – further details are discussed in section 4 and 5.

2.4 Time horizon

Given that impacts associated with climate change are projected to become more severe over time, it is important to understand how these changes will likely impact the airport in not only on the short term, but also in the medium and long term. Adaptation actions to increase the airport’s resilience to climate change will also have different time requirements for implementation. Understanding critical trigger points will help strategic planning of these actions.

Airports may consider the following three future timeframes:

- A short-term timeframe – 2030
- A medium-term timeframe – 2050
- A long-term timeframe – 2100.

Assessing climate risks for these timeframes is enabled by the availability of climate projections by key organisations, e.g. IPCC. Selection of timeframes is, however, subject to asset lifetimes and business planning timeframes.

2.5 Identify climate hazards

The selection of climate hazards must also be determined as part of the climate risk assessment. It is recommended that climate hazards which are significant to the airport operations are reviewed carefully. Below are examples of key climate hazards relevant to some airports.

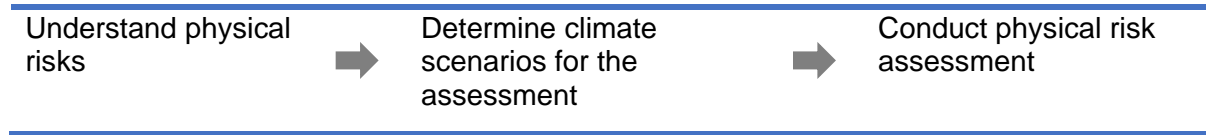
Climate hazards	Examples of relevant parameter
Extreme heat	<ul style="list-style-type: none"> ▪ Annual number of hot days ▪ Annual number of hot nights
Sea level rise	<ul style="list-style-type: none"> ▪ Mean sea level with vertical land displacement
Storm-events	<ul style="list-style-type: none"> ▪ Frequency ▪ Intensity
Extreme rainfall	<ul style="list-style-type: none"> ▪ Average rainfall intensity ▪ Annual maximum daily rainfall
Snow	<ul style="list-style-type: none"> ▪ Average snow cover
Lightning strikes	<ul style="list-style-type: none"> ▪ Frequency and intensity of lightning events.

2.6 Recommended procurement clauses for climate scenario analysis

1. The Consultant shall conduct desktop research, collect available local and international climate data to derive all relevant climate projections and hazards for the study.
2. The Consultant shall propose the methodology for conducting the climate scenario analysis. (Note: the airport may also consider if any modelling or downscaling of climate model is required).
3. In accordance with the latest Assessment Report published by IPCC, papers published by industry bodies such as ACI, IATA and ICAO, and any other relevant climate change information available from local sources, the Consultant shall develop a list of climate variables that may stress the airport's operations and cause disruptive shocks. Climate variables and hazards should include but are not limited to:
 - (a) Changes in rainfall intensity;
 - (b) Changes in the occurrence of extreme rainfall;
 - (c) Rise in storm surges;
 - (d) Mean sea level rise;
 - (e) Extreme sea level;
 - (f) Changes in wind speed;
 - (g) Changes in sunlight intensity and ambient temperature; and
 - (h) Increased occurrence of lightning strikes.
4. The Consultant shall identify appropriate climate scenarios that can be applied to the airport. The Consultant shall study and understand the technical sensitivities among different scenarios in order to advise the airport on scenario selection.
5. The Consultant shall recommend a number of climate scenarios, in consultation with the airport's key stakeholders. (Note: the airport could select climate scenarios which also meet the disclosure requirements under Task Force on Climate-related Financial Disclosures (TCFD)).

