



# Climate Scenario Analysis

## Session 1: Physical Risks and Opportunities

24 August 2021

Organised by:

CENTRE FOR  
**SUSTAINABLE**  
CORPORATIONS

Delivery Partner:



An Initiative By:



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*The business of sustainability*





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# Agenda

- 
- Introduction**
  - Climate Change and Emerging Market Drivers**
  - Task Force on Climate-related Financial Disclosures (TCFD) Recap**
  - Climate Physical Risks and Scenario Analysis**
  - ERM's Approach to Physical Risk**
  - Key Messages and Q&A**



# Today's Speakers



***Yulia Dobrolyubova***  
Partner, ERM

Climate Change & Sustainability



***Aniket Jalgaonkar***  
Principal Consultant, ERM

Climate Change & Sustainability

# About ERM



## **ERM - A Global Leader in Sustainability**

ERM is the leading pure play sustainability and climate change consulting company globally, bringing 50 years of deep subject matter expertise.



## **Support sustainability movement with The SustainAbility Institute by ERM**

Global think tank & advisory who inspire and enable business to lead the way to a sustainable economy.



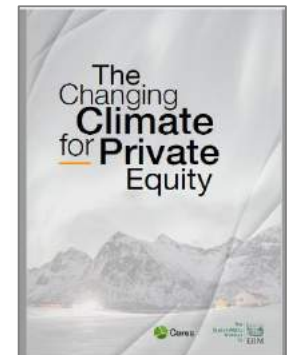
## **Preparing TCFD Scenario Analysis Supplement**

ERM was the sole consultant engaged by TCFD to prepare a technical supplement on the use of scenario analysis in relation to climate-related financial risks and opportunities.

### **ERM sets ambitious Net Zero target for 2025**

22 April 2021

To mark this Earth Day, ERM is announcing its commitment to achieving Net Zero carbon emissions across its operations by 2025



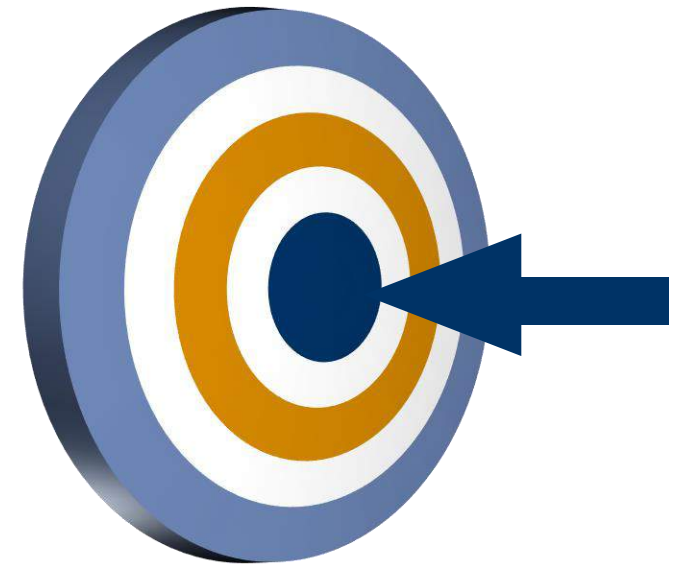
# Outcomes and Objectives

## Learning objectives:

1. Understand the range of **relevant climate-related drivers**.
2. Comprehend the **different climate scenarios** and integrate them into risk management process
3. Apprehend what a physical risk assessment looks like and **how it can help structure and prioritize approach and resources**.

## Expected outcomes:

- Develop an understanding of climate change and mechanisms associated with natural hazards.
- Have a better understanding of **physical risks** and **climate scenarios**.
- Prioritize the risks for the business.
- Know how to **address these risks**.



# Zoom Poll

1. Which of the following is an example of a climate characteristic of a location?

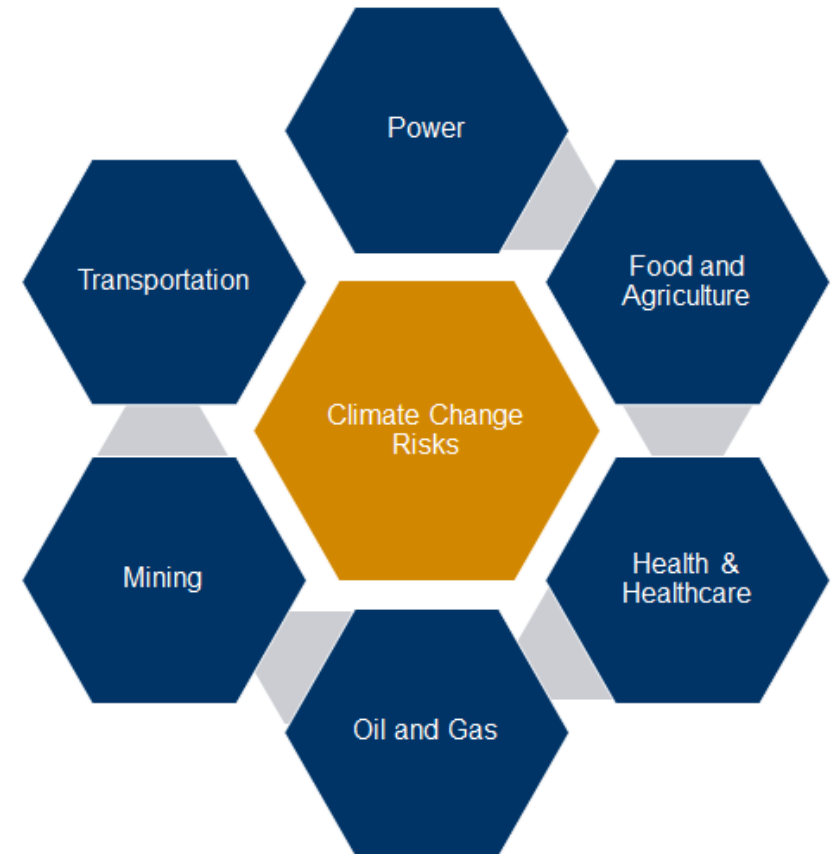
- An intense thunderstorm in Langkawi
- A hot day in Penang during winter
- A foggy season in Kota Kinabalu
- An average summer temperature in Kuala Lumpur over the last 50 years

2. Which of the following sectors do you feel **is the most exposed** to climate change impacts?

3. Which of the following sectors do you feel **can benefit the most** from climate change impacts?

4. In your opinion, how do you think climate change will influence investment trends?

- It will not influence investment trends.
- It may impact investment trends in the future.
- It has already impacted trends and will continue to do so in the future.
- I do not have an answer at the moment.







## 1.1 Climate Change



# What is Climate?

- Climate is the average weather in a given area over a longer period of time.
- The classical period is 30 years, as defined by the World Meteorological Organization (WMO).

- With climate change projections, **we cannot predict any singular extreme event**
- But we can predict a **general trend in long term climatic conditions** (e.g. whether the climate in the particular location will get warmer or cooler, wetter or drier).

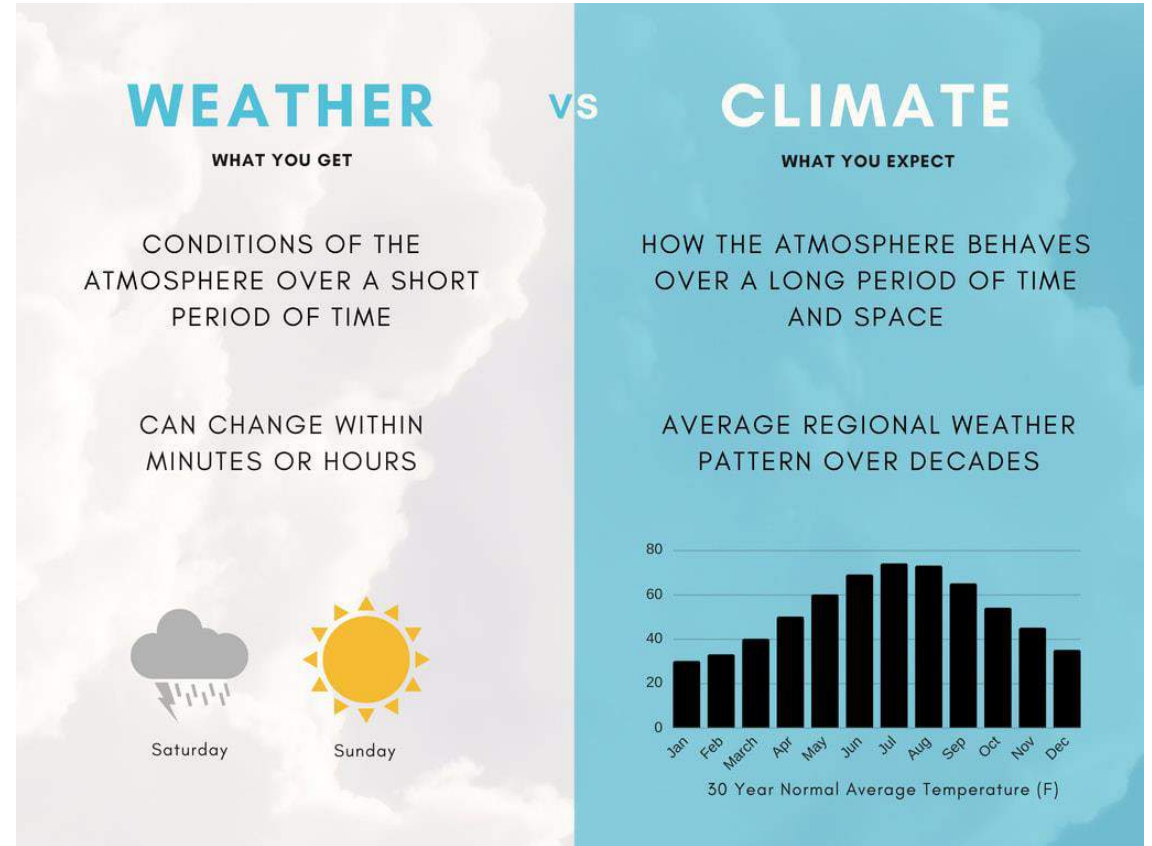
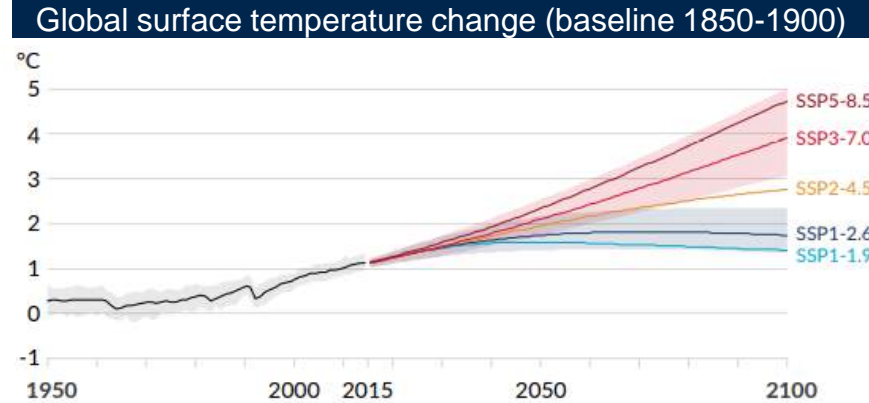


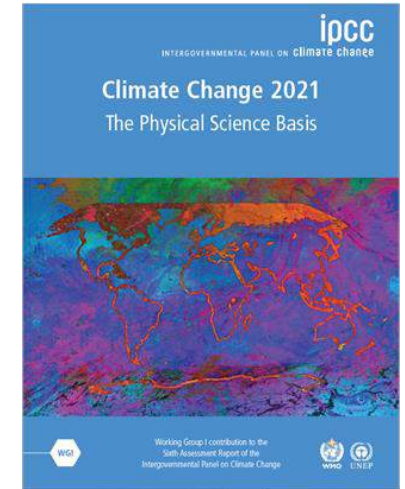
Image Source: <https://www.globalweatherclimatecenter.com/weather-education/weather-and-climate-whats-the-big-difference>

# IPCC – AR6 Introduction and Key Outcomes for Southeast Asia

Global surface temperature projected to reach 1.5°C under all 5 scenarios by 2040



Increases in the intensity/frequency of hot extremes, heavy precipitation & regional droughts per 0.5°C of warming.

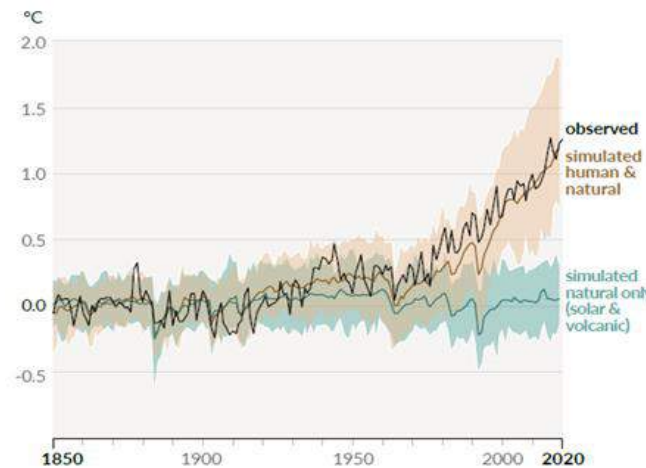


Link to report [here](#).

Data indicates that **human influence** is the main driver of many elements of climate change, including extremes.

