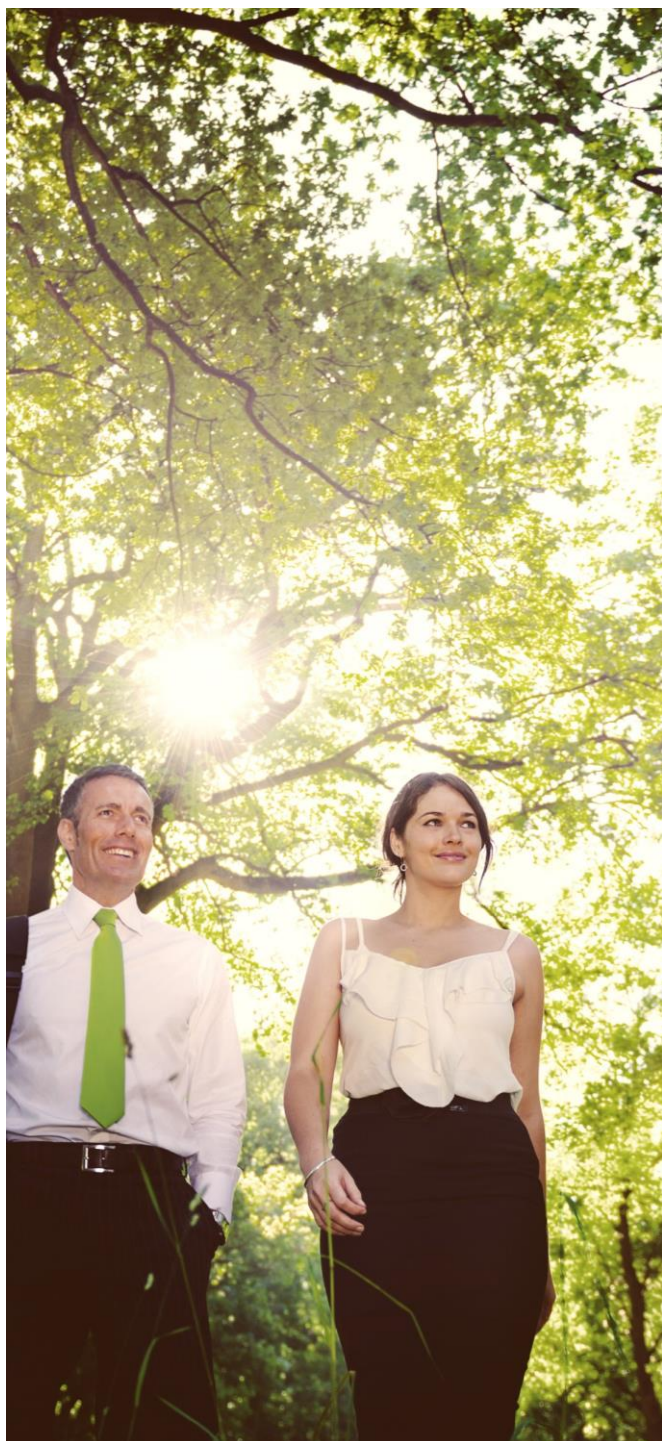




NGFS Series: Climate Scenarios – A range of plausible outcomes

Quantitative Risk

Introduction



Our team at Grant Thornton has been studying climate-related matters, mainly concentrating on examining their direct and indirect impacts on the processes and frameworks of banks. This is the first part of the NGFS Series publications, focusing on climate scenarios. In the following publications we investigate ways for bridging climate-related data gaps and present the analysis performed on the NGFS models' results, extrapolation of macro-economic indicators, and impact on default rates under different climate scenarios.

This report outlines the analysis done by the NGFS1 in partnership with an expert group of climate scientists and economists to design a set of plausible scenarios (NGFS Phase II Climate Scenarios) reflecting a variation of climate futures.

The scenarios provide a common reference point for understanding how both climate change (physical risks) and climate policy and technology trends (transition risks) could evolve under different climate futures. Each scenario was chosen to show a range of combinations of physical and transition risk outcomes.