3. Physical risk assessment

Key tasks involved:







3.1 What is physical risk?

Physical Risks: The risks resulting from climate change can be event driven (acute) or longer-term shifts (chronic) in climate patterns below:

Type	Examples
Acute	<ul style="list-style-type: none">– Increased frequency and severity of extreme weather events, e.g.<ul style="list-style-type: none">▪ Wildfires or Heatwave▪ Storm-events▪ Floods or Extreme Rainfall
Chronic	<ul style="list-style-type: none">– Longer-term chronic changes in mean values and ranges of fluctuation of various climate variables, e.g.<ul style="list-style-type: none">▪ Temperate pattern▪ Droughts▪ Rainfall▪ Sea level rise

Physical risks may have financial implications for airports, such as direct damage to assets and indirect impacts from supply chain disruption. A summary of selected relevant climate hazards, their impacts on airport infrastructures and operations are shown below.

Climate hazard	Impacts on infrastructure and operations
 <p data-bbox="289 590 410 646">Sea level rise</p>	<ul style="list-style-type: none"> • Inundation of low-lying infrastructures • Flooding of runway and airfield from storm drain overflows • Loss of ground transport access • Cancellation, diversion or delays of flights
 <p data-bbox="261 768 438 825">Higher temperatures</p>	<ul style="list-style-type: none"> • Heat damage to runway and taxiway surface • Increased heating and cooling requirements • Changes in aircraft performance may disrupt airlines operations • Higher risk of heat-related health issues for workers
 <p data-bbox="293 995 402 1052">Extreme rainfall</p>	<ul style="list-style-type: none"> • Reduction in airport throughput • Higher demand on drainage system capacity • Inundation of underground infrastructure Inundation of ground transport access • Disrupt local utility provision, e.g. power supply
 <p data-bbox="233 1215 464 1272">Storm events and storm surge</p>	<ul style="list-style-type: none"> • Damage to airport infrastructure and disruption to airport operations. • Intense rainfall can lead to flooding where runoff combines with storm surges.

3.2 Cascading impacts and indirect risks

Further to the direct impacts described above, the increasing frequency and magnitude of extreme weather events may result in cascading consequences across critical infrastructure systems that are highly interdependent, with damaged facilities and reduced services in one system impacting others. For example, for island airports, an extreme weather event could decommission the only road or railway connectivity between the airport and the mainland, leaving passengers stranded at the airport.

As airports do not function as a closed system and rely on support from other associated infrastructure, identifying potential climate hazards that are beyond the airport’s control and developing specific mitigation measures is key to minimise cascading impacts arising from climate change.

3.3 Determine a climate scenario for physical risk assessment

In order to build awareness of possible future as a result of climate change and gain buy-in for the implementation of adaptation measures, relevant stakeholders should be engaged when selecting climate scenarios for the climate risk assessment.

There is a large body of evidence that suggests global emissions are currently tracking close to the RCP8.5 emissions scenario. Using RCP 8.5 enables a wider breadth of impacts to be appraised and compared, under a scenario of continuing global emissions at the present rate. Adoption of RCP 8.5 is considered standard global practice for a physical risk assessment to identify and determine the significant climate-related risks to critical assets and operations.

Guidance by the IPCC notes that stakeholders with a low risk tolerance should provide a level of protection above the upper end of the likely range of projections associated with RCP8.5 in 2100 (i.e. higher than the 95th percentile), and it is common practice amongst international jurisdictions to comprehensively plan for this scenario. Those organisations wishing to pursue a worst-case scenario should also be aware that the National Oceanic and Atmospheric Administration (NOAA) has developed an H++ scenario⁹ which provides more extreme projections for sea level rise than IPCC's projections. This is particularly useful for coastal airports seeking more extreme modelling of sea level rise in line with the faster melting of the Antarctic ice caps.

Note: Airport Sustainability Managers may consider using the latest climate projections published in the IPCC Sixth Assessment (AR6) Report.

3.4 Conduct a physical risk assessment

Airport Sustainability Managers' consultant team may follow the process outlined in global standards, including ISO 31000:2018 *Risk Management Principles and Guidelines* and ISO 14090:2019 *Adaptation to Climate Change combined with ICAO Risk Matrix DOC 9859 - 4th Edition* to conduct the physical risk assessment.