**Sea level rise faster in 20<sup>th</sup> century** than any other century in the last three millennia

**Global mean sea level** continue to rise through **2100**



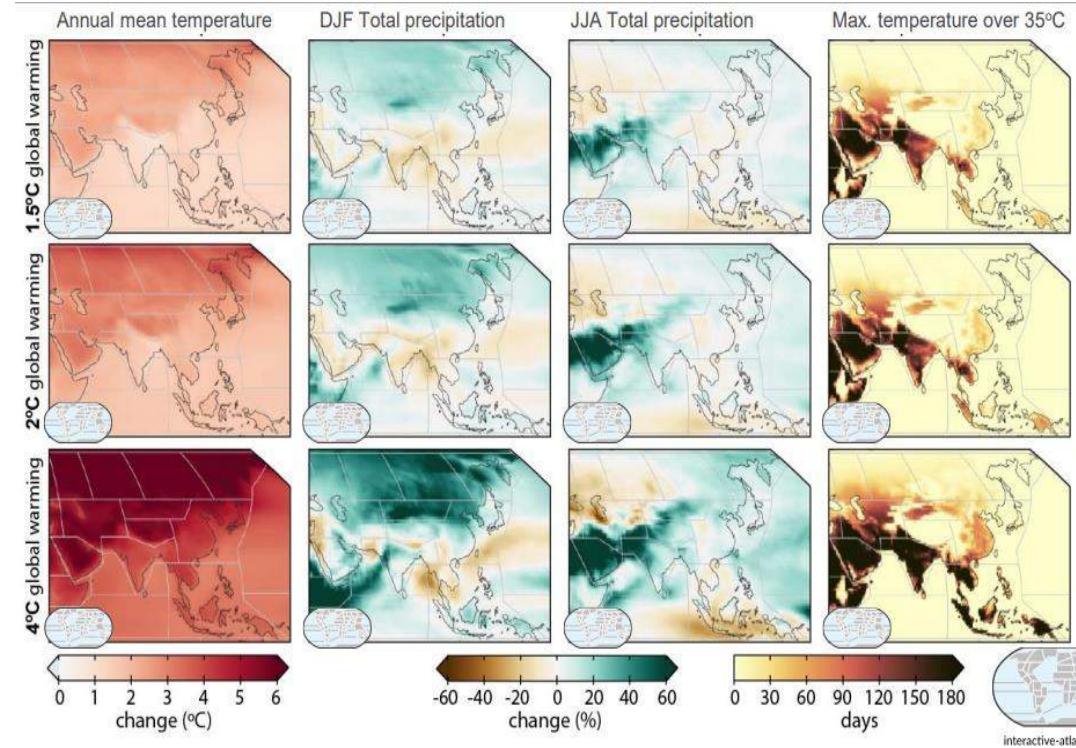
**Surface temperature** has risen faster since 1970 than in any other 50-year period over at least the past 2,000 years

# IPCC AR6: South-East Asia

## South-East Asia

- Future **warming will be slightly less** than global average.
- Rainfall will increase in northern parts and decrease in the western Pacific areas.
- Compound impacts of climate change, land subsidence, and local human activities will lead to **higher flood levels** and prolonged **inundation in the Mekong Delta**.
- **Fewer but more extreme tropical cyclones** have affected the region.
- South and Southeast Asian monsoon and East Asian summer **monsoon precipitation will increase**.
- **Heavy rainfall events will increase** in the western tropical Pacific with a 2°C scenario.

## Projections at 1.5°C, 2°C, and 4°C of Global Warming

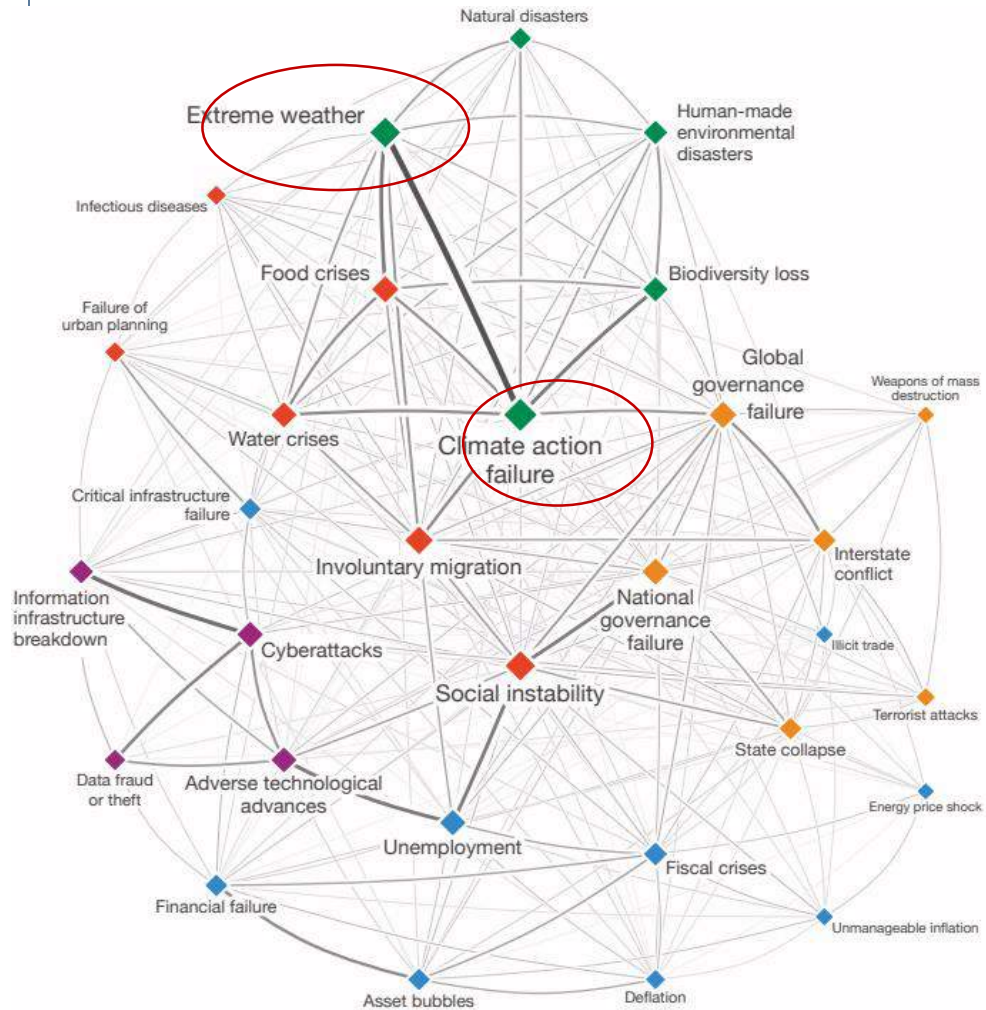


Source: [IPCC \(2021\)](#)



# WEF Global Risk Report 2020:

Climate Change Risks are Highly Ranked and Have Impacts to Many Other Risks

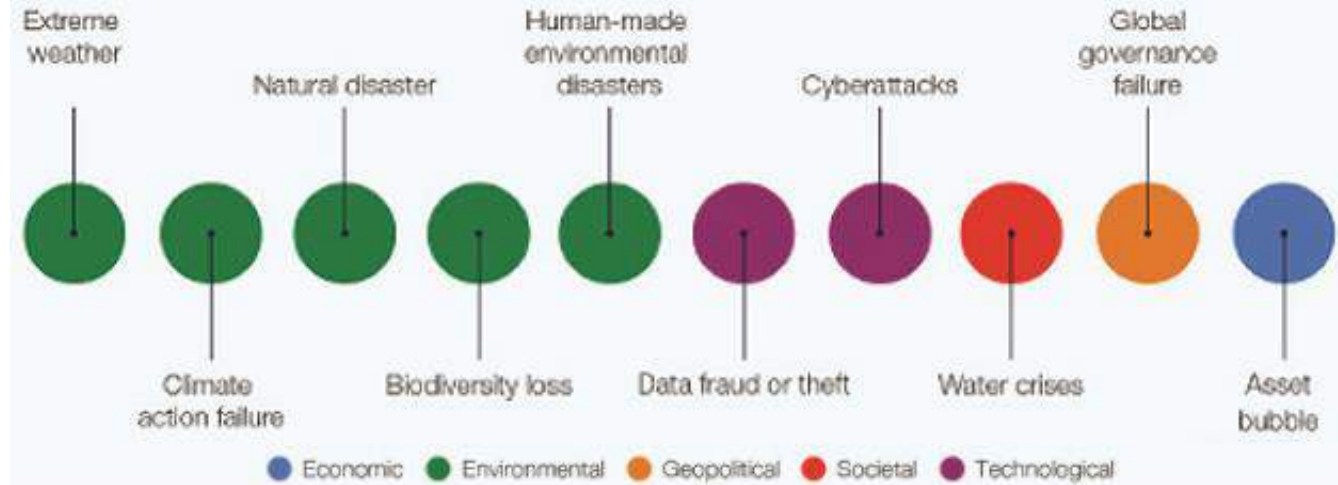


TOP 10 RISKS OVER THE NEXT 10 YEARS

## Long-Term Risk Outlook: Likelihood



### Multistakeholders



Global Risks Report 2020

Reference: World Economic Forum, The Global Risks Report (2020)





## 1.2. Emerging Market Drivers

# Global Agreement, Paris, France (Dec 2015)

**191**  
countries

unanimously adopted the 'Paris Agreement', with a goal to limit warming to <math><2^{\circ}\text{C}</math>

**192\***  
countries

(98% of global GDP) will have national plans to reduce GHG emissions to 2025 or 2030, including Malaysia

**858**  
companies

with Science Based Targets, and more are about to set these

**COP26 in November 2021** aims to define further Paris Agreement application, especially in relation to market- and non-market based instruments (Article 6)

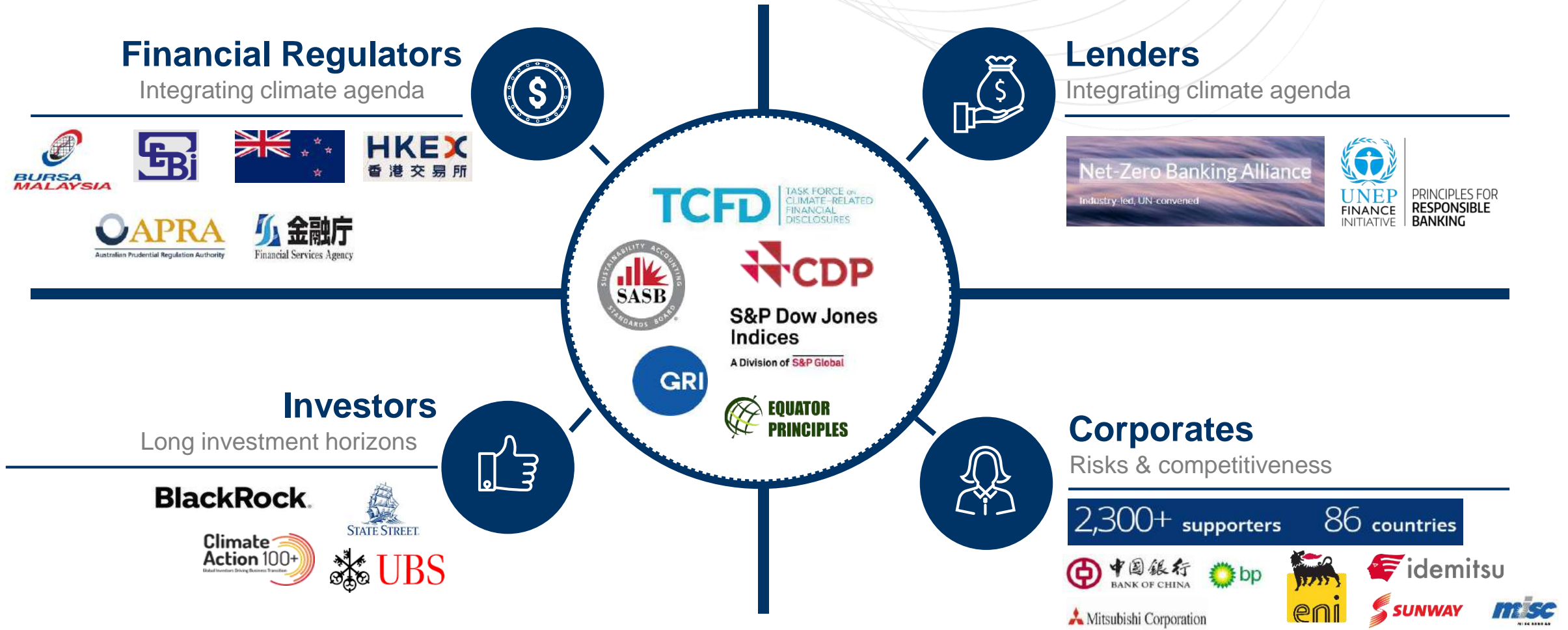


\*Eritrea has submitted its first NDC, but has not yet become a Party to the Paris Agreement.



# Pivotal role for climate disclosure in the climate agenda

*“Demand for climate-related financial disclosures has skyrocketed and the supply is responding.”*  
 Mark Carney



# Emerging market drivers



## Investor Expectations

*Meeting investor expectations for greater transparency on how climate and the transition will impact their future financial performance*



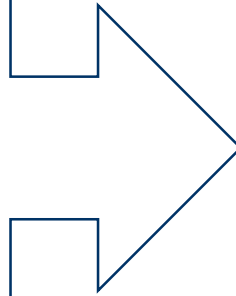
## Evolving Policy Landscape

*Shaping and satisfying legal obligations, as policy instruments are implemented to drive decarbonization*



## Market & Technology Changes

*Changing stakeholders' preferences for low carbon and climate-resilient products and services, decreasing costs of decarbonisation technologies*



**Increasing global expectations around management and disclosure of climate-related risks e.g. TCFD**



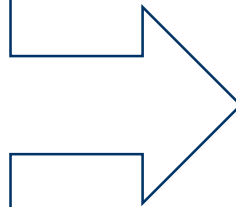
## Physical Climate Risks

*Adapting assets to physical climate change*



## Supply Chain Resilience

*Securing supply chain resilience in the context of physical climate risks*



**Actual business interruptions and effects due to changing climate patterns and intensity**







## 3. TCFD

# Zoom Poll

## 1. What is the main focus of TCFD disclosures?

- Companies' GHG emissions
- Companies' climate commitments
- Companies' sustainability performance
- Companies' resilience to climate-related financial impacts

## 2. Physical or Low Carbon Transition Risk/Opportunity?

2a. Traditional markets & asset values facing disruption from new technologies such as electric vehicles?