For the NGFS Phase II models, an additional scenario variant is produced which includes interaction between transition and physical risks, so that the transition trajectory is reflecting the social cost of carbon under each scenario.

It is noted that currently all NGFS scenarios are based on SSP 22.3 socio-economic assumptions whilst cumulative total emissions of CO₂ differ across models, as scenarios were harmonized to arrive at comparable warming levels which depend on greenhouse gases emissions.

Climate Scenario Analysis

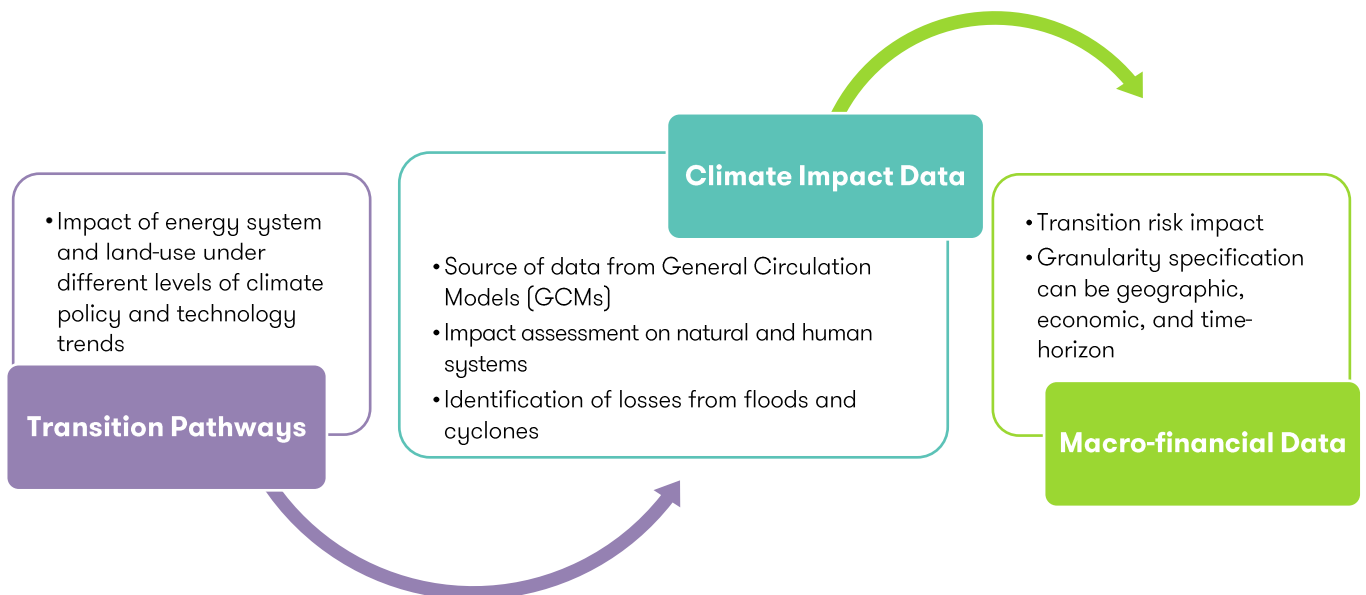
Understanding the data and resources

Climate scenario analysis involves exploration of climate and environmental related risks which enables central banks to enhance strategic thinking, assisting them into identifying metrics to be reported in climate-related financial disclosures of their supervised entities⁴ ⁵. Granular data is available for all transition pathways, climate impacts, and macro-financial indicators to support this analysis. Such analysis can be used as a basis for developing standardised frameworks and disclosures that can be reflected into banks processes e.g., ICAAP, Stress Testing frameworks, ECL, loan pricing, etc.

Climate scenarios were originally designed to advice on the risks from climate change and identify possible solutions under each pathway i.e., risk mitigation. They form a key part of scientific assessments such as those conducted by the Intergovernmental Panel on Climate Change (IPCC).

The scenarios have been adapted by the NGFS to help central banks and supervisors explore the possible impacts on the economy and financial system. Where possible, several outputs are provided for each one of the NGFS Climate Scenarios based on a range (3) of integrated assessment models (IAMs), which are established in academic research, in order to support an assessment of uncertainty or level of warming.