The adopted climate scenarios can be used to determine projected changes in climate variables and hazards. This information can be used to reveal where these changes may overlap with the locations of assets and operations. Examples of climate variables and hazards which are considered to be relevant to airports include:

- Temperature (mean and extreme)
- Rainfall (mean and extreme)
- Sea level rise (mean and extreme)
- Storm surges and flooding
- Lightning strikes and hail storms
- Storm-events

⁹ NOAA H++ scenario - <https://ntrs.nasa.gov/api/citations/20180001857/downloads/20180001857.pdf>

The physical risk assessment will include identifying and prioritising physical risks to the highest priority assets and operations. The Airport Sustainability Managers can consider for prioritising risks, through two methods that are qualitative in nature - (A) the qualitative evaluation method and (B) the quantitative scoring method. Airport Sustainability Managers may adopt such methods they see fit with reference to their corporate practices.

(A) Qualitative evaluation method

Qualitative evaluation relies on the management's internal discussions and prioritisation of identified risks. Its effectiveness depends primarily on the management's climate awareness and competence in aspects such as decision-making on risk, opportunities, long-term strategy related to climate issues, and business model impacts. While external experts may be brought in for advice, the airport's internal stakeholders are expected to have sufficient knowledge and understanding of different climate hazards and the climate-related risks relevant to their assets and operations to inform their decision on prioritisation of the risk.

Capacity building of climate competence is crucial to the success of the qualitative evaluation approach, and should be carried out regularly in order to ensure that the internal stakeholders' knowledge of climate-related issues remains up-to-date. Airport Sustainability Managers are also recommended to identify opportunities to share experiences, exchange ideas, best practices and lessons learned with external stakeholders or peers when conducting a climate risk assessment. The consultant shall be able to provide stakeholder engagement tools that visualise the interdependencies (cascade effect) of assets at risk within the system to support the prioritisation decision-making process.

(B) Quantitative scoring

The quantitative scoring approach adopts a risk matrix. Assessment of the severity of risks is based on their impact on the company and likelihood of occurrence.

Based on the priority hazard, Airport Sustainability Managers are recommended to work with the consultant to develop the climate risks, which take into account of the direct risks, interdependencies or indirect risks on systems that may affect the capacity of the airport.

The identified risks can be prioritised using a risk framework (including likelihood and consequence criteria – see below) to rate the risks for multiple timeframes and climate scenarios. Existing controls are to be reviewed for each risk. Assessment of the severity (tolerability) of risks can be based on their impact on the airport and likelihood of occurrence.

- a) Likelihood** - if an event is more likely to occur, it should be ranked as a higher priority. The possibility that a given event will occur in terms of i) frequency of event; ii) chance of happening.
- b) Consequence** - If an event has a more severe impact on the airport assets and operations, it should be ranked as a higher priority. Examples of consequences include:
 - Financial loss

- Reputation damage
- Prosecution and fines
- Operational disruption

Examples of physical risk and its assessment

Asset	Risk statement	Relevant hazards	Existing control	2030 – RCP 8.5*		
				Likelihood (1 = lowest; 5 = highest)	Consequence (1 = lowest; 5 = highest)	Risk (subject to the risk matrix)
Airfield	Flooding resulting in damage or failure of infrastructure leading to operational disruption	Extreme rainfall and typhoons	Sea wall and drainage system	3 (Possible)	4 (Serious)	High or Intolerable
Terminal buildings	Extreme storm resulting in disruption of aircraft movements leading to stranded passengers	Extreme rainfall, typhoons	Procedure manual, e.g. stranded passenger handling	2 (Remote)	4 (Serious)	Medium or tolerable

* The assessment is also applicable to other timeframe and climate scenarios selected.