2b. Increased incidence and severity of extreme weather events such as floods or cyclones?

- Physical
- Transition
- Both
- None



# TCFD - quick recap

A consistent framework for disclosing a new set of **financial** risks and opportunities



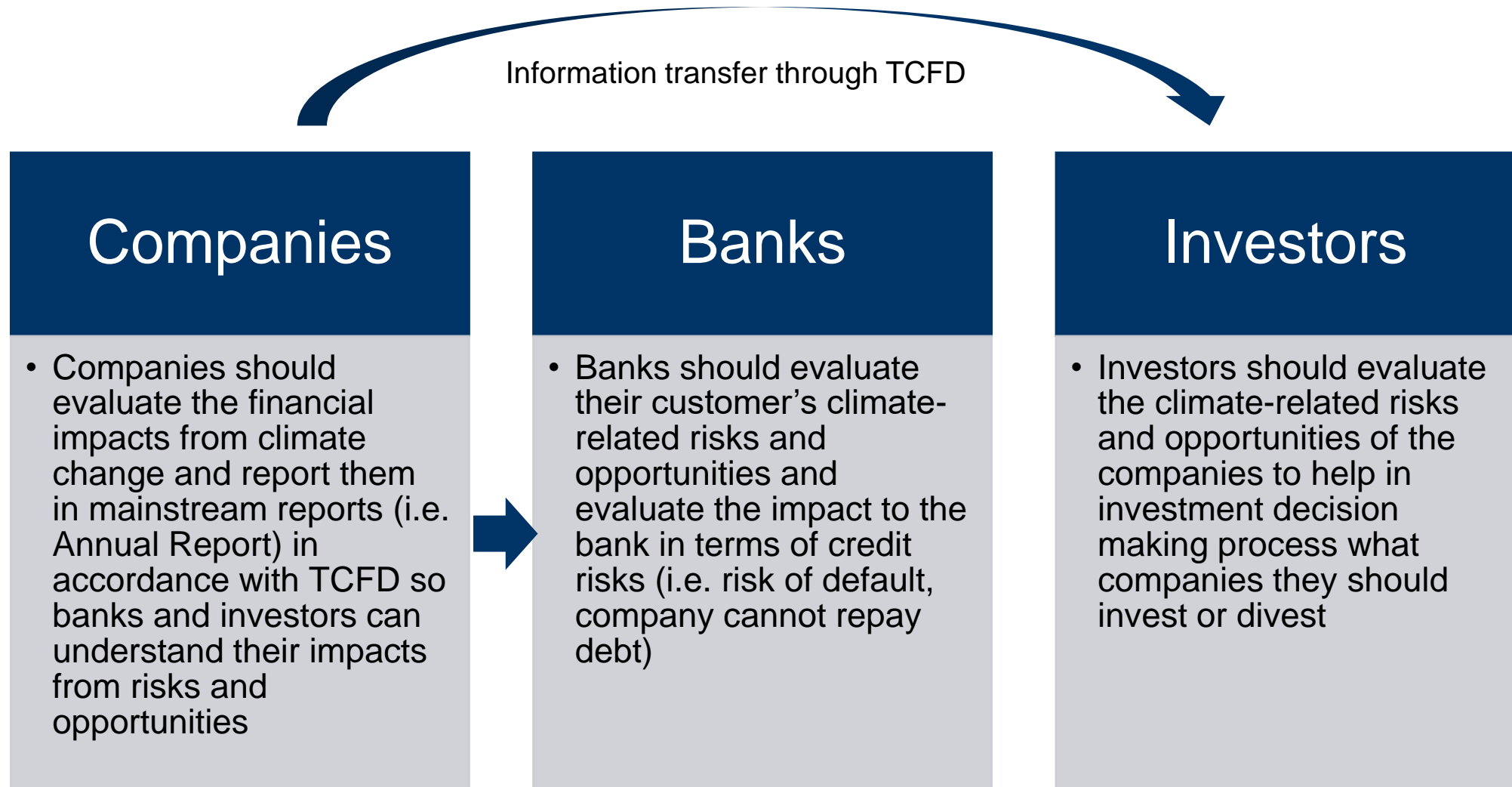
“The TCFD will develop voluntary, consistent climate-related financial risk disclosures **for use by companies in providing information to investors, lenders, insurers, and other stakeholders**”.



ERM wrote the technical supplement on the use of scenario analysis in relation to climate-related financial risks and opportunities to determine strategic response options

- TCFD **not** a tool to become ‘Paris-compliant’
- TCFD is a framework to uncover & understand climate-related risk & opportunity
- **Considers different scenarios: base case AND low CO<sub>2</sub>**
- Develop strategy to manage climate-related risk
- Communicate risks, opportunities, strategies to stakeholders

# Expectations for Companies, Banks and Investors

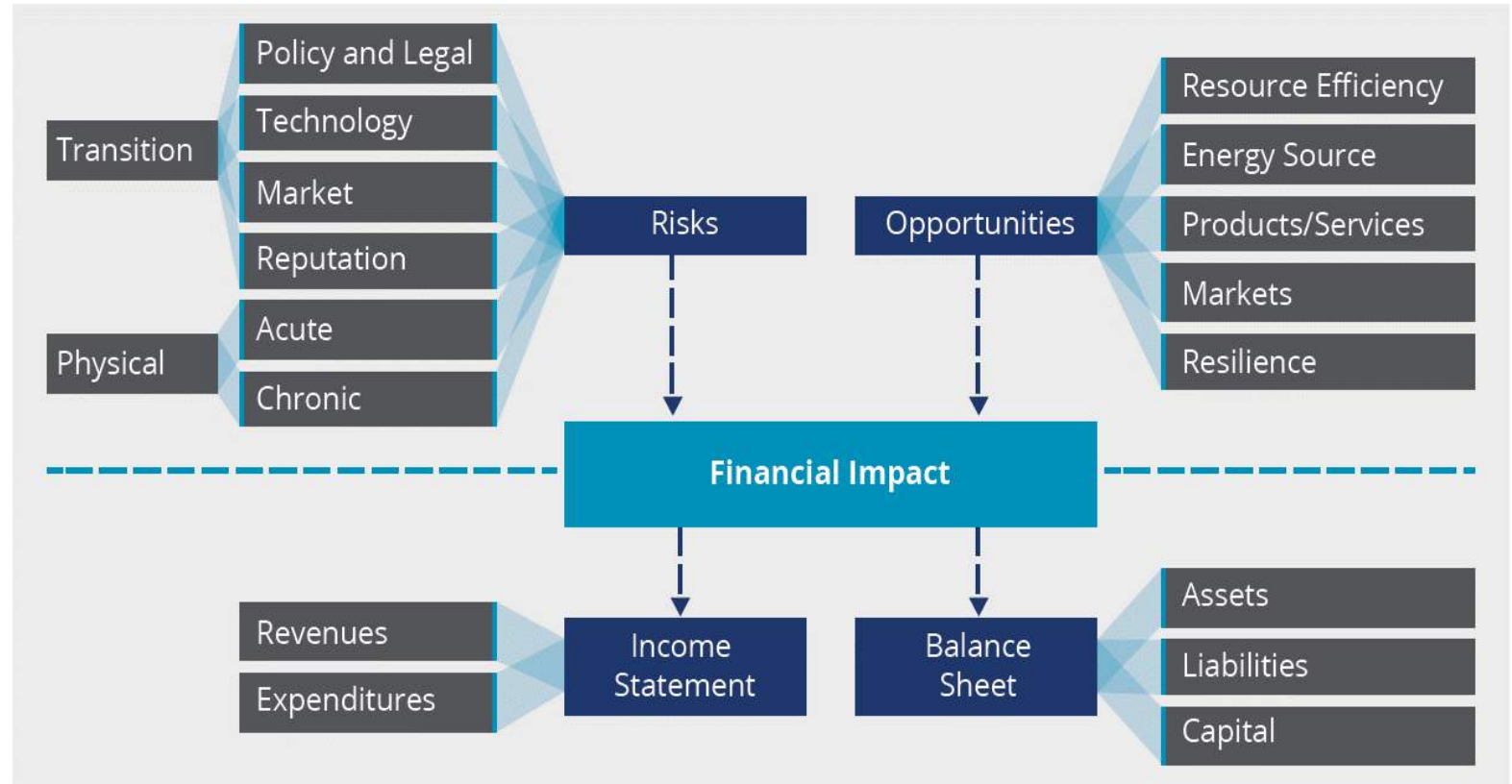




# Risks, Opportunities and Financial Impacts

TCFD encourages companies to:

- i. Evaluate and **quantify** climate-related risks and opportunities
- ii. Over **multiple** time-periods
- iii. Considering **various scenarios**.



**ERM assesses physical risks to companies in alignment with the TCFD requirements. Although some opportunities may be present to companies, particular in the value chain, these are not typically the core focus of project work.**

# The TCFD's recommendations on scenario analysis



Organisations should describe how resilient their strategies are to climate-related risks and opportunities, taking into consideration a transition to a lower-carbon economy consistent with a 2°C or lower scenario and, where relevant to the organisation, scenarios consistent with increased physical climate-related risks.



Publications | Task Force on Climate-Related Financial Disclosures

The specific guidance is relatively light, but:



The IPCC is namechecked as a source that can provide “context and a basis for company, industry or sector scenarios”



Guidance in general indicates that companies could use assessment to look out to “2030, 2050 and beyond”



“What is likely to be most helpful for physical risks assessment is to consider scenarios consistent with RCP8.5 (which most closely reflects a business-as-usual pathway consistent with failure to properly implement NDCs).” RCP 4.5 is also discussed but no specific guidance is given.

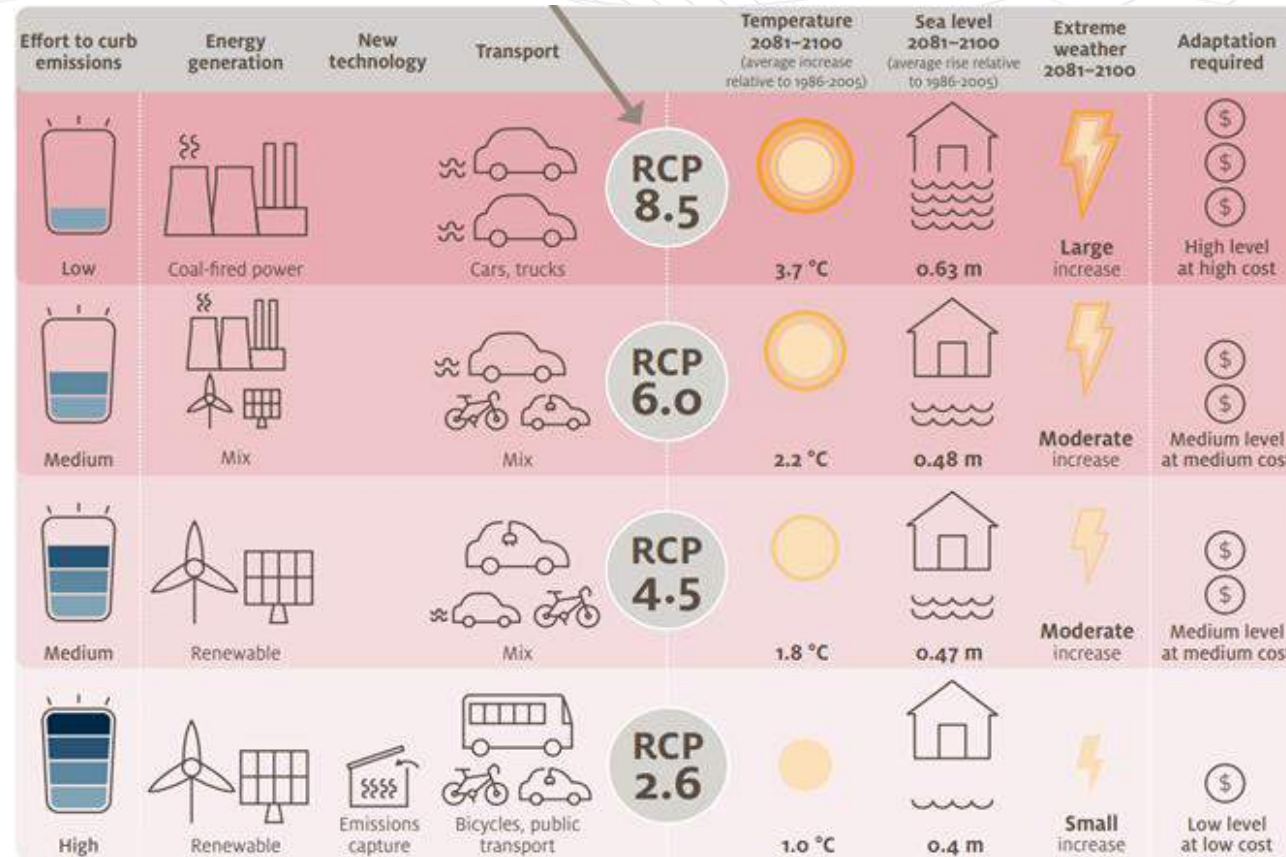


“Can” include assessment of hazards related to “temperature, wildfires, water supply and demand, precipitation, hurricanes/ cyclones, sea level rise, drought, typhoons’ landslides, storm surges, floods”

# How to assess climate-related risks?

Difference between physical and transition risks scenario selection

**Business as usual (BAU) scenario** – greenhouse gas (GHG) emissions increase, temperatures increase. How will increasing physical climate risks impact my portfolio? Will there be any new opportunities to capture?