The NGFS Climate Scenarios combine a global harmonised set of transition pathways, physical climate change impacts, and macro-financial data. The three NGFS integrated assessment models (IAMs) include macro-economic models that quantify the potential impact from transition using data based on carbon prices and energy use and chronic physical risks.



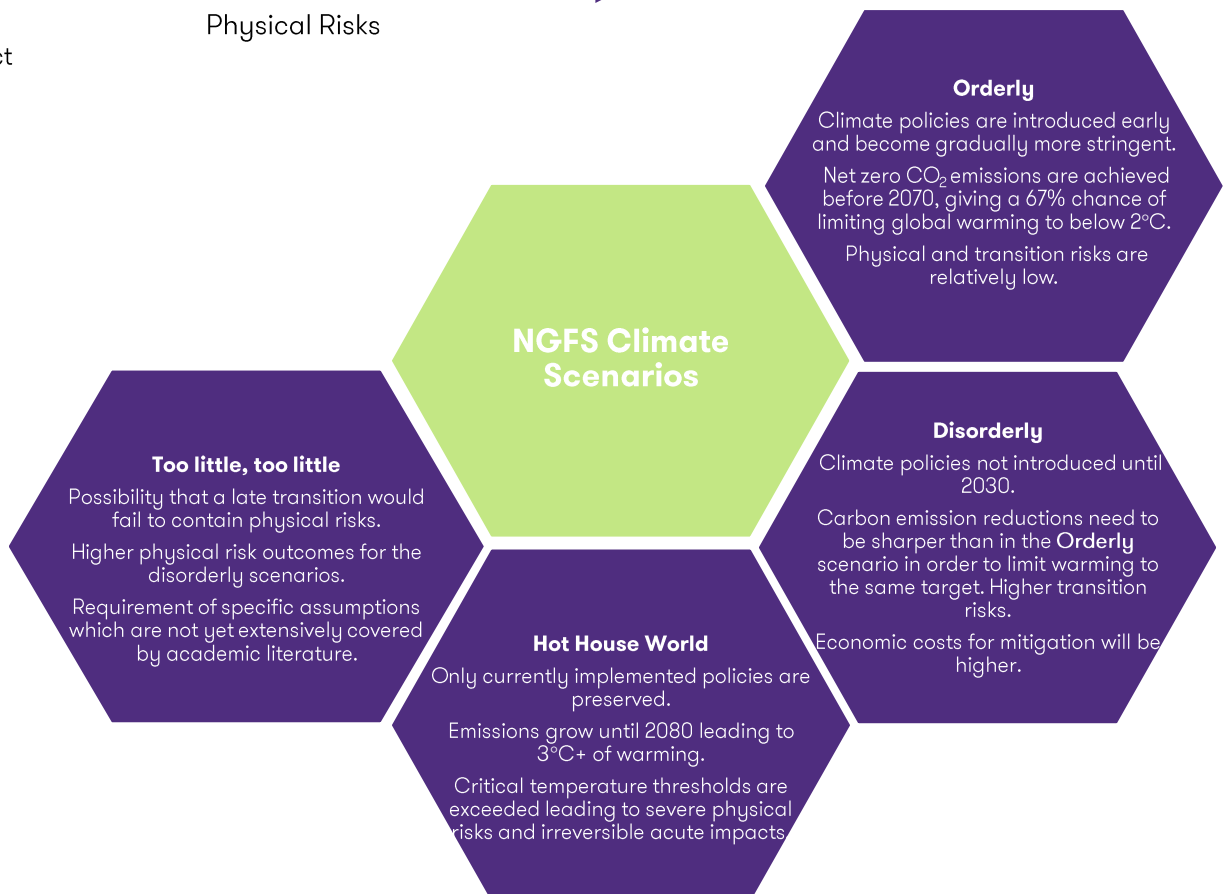
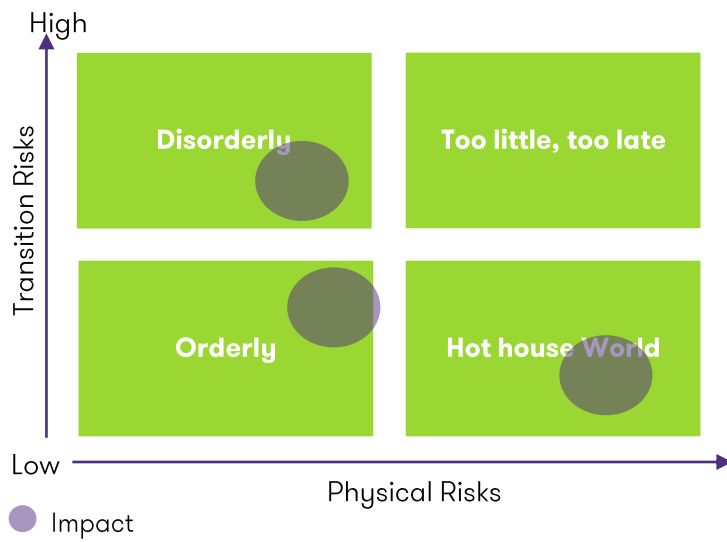
⁴ [Guide to climate scenario analysis for central banks and supervisors](#).