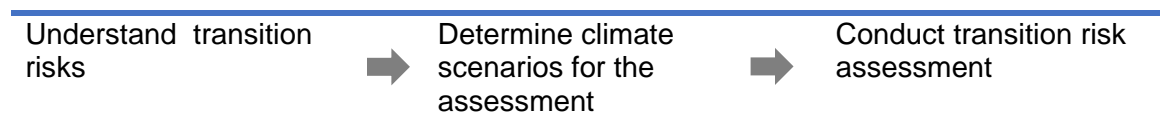
Assets and operations which are identified as critical and vulnerable to climate change impacts may undergo a more detailed assessment to determine current controls in place to reduce these risks. Additional adaptation measures can also be identified and developed in response to the priority risks. The outcome of the physical risk assessment would inform the development of a Climate Action Plan (Section 5). It is recommended to engage the asset owners and technical representatives of each priority asset throughout the whole assessment process.

3.5 Recommended procurement clauses for physical risk assessment

1. The Consultant shall undertake a review of physical risks (both acute and chronic) across similar global airports in order to identify similar risks relevant to the airport. (Note: Airport Sustainability Manager may also consider reviewing the climate risks across relevant public infrastructure within the same geographical regions).
2. The physical risk assessment will assess the airport's current controls, exposure and vulnerability, as well as the capacity to adapt to climate change risks, and identify possible opportunities to increase resilience in infrastructure and building design, connectivity, operational management. Operational management may also include business continuity during extreme weather events.
3. The Consultant shall develop a strategic approach and methodology to conduct the physical risk assessment. The methodology must include a clear approach to identifying and prioritising the physical risks that are most pertinent to the airport and its business activities. (Note: Airport Sustainability Manager may consider i) working with the Consultant to identify a list of critical and non-critical assets and operations to be assessed under the physical risk assessment; and ii) adopting an approach which meets the TCFD disclosure requirements).

4. Transition risk assessment

Key tasks involved:



4.1 What is transition risk?

Transition Risks include various types of risks involved in the transition to a low-carbon economy. It could lead to extensive policy, legal, technology and market changes that should be addressed through risk adaptation and mitigation.

Type	Examples
Policy & Legal	<ul style="list-style-type: none"> – Introduction of a carbon tax (pricing of GHG emissions) – Increased emissions reporting requirements – Increased regulation of existing products or services requirements – Increased permitting restrictions – Exposure to legal claims
Technology	<ul style="list-style-type: none"> – Cost to transition to lower emissions technology – Failure of new technology and resultant loss of investment – Product substitution for lower emissions products (and therefore reduced demand for existing products)
Market	<ul style="list-style-type: none"> – Increased cost of raw materials – Increased costs due to supply chain changes or disruption – Changing customer behaviour
Reputation	<ul style="list-style-type: none"> – Changes in consumer perception or preferences – Stigmatisation of sector (e.g. extractive sector) – Increased stakeholder concern – Negative external feedback (e.g. social media, press)

4.2 Determine a climate scenario for a transition risk assessment

The identification of transition risks and opportunities is recommended to be undertaken using a low-emissions scenario e.g. RCP 2.6, which assumes strong mitigation efforts, with early participation and uptake from all emitters, followed by active capture and permanent storage of atmospheric carbon dioxide. It represents an aggressive and disruptive scenario to allow peak emissions early in the century, followed by a rapid decline resulting in net zero emissions by 2070.

Under a low-emissions scenario, the scale and speed of the technological and regulatory responses required will provide increasing change as the region (and the world) transitions from traditional and conventional energy and consumption models to embrace more sustainable patterns for growth in line with the transition to a low-carbon economy. It represents the most ambitious scenario with regard to policy drivers, market transformation, and technological change.

4.3 How to assess transition risks and opportunities?

Using the adopted climate scenario, the transition risk assessment promotes understanding of how the airport may be impacted by policy and market changes brought on by a transition to a low carbon economy. It is a complementary exercise to the physical risk assessment, providing the airport with a holistic review of the drivers and impacts of climate change.

The identification of transition drivers could be informed by research into policy and market trends likely to influence the airport’s assets and operations. Airport Sustainability Managers may consider reviewing a wide and diverse range of publications by government agencies, international market sector representative bodies (including the International Energy Agency, Airport Council International and World Travel & Tourism Council) and the airport’s services partners to identify the transition drivers.