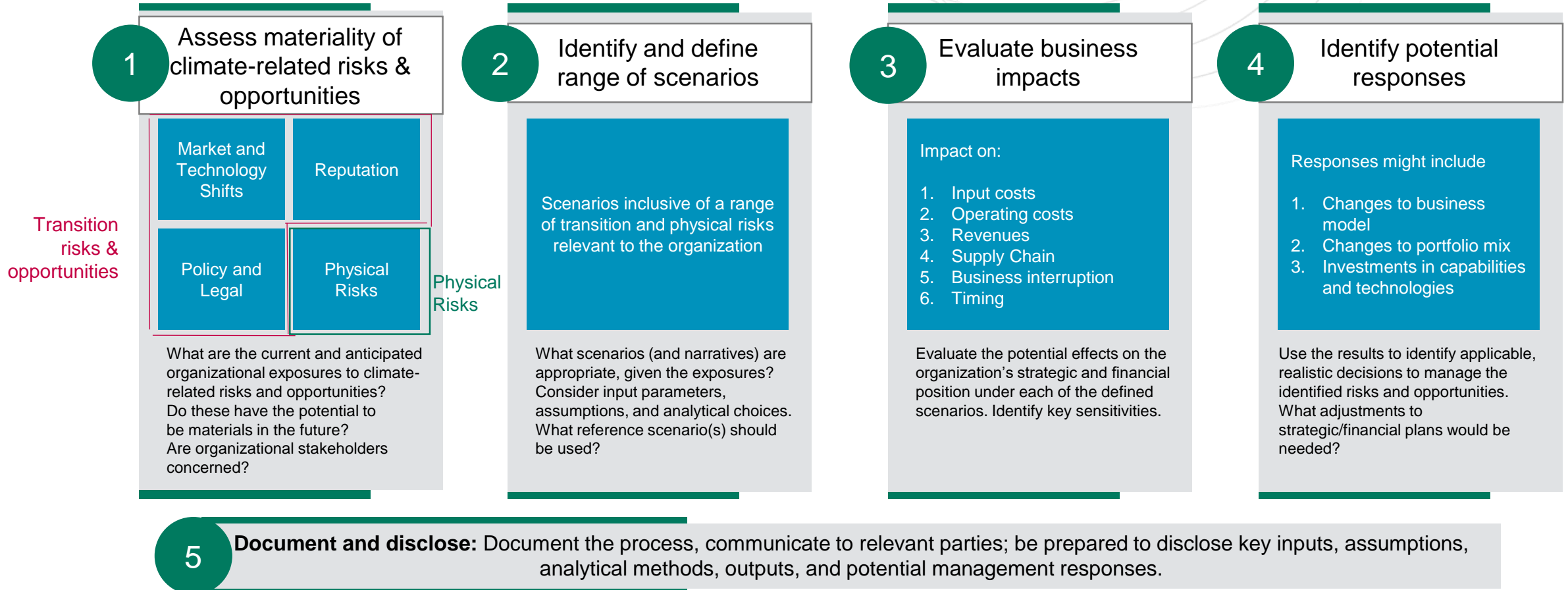
**Low carbon economy scenario (<2 °C)**: accelerated shift towards clean energy and low carbon technologies. How will this impact my current assets / products and future investment decisions?

Different sectors will likely be impacted more from transitional risks (high energy users), while others will have more impacts from physical risks.

# How to assess and manage climate-related risks?

## Recommended approach and steps

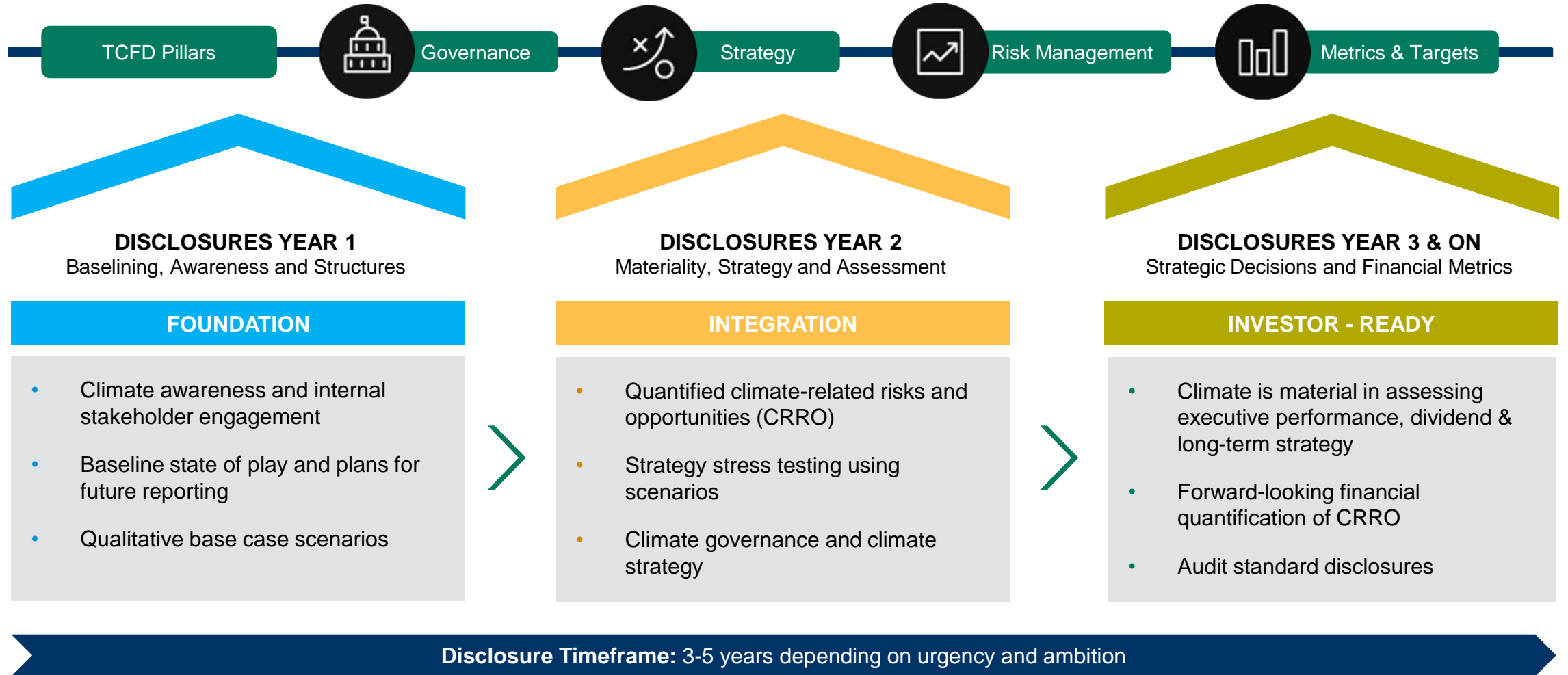
Stakeholder engagement & governance: Identify which internal (and external) stakeholders to involve and how. Integrate scenario analysis into strategic planning and/or enterprise risk management processes. Assign oversight to relevant board committees.





# Decoding TCFD disclosure

*ERMs three phase approach*

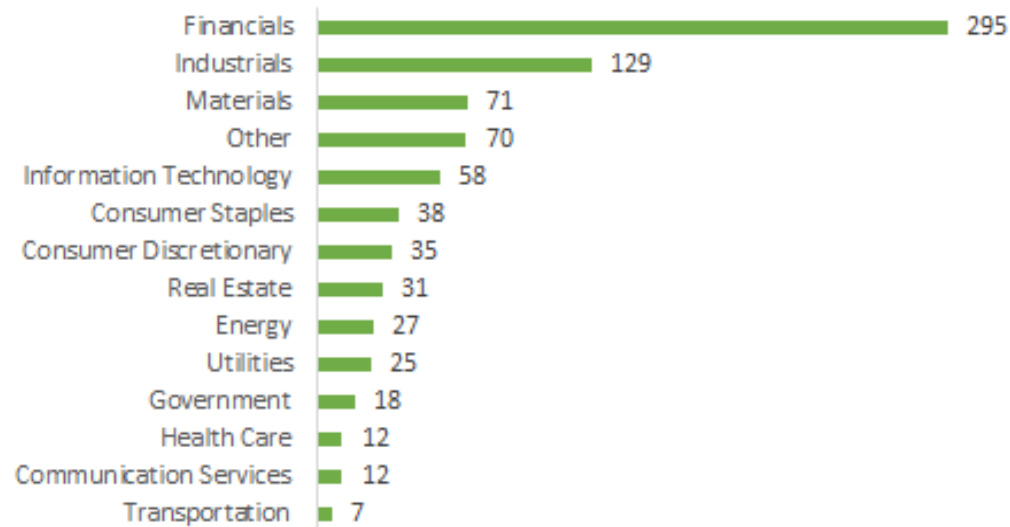


# TCFD status updates

**Current TCFD APAC  
Supporters\*: 828**

**Japan** leads the supporter count in APAC with a whopping **423 supporters** followed by Australia with 108 and South Korea with 60 supporters.

Supporters by Sector



Pacific  
15%

South-east Asia  
9%

South Asia  
6%

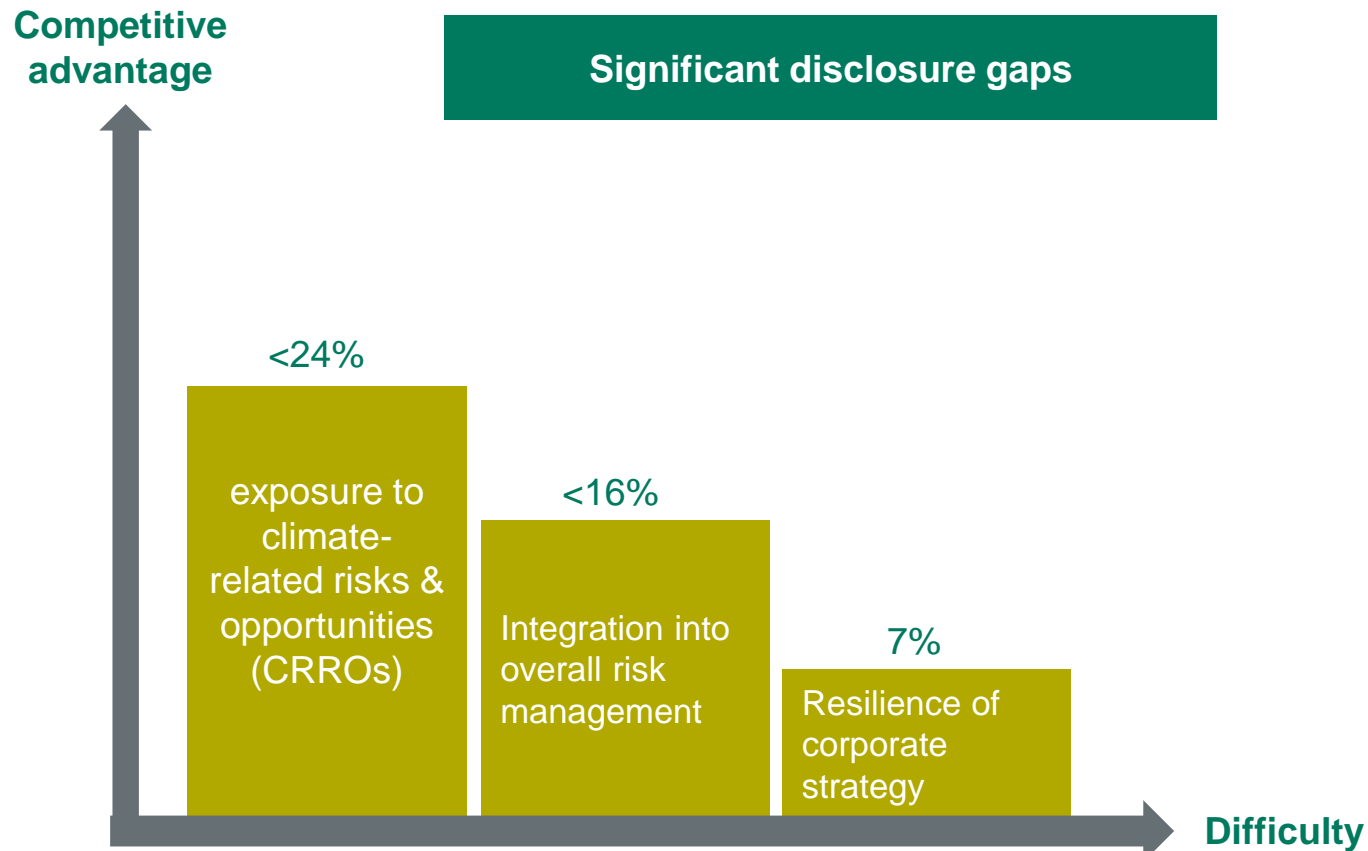
East Asia  
70%

Supporters by sub-region

\*As on 6th July 2021

# The corporate response in APAC

*Despite the strong business rationale disclosures are incomplete and there are obstacles to TCFD uptake*



Source: [2020 Status Report, TCFD](#)

## Reasons for non-disclosure to TCFD

**49%** Stated climate is integrated into corporate processes & there no need for **separate disclosure.**

**46%** Stated the **confidential nature of scenario analysis** of business impact.

**42%** Stated the lack of recognized **standardized, industry metrics.**

Source: [2020 Status Report, TCFD](#)

# Key takeaways

- ✓ **Regulators, Investors, Lenders and Corporates are all demanding better climate disclosures**  
.....
- ✓ **Mandatory disclosure of climate-related financial risk is accelerating in APAC and globally**  
.....
- ✓ **TCFD is the most widely used framework to understand and disclose climate-related financial risks**  
.....
- ✓ **Businesses who start to decode TCFD now are realizing competitive advantage**  
.....
- ✓ **The need for climate-related financial disclosures will increase**  
.....
- ✓ **Start your TCFD gap analysis, benchmark and planning now to build foundations**