⁵ The report's focus is on assisting central banks, however the same are expected to be adopted by their regulated entities as well.

Climate Scenario Impact

Navigating through the impact of climate scenarios

The NGFS Scenarios identify the impact of climate change (physical risks), and climate policy and technology trends (transition risks) under different futures.



The NGFS Climate Scenarios

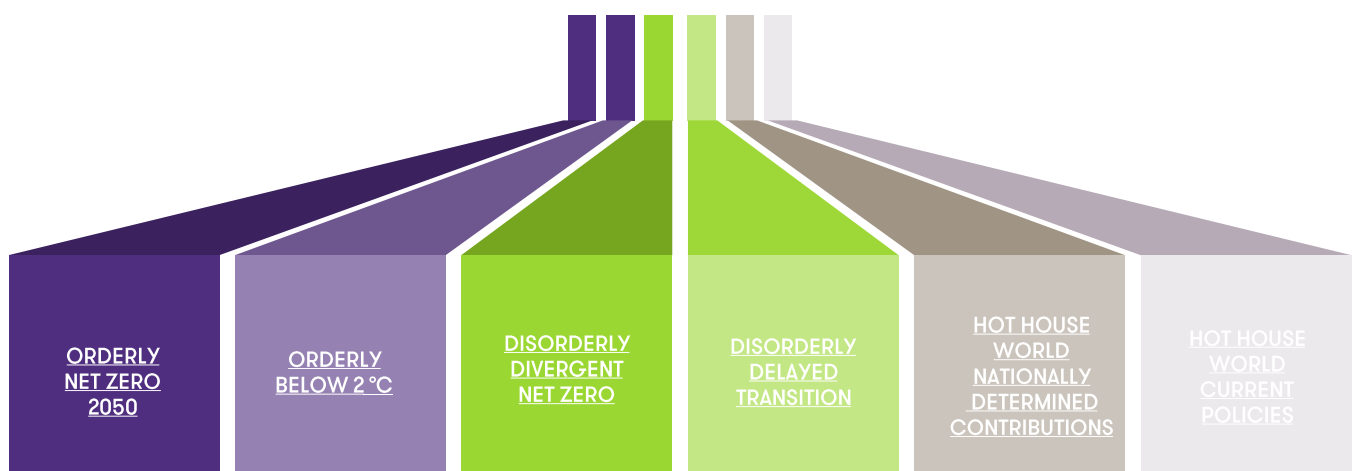
In order to cover a broad range of physical and transition risks, the NGFS has designed 6 scenarios sharing similar socio-economic assumptions. The NGFS currently focuses on scenarios that are more relevant to central banks and supervisory bodies.