Airport Sustainability Managers or their consultants may develop a list of transition drivers with transition risks and opportunities and evaluate them according to a set of prioritisation criteria, such as financial materiality and degree of control, or according to the risk framework (i.e. likelihood and consequence risk matrix). Other internal stakeholders could also be given the opportunity to identify existing controls in place and any additional transition risks and opportunities.

Examples of transition driver and risk/opportunity

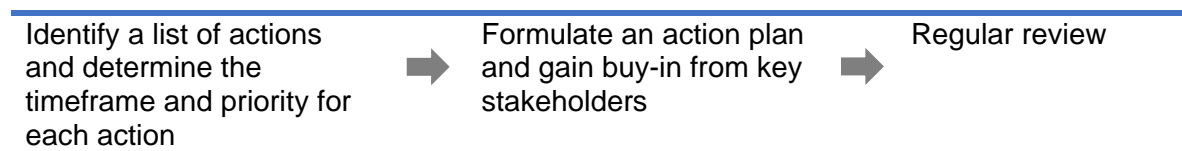
Driver	Risk/Opportunity
Global adoption of net-zero emissions policies and action plans	<ul style="list-style-type: none"> – Risk to airport’s reputation if the airport does not develop a practical plan towards reaching net-zero carbon emissions by 2050 and other peer airports do. – Opportunity for airports to collaborate together on emissions reduction and net-zero efforts.
Shifting consumer preferences to travel and freight	<ul style="list-style-type: none"> – Risk that increased awareness of carbon intensity of flying reduces passenger demand for domestic and international flights, or reduced air-freight demand, resulting in a reduction of revenue. – Opportunity to accommodate greater freight travel by air in response to increasing consumer demand for international products, resulting in increased revenues.

4.4 Recommended procurement clauses for transition risk assessment

1. The Consultant shall undertake a review of transition risks and opportunities (including regulatory, market, technology, reputation and other risks which are related to the transition to a lower-carbon economy) across similar global airports. (Note: Airport Sustainability Manager may also consider reviewing the climate risks across relevant public infrastructure within the same geographical regions).
2. The transition risk assessment will assess the airport's current controls and exposure, as well as the capacity to adapt to the transition risk, and identify possible opportunities to increase airport's operational resilience.
3. The Consultant shall develop a strategic approach and methodology to conduct the transition risk assessment. The methodology must include a clear approach to identifying and prioritising the transition risks and opportunities that are most pertinent to the airport and its business activities. (Note: Airport Sustainability Manager may consider adopting an approach which meets the TCFD disclosure requirements).

5. Climate Action Plan and regular review

Key tasks involved:



5.1 Climate Action Plan

A Climate Action Plan refers to the detailed steps to be taken by an airport to build climate resilience through mitigation and adaptation measures. Airport Sustainability Managers are encouraged to engage with relevant internal and external stakeholders to develop practical actions to address physical and transition risks and opportunities identified through the physical and transition risk assessment.

5.1.2 Benchmarking of climate adaptation measures

Prior to developing a Climate Action Plan, the Airport Sustainability Managers or their consultant are recommended to undertake a review of resilience or adaptation measures across peer airports and other relevant public infrastructure, and identify best practices to identify potential opportunities to increase airport's resilience.

5.1.3 Assess Adaptation Measures

The Airport Sustainability Managers or their consultant are recommended to thoroughly review any existing and planned resilience or adaptation measures implemented by the airports and their capacity to respond against the outputs of the climate risk assessment, as well as the potential climate adaptation measures identified through the benchmarking exercise in 5.1.2 above. In particular, the consultation with professional and frontline team members is important as they can often provide insights on improvement opportunities and practical constraints, which help to ascertain the feasibility of proposed actions and determine a pathway for implementation of enhanced measures. This is an iterative process where plans may be adjusted according to feedback received in order to ensure the effectiveness of the Climate Action Plan. Gaining buy-in from teams that will be responsible for implementing future actions is essential and also raises awareness of climate adaptation across an organisation.