## **4. Climate Related Physical Risks**

Hazards

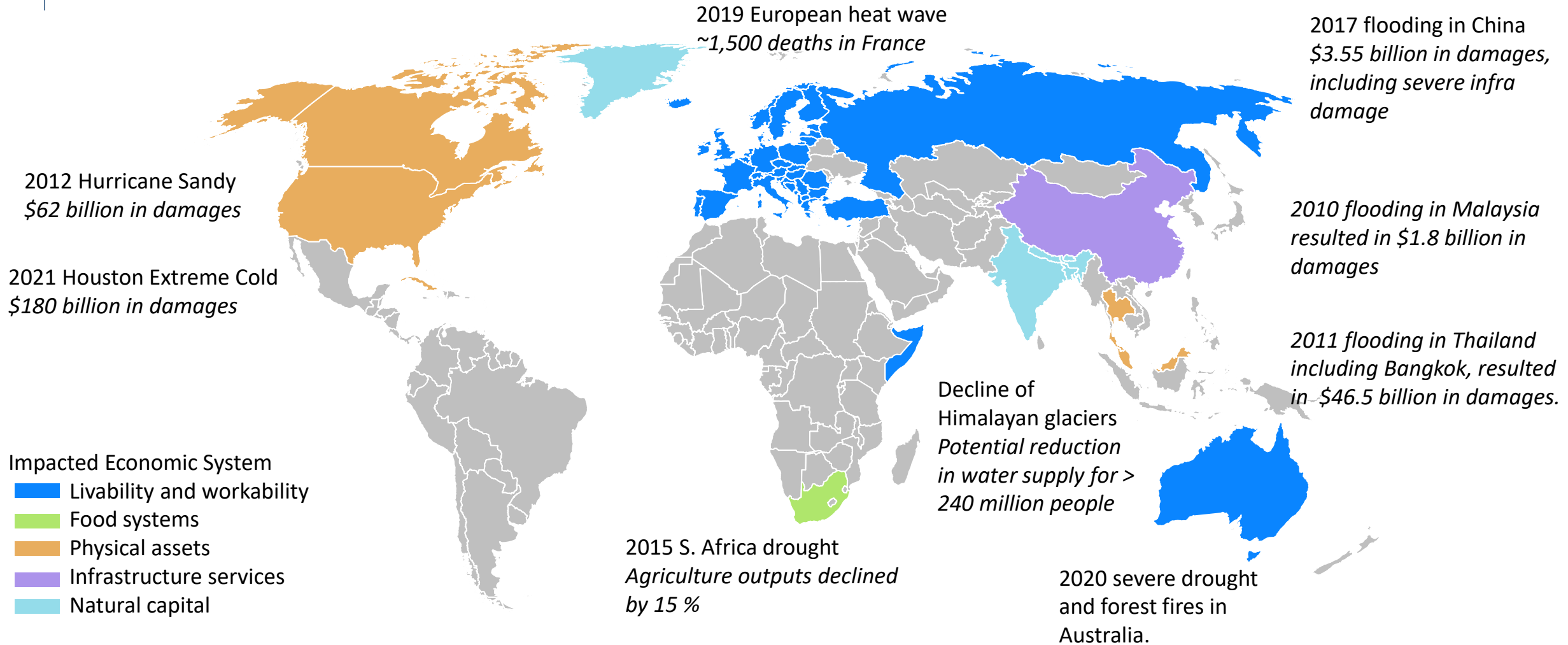
Risks

Scenarios

# Typical physical climate hazards



# Physical climate risks are happening today!



Data source: MGI (2020), WRI (2018)



# Introduction to Physical Risk

## Physical Risk Assessment

- Assess the **location, severity (magnitude), frequency of occurrence** and the likely effects of a given **magnitude** of a hazard
- Risk combines the probability of a hazardous event and its negative consequences through interaction between hazards, exposure and vulnerability components
- Vulnerability are the characteristics and circumstances that make an asset susceptible to damaging effects of a hazard



## Considering onset timings

- **Acute Physical Risks** refer to those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.
- **Chronic Physical Risks** refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves.

## Financial Overlay

- **TCFD and associated frameworks** are more focused on financial risks rather than ESG risks.
- Physical risk assessment needs to be linked back to **financial impacts** such as:
  - Value at Risk
  - CAPEX
  - OPEX
  - Down time
  - Loss of revenue etc.



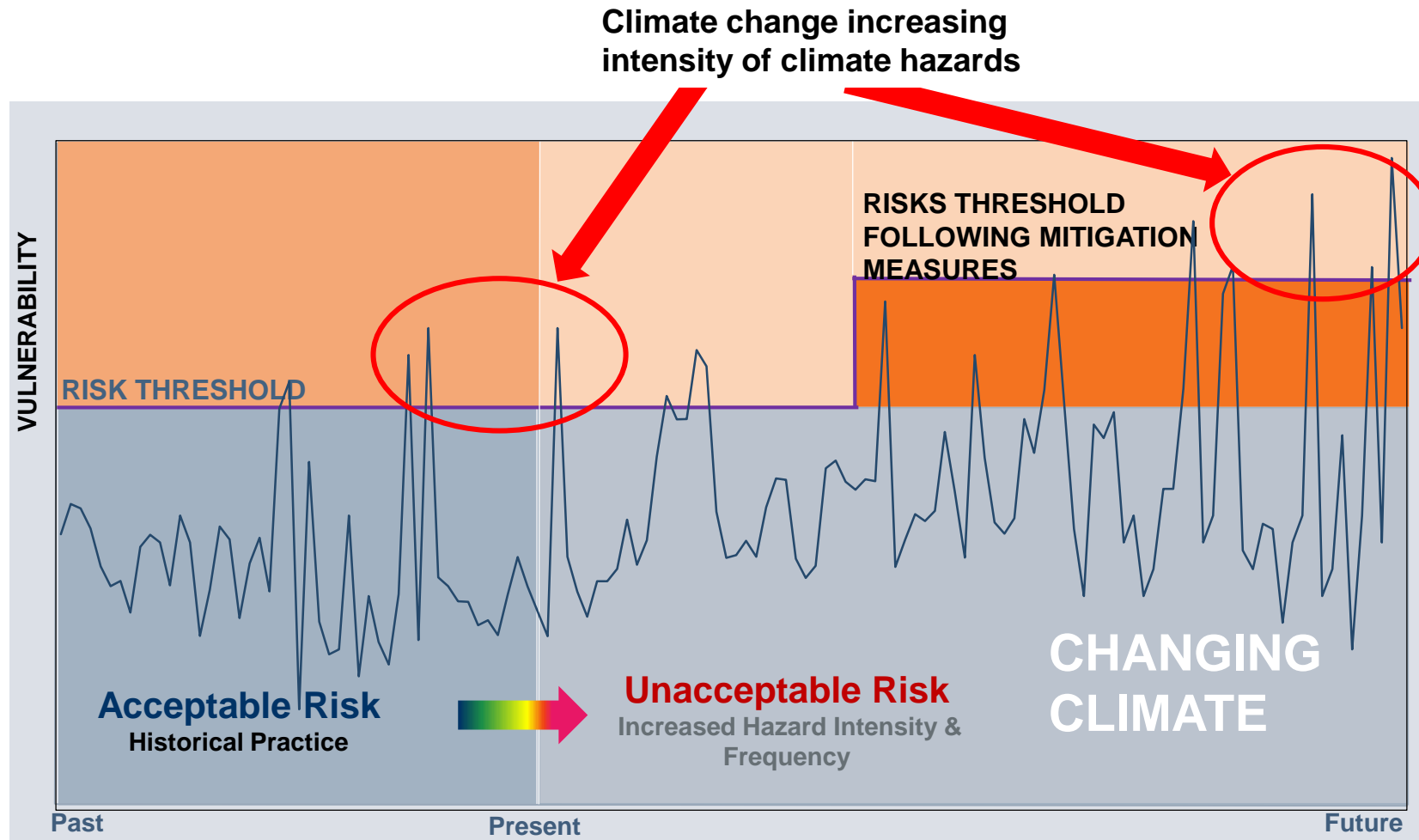
# Climate hazards

Climate Hazard Group	Hazards within the group	
Temperature Averages and Extremes	<ul style="list-style-type: none"> <li>Heatwaves</li> <li>Cold spell</li> <li>Frost</li> <li>Ice</li> </ul>	<ul style="list-style-type: none"> <li>Average Surface Temperatures</li> <li>Thawing Permafrost</li> <li>Melting Sea/Fresh Ice</li> <li>Wind Chill</li> </ul>
Flooding	<ul style="list-style-type: none"> <li>River (<i>Fluvial</i>) Flood</li> <li>Flash (<i>Pluvial</i>) Flood</li> <li>Groundwater Flood</li> <li>Sedimentation</li> </ul>	<ul style="list-style-type: none"> <li>Ice &amp; Debris-Jam Flood</li> <li>Snowmelt Flood</li> <li>Glacial Lake Outburst</li> <li>Monsoons (<i>Flood Related</i>)</li> </ul>
Coastal & Offshore	<ul style="list-style-type: none"> <li>Storm Surge</li> <li>Storm Tide</li> <li>High Tides (<i>King Tides</i>)</li> <li>Estuarine Flood</li> </ul>	<ul style="list-style-type: none"> <li>Coastal Erosion</li> <li>Wave Height</li> <li>Sea-Surface Temperatures</li> <li>SLR Associated Coastal Zone Inundation.</li> </ul>

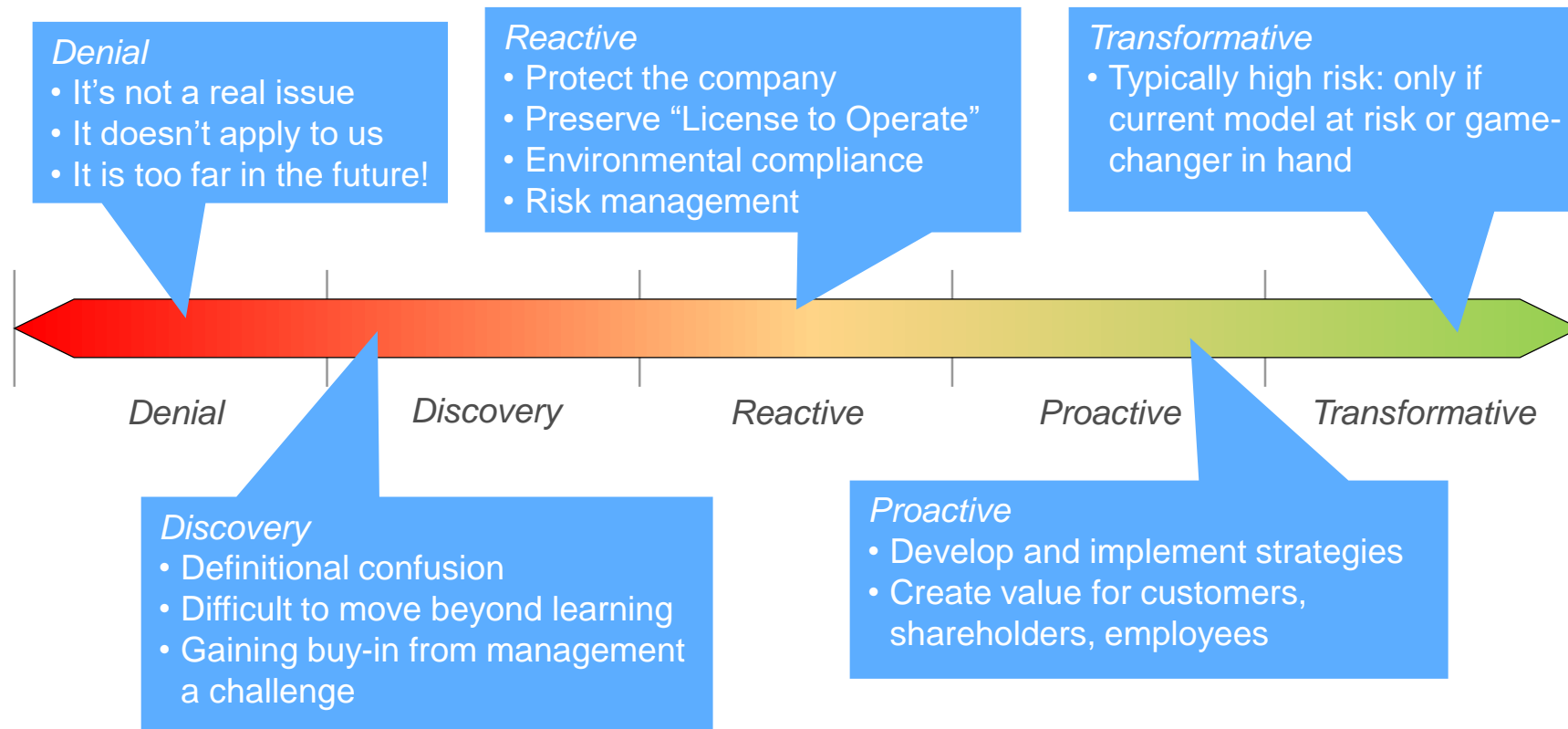
Climate Hazard Group	Hazards within the group	
Storms & Wind	<ul style="list-style-type: none"> <li>Tropical Cyclones &amp; Storms (<i>incl. Typhoons/Hurricanes</i>)</li> <li>Tornado (<i>incl. Waterspouts</i>)</li> <li>Severe Winds</li> <li>Wind Availability</li> <li>Extra-Tropical Cyclone</li> </ul>	<ul style="list-style-type: none"> <li>Thunderstorm</li> <li>Dust/Sand Storm</li> <li>Electrical Storm</li> <li>Hailstorm</li> <li>Snow Storm/Blizzard</li> </ul>
Wildfires	<ul style="list-style-type: none"> <li>Forest Fire</li> <li>Bush Fire</li> <li>Grass Fire</li> <li>Pasture Fire</li> </ul>	<ul style="list-style-type: none"> <li>Scrub Fire</li> <li>Smoke &amp; Reduced Air Quality</li> </ul>
Landslides	<ul style="list-style-type: none"> <li>Debris flow</li> <li>Mudslide</li> </ul>	<ul style="list-style-type: none"> <li>Debris Avalanche</li> <li>Mud flow</li> </ul>
Water Stress & Drought	<ul style="list-style-type: none"> <li>Dry Spell (<i>Meteorological Drought</i>)</li> <li>Water Scarcity (<i>Socio-Economic Drought</i>)</li> <li>Low River Flow (<i>Hydrological Drought</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Desertification (<i>Agricultural Drought</i>)</li> <li>Groundwater depletion</li> <li>Monsoons (<i>Water Availability</i>)</li> </ul>

Consider not just the direct potential impact of the hazard e.g. flooding, heat damage; but also indirect effects e.g. ground stability, dust from fires etc.