To account for uncertainty and provide more robust insights across the models, the 6 NGFS scenarios have been generated by 3 different integrated assessment models namely, GCAM (provides highest regional and sector granularity), MESSAGEix-GLOBIOM (provides optimal benchmark scenarios), and REMIND-MAgPIE (provides optimal benchmark scenarios and higher detail of industry sector granularity).

The different scenarios can be used to assess the impacts on business models, financial risks, and any other climate-impacted activities completed by the banks. Incorporation of such scenarios can be applied to either short- or longer-term horizons.

Different scenarios illustrate different impacts. For example, the Current Policies scenario is best suited to assessing physical risks. The Delayed Transition scenario is best suited to assessing more sudden shifts in policy and technology. The Net Zero 2050 scenario highlights the most cost-effective pathway to reach net zero CO₂ emissions by the middle of the century. Differences in scenarios include policy strength and timing, temperature outcomes, regional coordination, and technology trends.

The NGFS Phase II Climate Scenarios



The NGFS Climate Scenarios

Overview and definition of NGFS Scenarios

Net Zero 2050

- Ambitious scenario aiming to limit global warming to 1.5 °C through stringent climate policies, innovation, and fast technological change
- Net zero CO₂ emissions around 2050
- Immediate climate policies resulting relatively low physical risks and high transition risks

Below 2°C

- Gradual increase of climate policies
- 67% chance to limit global warming below 2 °C, with net zero emissions after 2070
- Climate policies are immediately introduced gradually becoming more stringent
- Both physical and transitional risks are relatively low

Divergent Net Zero

- Net-zero emissions by 2050
- Higher costs due to differing policies across sectors and a more abrupt elimination of fossil fuels
- Availability of Carbon Dioxide Removal (CDR) technologies is assumed to be lower than the Net Zero 2050 scenario
- Higher expected transitional risks compared to the Net Zero 2050 scenario, but with lower physical risks across all available climate scenarios

Delayed Transition

- Global annual emissions do not decrease until 2030.
- Robust policies, which will differ across countries and sectors based on the current applicable implemented policies, will be needed to limit warming to below 2 °C
- The availability of CDR technologies is very limited with subsequent effects on the carbon prices
- Higher physical and transition risks compared to both Orderly scenarios.

NDCs

- Inclusion of all pledged policies even if those not yet implemented.
- Emissions decline but exceed the preferred temperature limits, resulting about 2.5 °C of warming
- Scenario associated with moderate to severe physical risks and low transition risks

Current Policies

- Only currently implemented policies are retained, leading to high physical risks
- No impact of transition risks due to no implementation of new policies
- Emissions gradually grow until 2080 leading to warming exceeding 3 °C.
- Key scenario to identify long-term physical risks to the economy and the financial system based on the current path leading to a "hot house world"

Category	Scenario	Physical Risk		Transition Risk			High*
		Global Warming Level	Policy Reaction	Technological Change	Carbon Dioxide Removal Technologies	Regional Policy Variation	
ORDERLY	Net Zero 2050	1.5 °C	Immediate and smooth	Fast change	Medium use	Medium variation	↑ ↓
	Below 2	1.7 °C	Immediate and smooth	Moderate change	Medium use	Low variation	
DISORDERLY	Divergent Net Zero	1.5 °C	Immediate but divergent	Fast change	Low use	Medium variation	
	Delayed Transition	1.8 °C	Delayed	Slow then Fast change	Low use	High Variation	
HOT HOUSE WORLD	NDCs	~2.5 °C	NDCs	Slow change	Low use	Low variation	
	Current Policies	3 °C +	None - current policies	Slow change	Low use	Low variation	