Example - action for physical risk

Priority asset class	Risk	Action	Responsible dept	Timeframe for action
Airfield	Flooding resulting in damage or failure of infrastructure leading to operational disruption	Conduct drainage studies to identify flood risk hotspots and develop specific control measures.	Technical services	0-5 years

Example - action for transition risk and opportunity

Priority asset class	Risk	Action	Responsibility	Timeframe for action
Global adoption of net-zero emissions policies and action plans	Risk to airport's reputation if the airport does not develop a practical plan towards reaching net-zero carbon emissions by 2050 and other peer airports do.	Investigate possible cost-effective emission reduction options	Technical services and Sustainability	0-5 years

5.2 Regular review

Following the development of a Climate Action Plan, the responsibility of implementation will likely fall on various relevant departments. Progress of specific actions is recommended to be reviewed regularly. It is also important to ensure that the plan reflects the most up-to-date condition of the airport, changes in internal and external policies, and updates in technology developments, all of which may affect action planning. Responsible departments are recommended to report to airport senior management periodically to keep them informed, and to raise awareness of progress against actions and any newly identified risks and opportunities. This facilitates management's assessment of the effectiveness of the plan, allowing it to make adjustments where necessary.

Other factors that may trigger a review of the actions include the release of new climate projections that materially influence the findings. Examples of climate projections that may trigger a review include the release of an Intergovernmental Panel on Climate Change Assessment Report (i.e. The Synthesis Report of the Sixth Assessment (AR6) is expected to be published in late 2022).

5.3 Recommended procurement clauses for the development of a Climate Action Plan

1. The Consultant shall develop a Climate Action Plan (CAP) which includes prioritised actions to key climate risks and opportunities to strengthen the resilience of the airport's infrastructure development, business continuity and operations. (Note: Airport Sustainability Managers may consider developing a CAP which also addresses any relevant or selected TCFD requirements.)
2. The Consultant shall thoroughly review any existing and planned resilience or adaptation measures implemented by the airport and its capacity to respond against the climate risks assessment outputs.
3. The CAP shall include thresholds or trigger points for responding to those risks (i.e. number of events per annum or value insurance claims per event).
4. The Consultant shall recommend a review process for the CAP to take into account these triggers as well as new climate science.
5. The CAP shall propose indicative resources and timescales required to implement adaptation responses to identified risks.
6. (Optional) The Consultant shall undertake consultation with the working level and senior management level to secure buy-in on the Climate Action Plan.

6. Alignment with Taskforce on Climate-Related Financial Disclosure (TCFD)

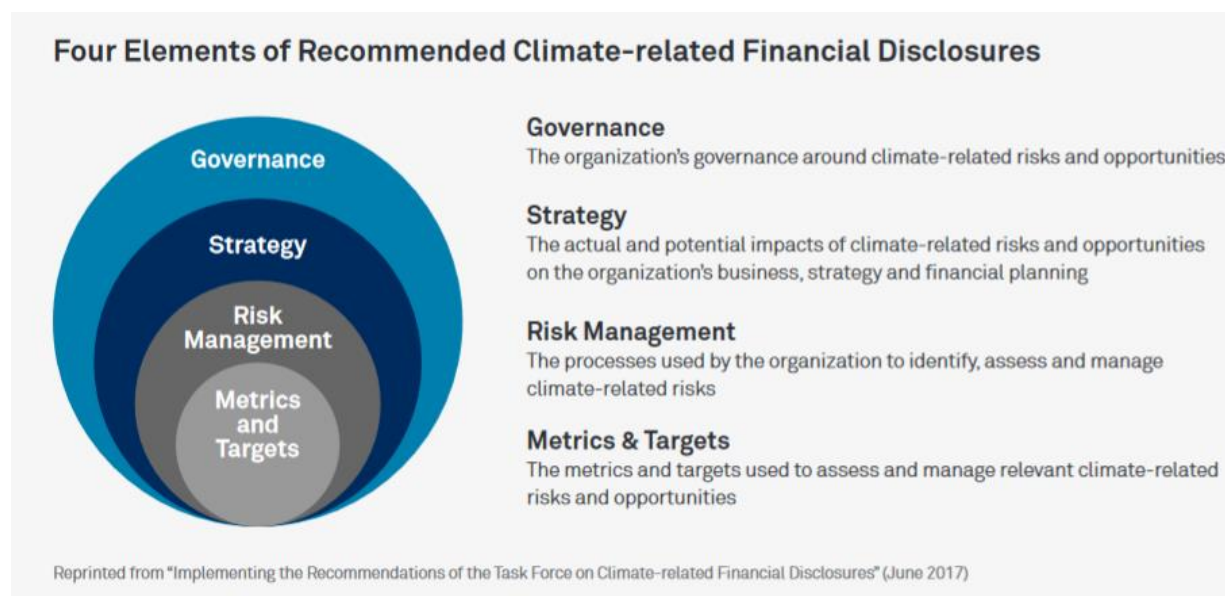
6.1 Growing demand for climate-related disclosure