# Increasing intensity (and frequency) of climate hazards are significant for company and asset risk thresholds

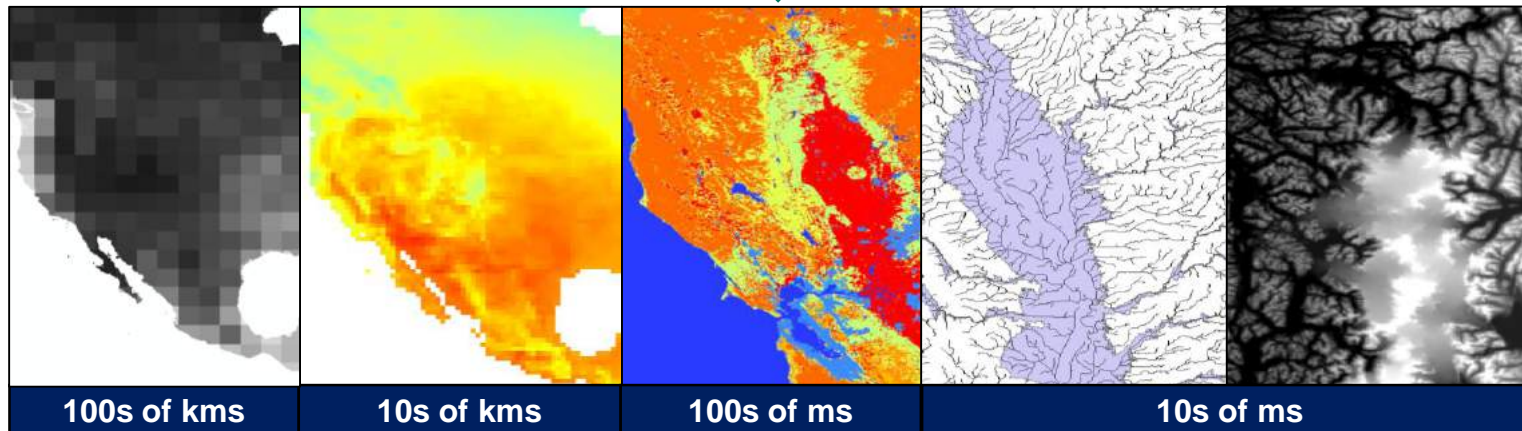


# Opportunities



# Using the latest, open source, reputable climate science

The resolution of the climate data we use varies to reflect the different spatial and temporal resolutions of natural hazard events assessed.





# Zoom Poll



## How do you think physical climate risks can impact a project/ business? (Choose more than one)

- increased operating costs
- capital upgrade requirements
- inefficient/ stranded assets
- impacts on staff safety



## **5. Climate Change Risk Assessment**

Tiered approach

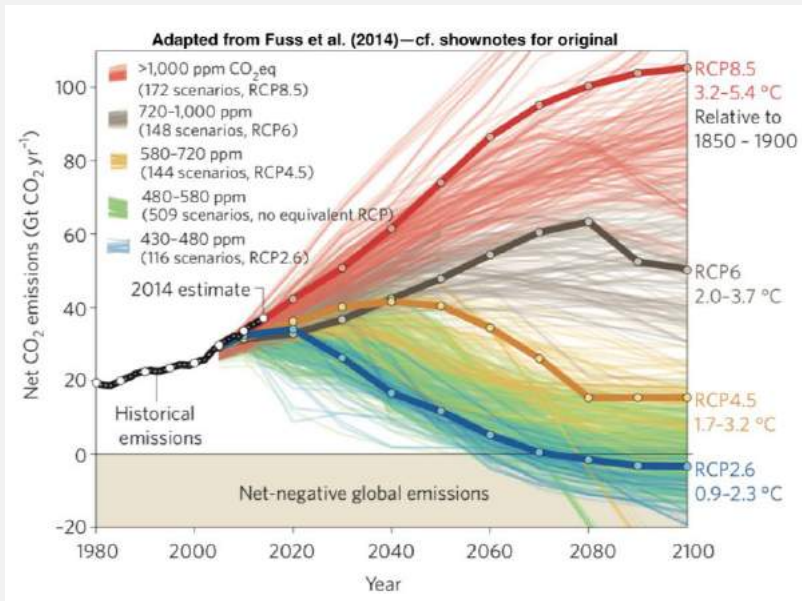
Adaptation and Resilience

# Physical scenarios provide possible future climate pathways

Scenarios model likely **impacts of GHG concentrations** on basic climate parameters, such as **temperature** and **precipitation**.

They are plausible descriptions of how the future may develop **based on a coherent and internally consistent set of assumptions** about driving forces, e.g. rate and extent of GHG emissions. They are not predictions nor forecasts.

## Different Emissions Pathways



## Different Assumptions

Radiative forcing

Greenhouse gases

Short-lived gases and aerosols

Land cover and use

Near-term and longer-term climate

## Different Outcomes for Physical Climate

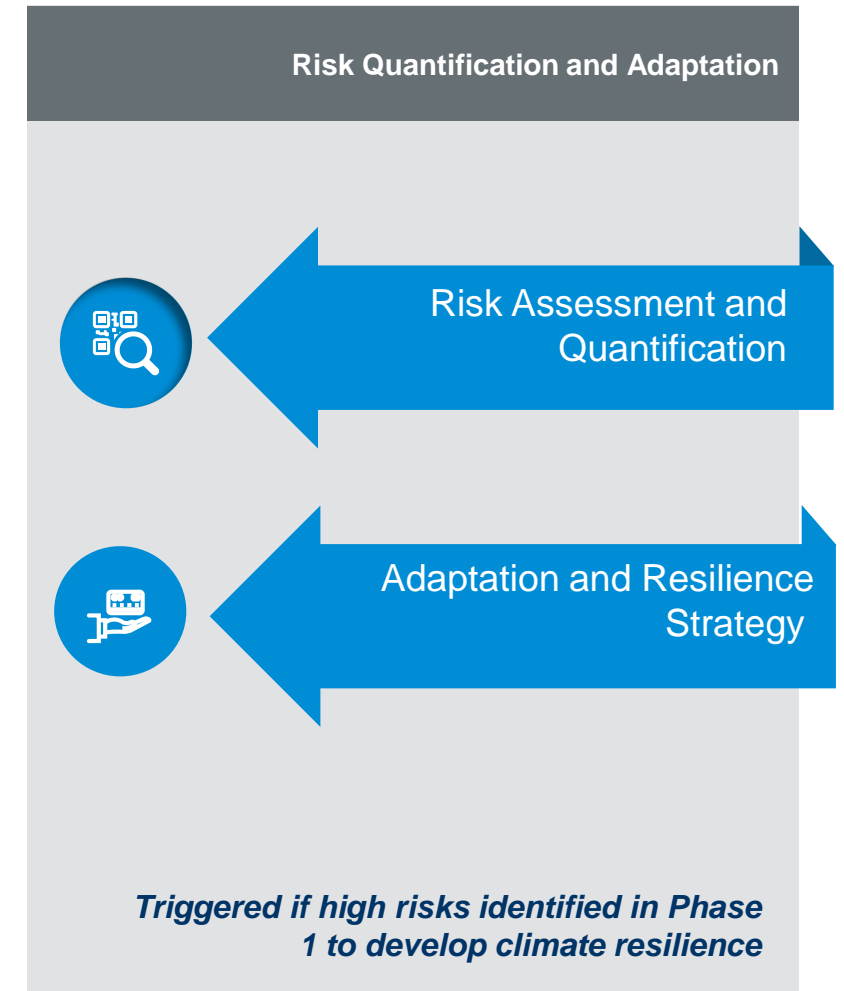
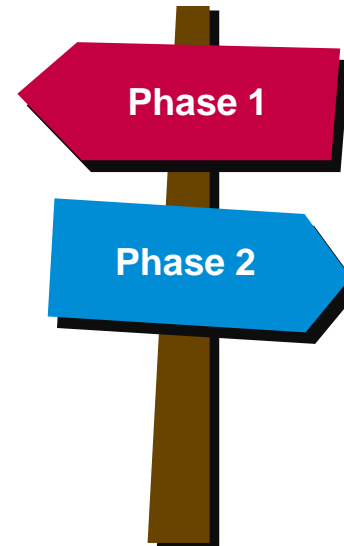
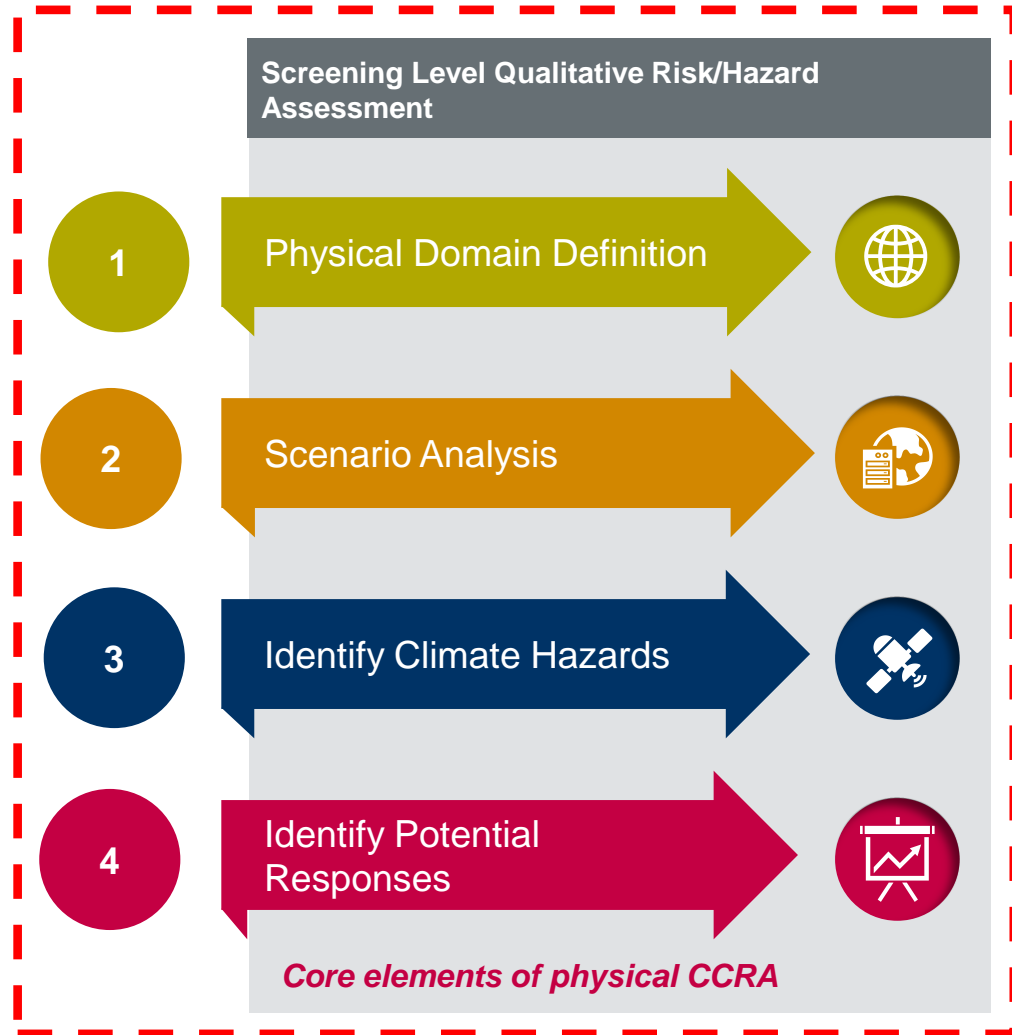
### RCP 4.5

Best-aligned to a reduction in emissions which means warming reaches a final increase of **around 2.6°C**—closest aligned with the **Paris Agreement**.

### RCP 8.5

**'Business as usual'** scenario which is the **closest aligned scenario to current trends** in the actual emissions trajectory and the current rate of warming.

# Physical climate change risk assessment (CCRA) and adaptation





# 1. Screening

Step 1

- Evaluation of **Historical Data** on natural hazards (floods, droughts, storms, etc.) where assets are located to understand their magnitude in these areas.

Step 2

- Evaluation of **future climate change scenarios** to assess the extent of changes in climatic conditions (e.g. temperature, precipitation).

Step 3

- **Overlaying** climate change projections over historical conditions to estimate future severity of natural hazards and **identify hot spots** among all assets, i.e. likely most affected.