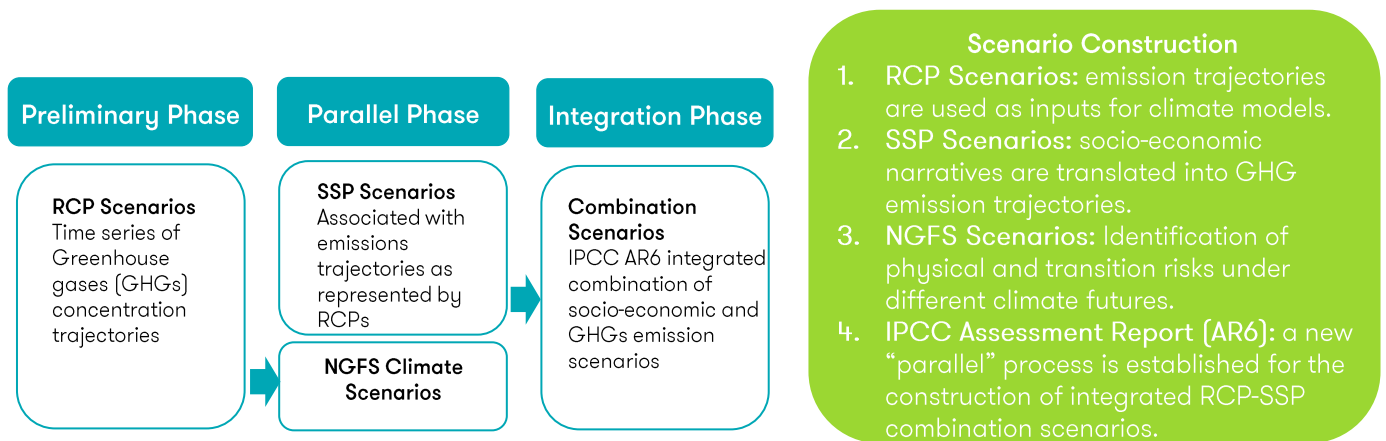
Source: NGFS

* Colour codes indicate scenario severity in terms of a macro-financial perspective

Climate Scenario Design

Leveraging Globally Accepted Solutions

Currently all NGFS scenarios are based on SSP 2 socio-economic assumptions whilst cumulative total emissions of CO₂ differ across models, as scenarios are harmonized to arrive at comparable warming levels which depend on GHGs emissions. Under the RCPs⁶, different levels of global warming are estimated based on GHGs emissions trajectories until the end of the century. These temperature projections are broadly similar, though not identical, to the NGFS transition pathways. These can be mapped to the NGFS climate scenarios where the orderly and disorderly 1.5°C and 2°C scenarios are in the range of the low temperature scenario (RCP2.6), whereas the Current Policies scenario is close to the high temperature scenario (RCP 6.0).⁷



Shared Socioeconomic Pathways Framework

The SSPs Framework contains alternate socioeconomic scenarios developed to aid in assessing future risks due to the changing socio-economic landscape. The scenarios are:

- SSP 1- Sustainability
- SSP 2- Middle of the Road,
- SSP 3- Regional rivalry
- SSP 4- Inequality
- SSP 5 – Fossil-Fueled Development

The Representative Concentration Pathways

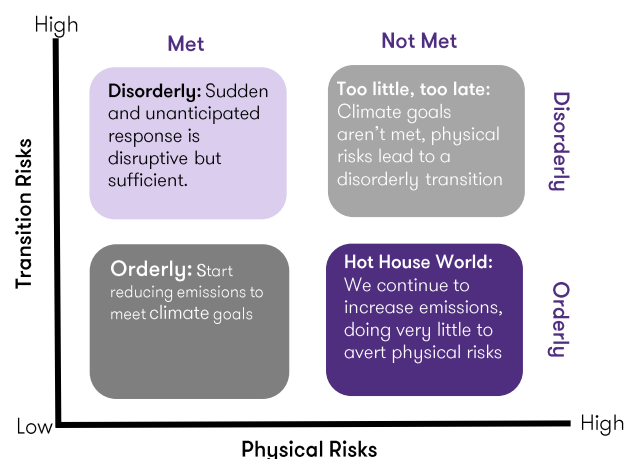
- RCPs are designed for modelling different climate futures depending on GHG emissions. These give estimates for emissions trajectory based on various assumptions specific to each pathway.
- Each RCP pathway defines a specific radiative forcing by 2100.

Network for Greening the Financial System

Provides a framework for analyzing climate risks, identifying key transition and physical risks associated with climate change.