Investors and shareholders are expecting more companies, especially those within vulnerable sectors, to report the impact of climate risks and opportunities systematically, and demonstrate their readiness to adapt to climate change impacts. To this end, disclosure of climate-related information and alignment with the Task Force for Climate-related Financial Disclosures (TCFD) recommendations is becoming increasingly common. TCFD has developed a guidance framework that helps companies disclose climate-related financial risks to investors, lenders, and insurers. It provides a systematic and transparent way to address climate change-related issues and increase reporting of climate-related financial information.

6.2 What is Taskforce on Climate-Related Financial Disclosure (TCFD)?

Established by the global Financial Stability Board in 2015 to support efforts to reach the Paris Agreement targets, the Taskforce on Climate-related Disclosures (TCFD) aims to “promote more informed investment, credit [or lending], and insurance underwriting decisions”. This enables stakeholders to better understand the concentrations of carbon-related assets in the financial sector and the financial system’s exposures to climate-related risks.

Published in 2017, the Recommendations provide a framework that guides the reporting and disclosure of material climate-related risks and opportunities (together referred to as climate-related issues) within organisations’ financial filings across all sectors, industries and geographies. The TCFD Recommendations are structured around four thematic areas that represent core elements of an organisation’s operation as follows:



By following these disclosure recommendations, businesses are able to identify, evaluate and address actual and potential climate change-related risks, leading to better investment decisions, protected assets, greater business continuity and improved reputation among stakeholders.

6.3 International developments

Global momentum behind the Task Force's work has grown significantly over the past years. Multiple jurisdictions have proposed or finalised laws and regulations to require disclosure aligned with TCFD recommendations – some coming into effect as early as 2022. The TCFD recommendations are also the basis upon which international accounting standard setters are building global standards for climate risk disclosure. In a rapidly evolving climate risk landscape, transparency on climate-related issues is increasingly critical for investors, lenders and insurance underwriters to make informed economic decisions.

As investor demands for climate-related disclosure continue to grow, TCFD-aligned reporting will give airports an edge to raise capital. Below are the advantages of reporting aligned with TCFD.

Advantages of TCFD-aligned reporting



Informed Investment

The TCFD encourages clear and consistent reporting leading to informed investment decisions and reduced capital loss.



Compliance readiness

TCFD is now/will be mandatory in some countries. For example, the UK requires mandatory climate-related financial disclosures by large UK registered companies and financial institutions from April 2022¹⁰; Singapore is also paving the way for mandatory climate disclosures to be introduced in 2023 for issuers in the financial industry; the agriculture, food and forest products industry and the energy sectors¹¹.



Mitigation of climate risk

Aligning to the recommendations will help organisations to understand and mitigate the climate risks posed to their business.



Preparedness for net zero

The steps for achieving net zero overlaps with the TCFD, and its recommendations will help to strengthen your understanding of the risks and opportunities for your business along the road to a zero-carbon economy.