Baseline Hazards



Climate Projections

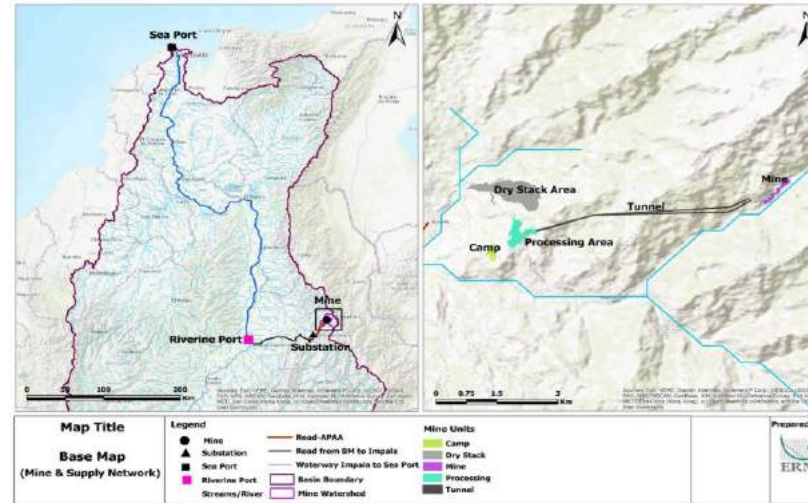
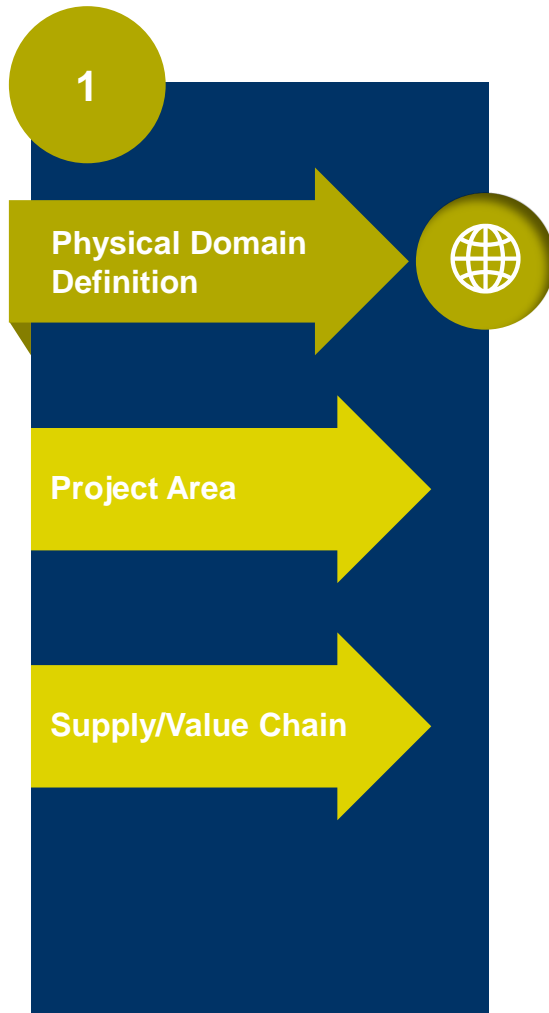


Future Climate Risk

Ambitious scenario – such as the IPCC 'RCP 4.5' comparable to a "global 2 degrees warming by 2100"

BAU scenario – such as the IPCC 'RCP 8.5' comparable to a "global 4 degrees warming by 2100" (business as usual)

# Phase 1: Screening level qualitative risk/hazard assessment



# Phase 1: Screening level qualitative risk/hazard assessment

2

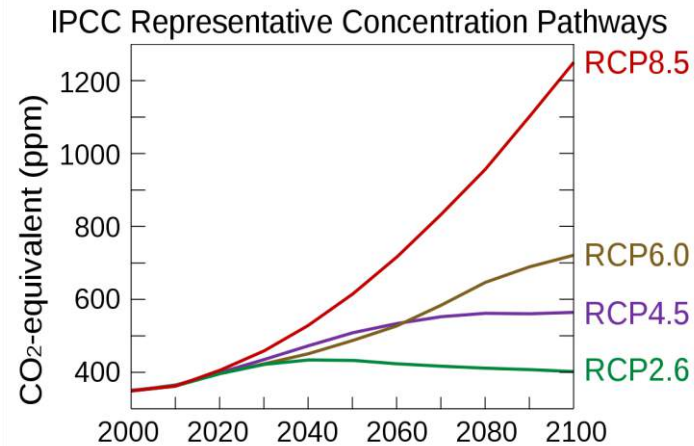
Scenario Analysis

Scenario

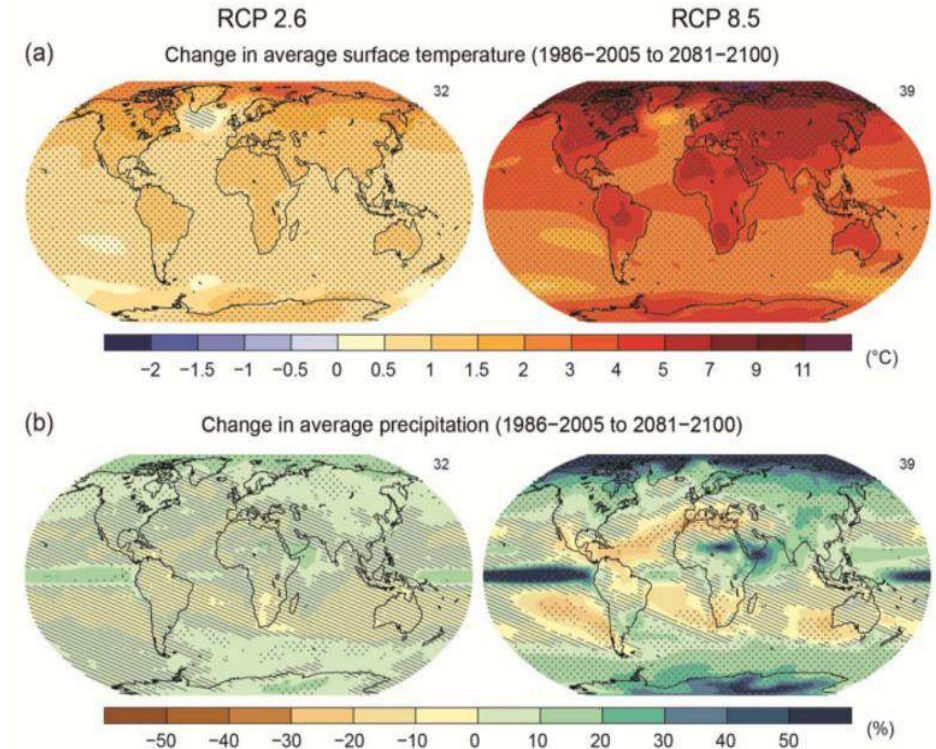
Timeline



Scenario Analysis:  
Representative Concentration Pathway  
(RCP) Scenarios of Intergovernmental  
Panel on Climate Change (IPCC)

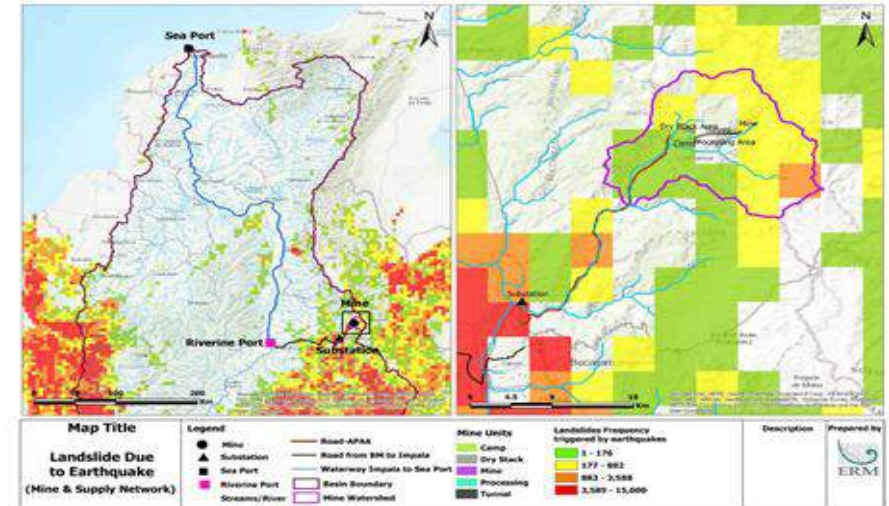


Source: IPCC





# Phase 1: Screening level qualitative risk/hazard assessment



Source: ERM Stock Images



# Phase 1: Screening level qualitative risk/hazard assessment

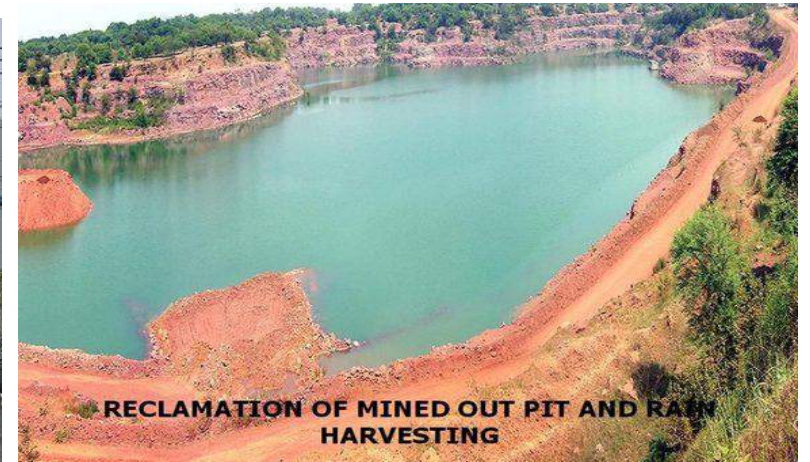
4

Identify Potential Responses



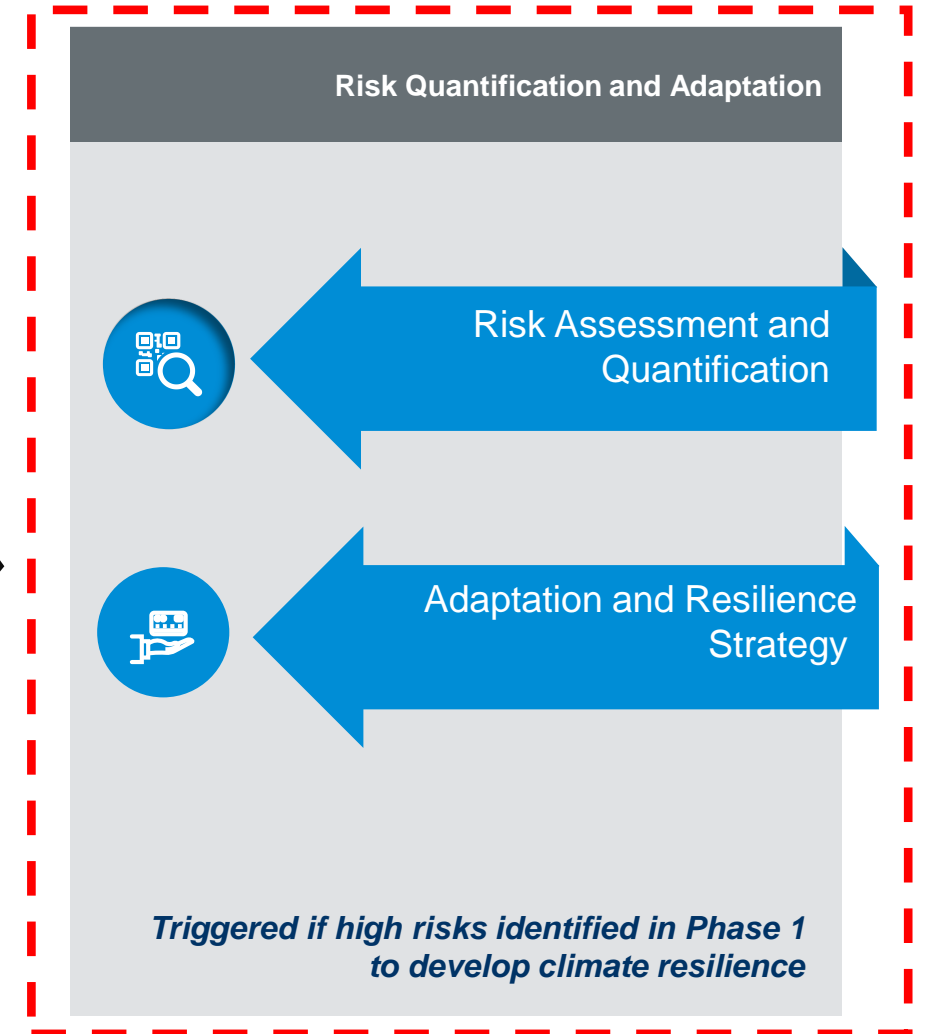
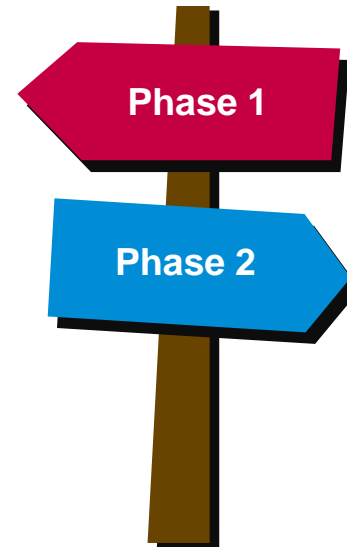
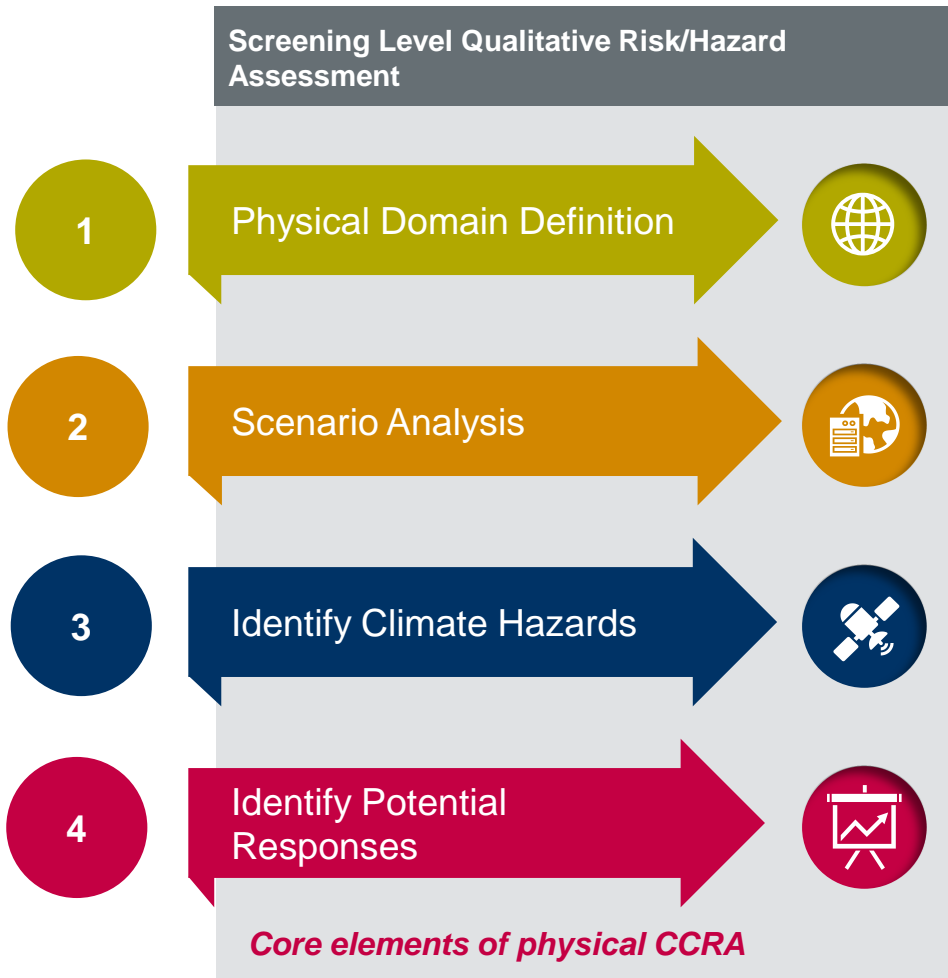
Adaptive Capacity and Project Implication