¹⁰ News article: [UK to enshrine mandatory climate disclosures for largest companies in law - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/news/uk-to-enshrine-mandatory-climate-disclosures-for-largest-companies-in-law)

¹¹ News article: [Mandatory TCFD Reporting in Singapore from 2023](https://www.singaporeair.com/en_UK/press-releases/2023/03/mandatory-tcfid-reporting-in-singapore-from-2023)

6.4 Aligning with the TCFD

This Guideline facilitates Airport Sustainability Managers to address the “**Strategy**” and “**Risk Management**” aspects of the TCFD recommendations. The table below shows the TCFD aspects cover by this Guideline.

TCFD recommendations	Covered by this Guideline
<p>Governance Disclose the organisation’s governance around climate-related risks and opportunities.</p>	No
<p>Strategy Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation’s businesses, strategy, and financial planning where such information is material.</p>	Yes - partially but an organisation should consider a holistic climate change strategy in disclosures, which may include a financial assessment to quantify the climate-related risks and opportunities
<p>Risk Management Disclose how the organisation identifies, assesses, and manages climate-related risks.</p>	Yes – but an organisation should review carefully how risks are managed in their organisation in line with their enterprise risk management system
<p>Metrics and Targets Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.</p>	No

If an airport would like to report on the climate-related disclosures aligning with TCFD recommendations, there are publications available on the TCFD website to guide the process.

TCFD official website - <https://www.fsb-tcf.org/>

6.5 Recommended clauses for aligning with the TCFD requirements

(Note: if inputs from this consultancy are used to develop a TCFD Statement, the Airport Sustainability Manager should be aware that the consultant would only be able to support a basic TCFD disclosure, not necessarily fully compliant with all TCFD Recommendations – further contractual clauses would be required to enable a more comprehensive disclosure.)

1. The Consultant shall develop a plan for the airport to make TCFD disclosures according to its current and future readiness, which shall include a TCFD statement for the airport that aligns with TCFD Recommendations.
2. The Consultant shall undertake any tasks to enable disclosure against the TCFD Recommendations.

7. Suggestions on tender evaluation

For tender assessment, Airport Sustainability Managers can consider adopting a tender evaluation process using a system of weighing the selection criteria to compare tender submissions and identify the tenderer with the best performance record in terms of track record, specialists' skillsets, tools, programme, cost and value for money.

Selection criteria are intended to assess the competence of the tendering organisations to achieve the required project outcome and are used to rate each of the tenders. Examples of selection criteria include:

Criteria	Guidance information on the example criteria
<ul style="list-style-type: none"> ▪ Company background and relevant experience 	<ul style="list-style-type: none"> ▪ The Tenderer's and its proposed sub-consultants' history and business, including current operations and number of relevant experts. ▪ Previous experience of the tenderer in relation to the fields of expertise (i.e. conducting an airport climate risk assessment) required to achieve the intended outcomes of the project. ▪ The company's previous experience in technical areas comparable to the tendered project, the appropriate scale of past projects and the role undertaken within those projects should be considered.
<ul style="list-style-type: none"> ▪ Project team and technical skills 	<ul style="list-style-type: none"> ▪ Information required may include the following details of the proposed project team: <ul style="list-style-type: none"> - Names; - Roles; - Technical expertise (could specify at least 10 years of experience for the Project Manager in delivering airport projects with an emphasis on climate risk assessments, could specify years of experience for other team members as well); and - Resumes to be provided.
<ul style="list-style-type: none"> ▪ Methodology 	<ul style="list-style-type: none"> ▪ The tenderer should be able to demonstrate its capability to bring the contract to a satisfactory conclusion by describing the methodology of approach and tools to accomplish the project's required outcomes. The information required could include the following: <ul style="list-style-type: none"> - Programme of works - Methodology and tools for each task - Approach to working remotely, if required

If the organisation is pursuing TCFD disclosure, the tenderer could be asked to develop a list of tasks required to develop a basic / comprehensive (choose a level for the airport) disclosure. This will provide a good action list needed outside of the physical and transition risk assessment.

-
- Price
 - This should include all costs excluding travel and taxes over the duration of the contract.
-



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