High Level Adaptation and Resilience Measures



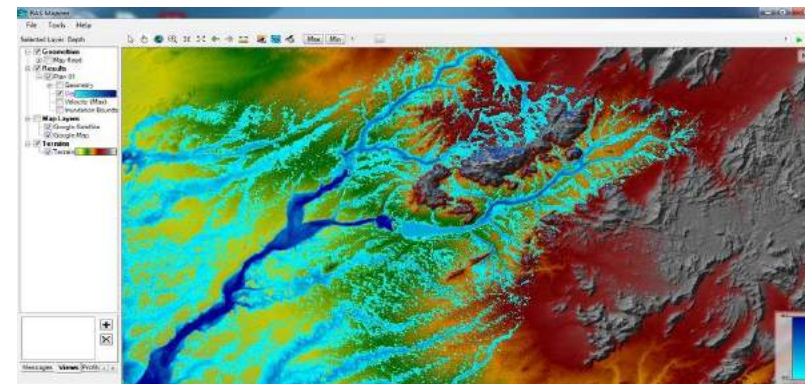
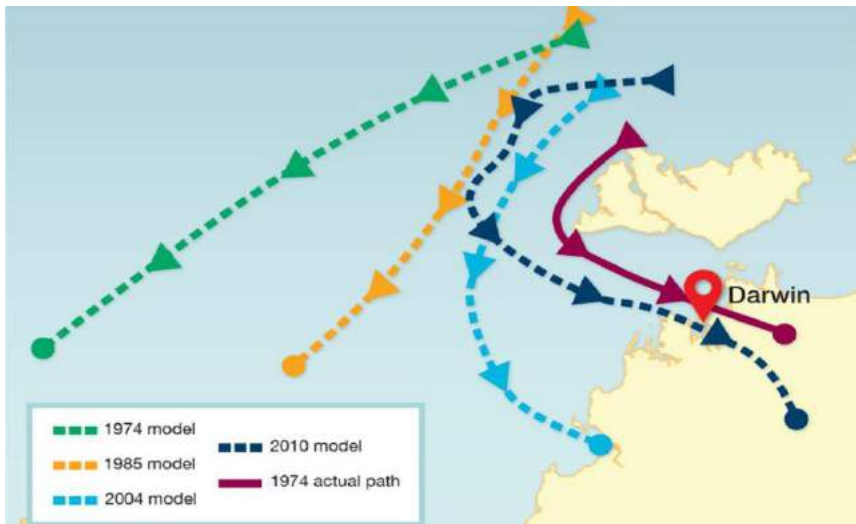
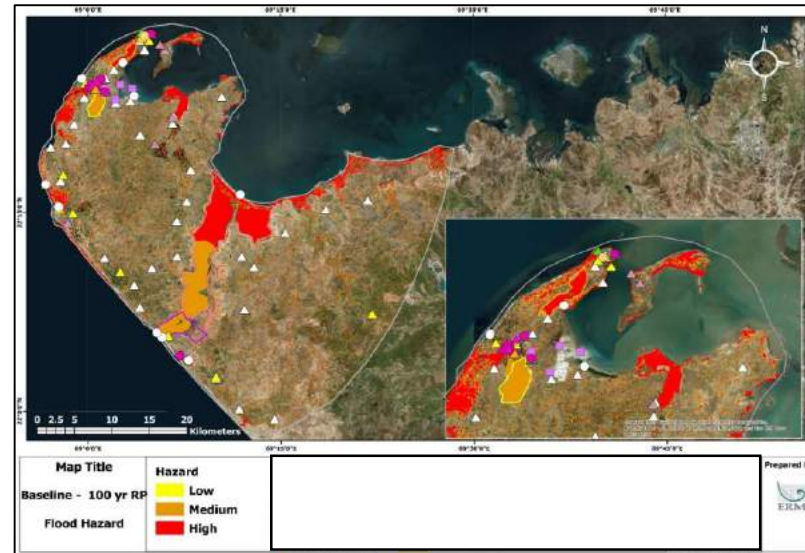
Source: ERM Stock Images

# Phase 2: Quantification and adaptation





# Phase 2: Quantification and adaptation



Risk Assessment and Quantification

Risk Assessment

Loss and Damage Estimation

Source: ERM Stock Images

# Phase 2: Quantification and adaptation



Adaptation and Resilience Strategy

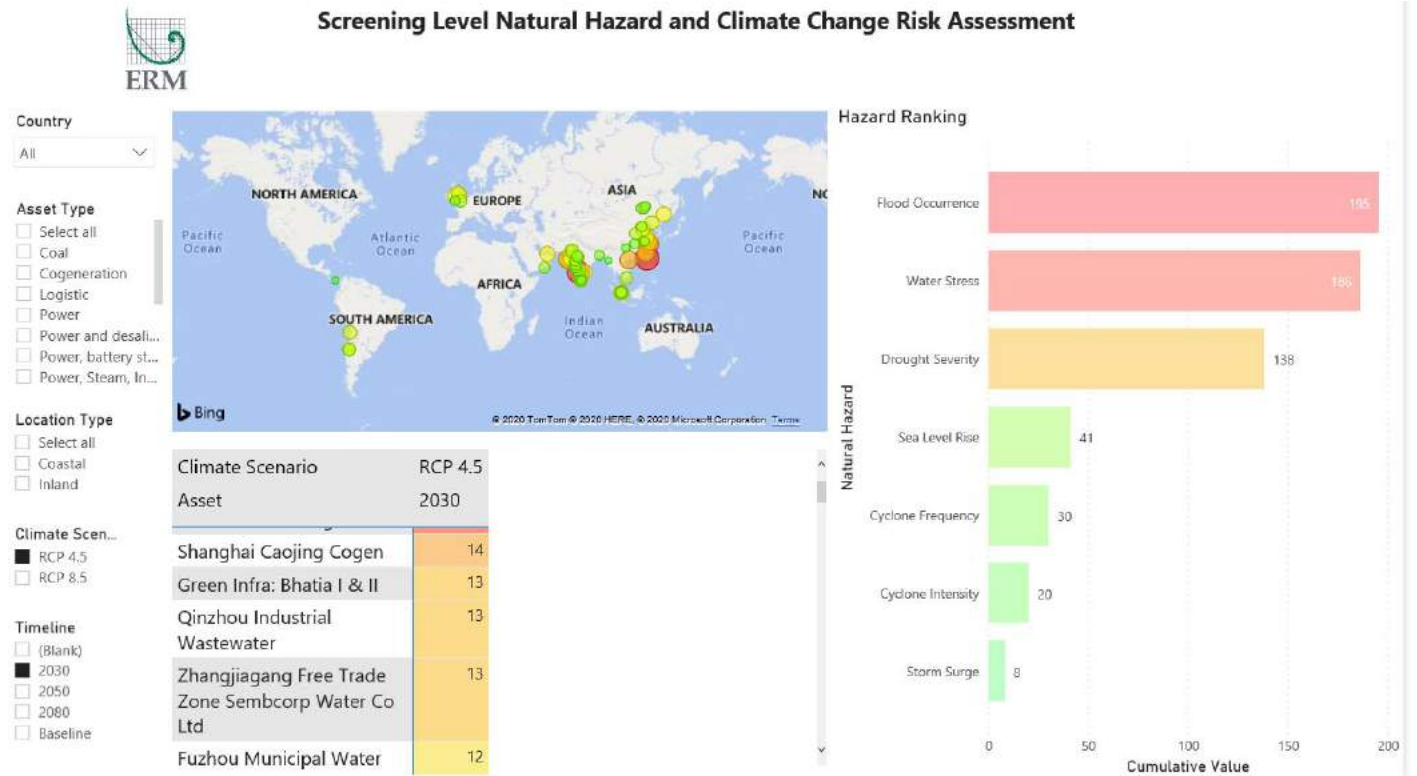
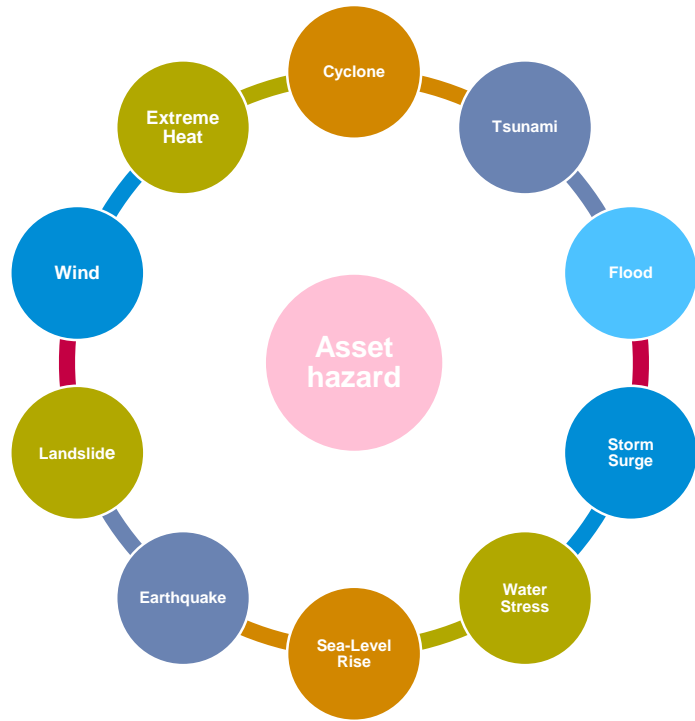
Climate Adaptation Strategy

Economics of Climate Adaptation (ECA)

Source: ERM Stock Images



# Climate Dashboard Screenshot



# Broad Types of Adaptation Solutions

- **Enabling responses** – enable people (staff, stakeholders, public) to prepare for potential climate change events - early warning systems or enhanced data collection approaches to improve understanding.
- **Social responses** – focus on building capacity and understanding among stakeholders and affected communities - education programs, training, community awareness programs.
- **Management responses** – management plans (such as coastal zone management plans) or clearing of drainage infrastructure.
- **‘Green’ responses** – promote resilience through the use of natural systems such as the use of mangroves for coastal protection.
- **Physical responses** – physical building of structures or systems to protect against potential hazards. This may include beach erosion controls, flood wall construction or elevation of buildings and infrastructure.

# Zoom Poll



**Among the options below, which is the first step in screening physical climate risk?**

- Identify Climate Hazards
- Identify Potential Responses
- Scenario Analysis
- Physical Domain Definition

# Zoom Poll



## What outcomes can you expect after conducting a Climate Change Risk Assessment? (Choose more than one)

- Know what physical climate risk can impact your business.
- Evaluating the financial impact of the risk to the business.
- Being able to identify mitigation and adaptation strategies.
- Get a high-level grasp of how it could impact your business' supply chain.





## 6. Key Messages

# Summary of Key Messages

- There are **clear business drivers** related to expectations and disclosure of climate related risks e.g. TCFD; and also actual business interruptions and effects due to changing climate patterns
- Climate hazards can have both **direct and indirect business impacts**
- TCFD and associated frameworks are more focused on **financial risks** rather than ESG risks – important our work is linked back to financial impacts
- We use **publicly available scenarios to project future changes** – the scenarios model likely impacts of GHG concentrations on basic climate parameters, such as temperature and precipitation
- ERM has **supported industry leaders** across a continuum of screening, site-level assessments and detailed risk studies including financial analysis
- The more detailed the studies we perform, we can **deliver increased quantification** to support financial decision making



# Coming Next

## Session 2: Transition Risks & Opportunities objectives

**1 Understand the drivers and financial impact of transition risks and opportunities**

**2 Understand the need for scenario analysis**

**3 Understand our methodology for developing scenario analysis**



Q&A





# Thank you

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