- **Physical Risk:** Impact from increasing frequency and magnitude of natural hazards.
- **Transition Risk:** Financial loss from the process of adjustments towards a sustainable economy.

The NGFS Framework allows examination of the economic impact of policies implemented in representative scenarios.

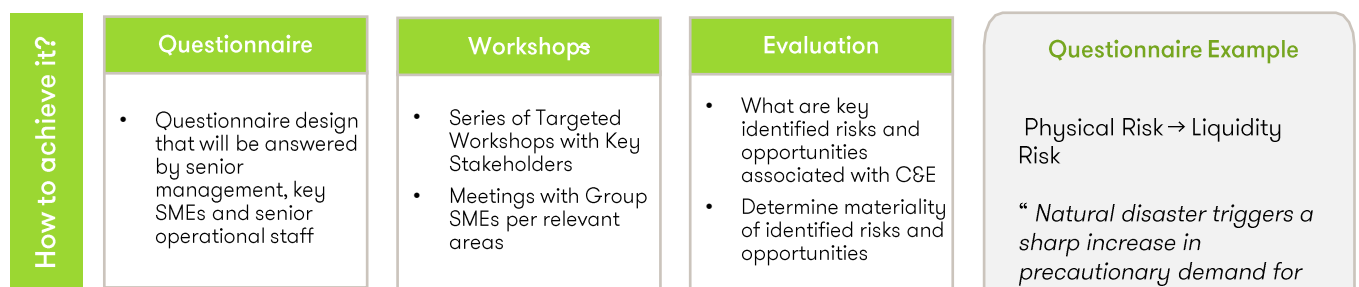
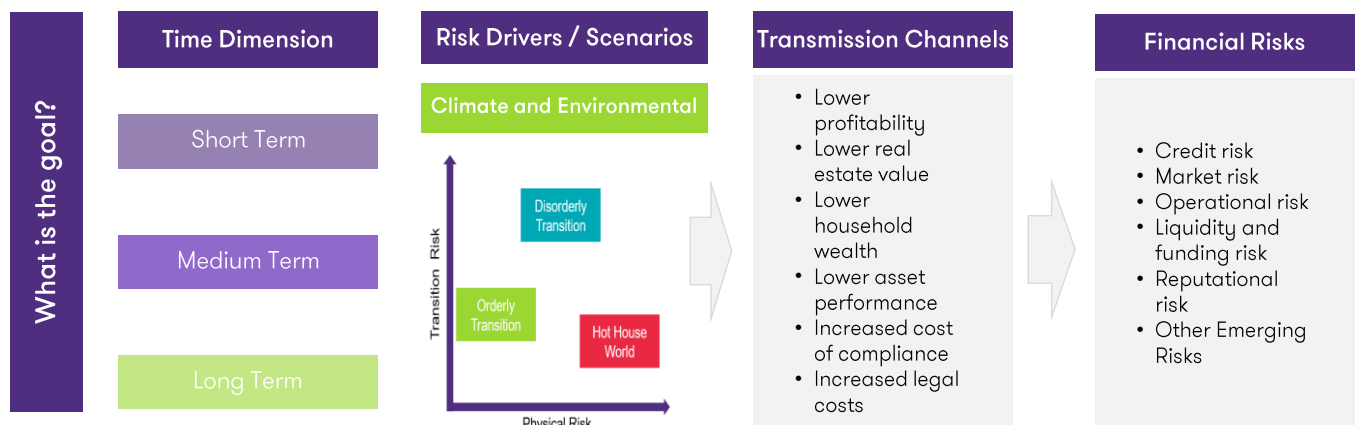


⁶ The Representative Concentration Pathways: An Overview

⁷ Climate Scenarios Database – Technical Documentation

The Grant Thornton Risk Quantification Approach

Integrating C&E risk should be considered a step-wise process. Determining exposures to C&E risks starts with a materiality/risk assessment and through questionnaires, workshops and stakeholder engagement, a comprehensive list of material C&E risks can be produced. Once these material C&E risks are determined, their impact over the short, medium and long-term can then be assessed through Qualitative and Quantitative Scenario Analysis, the output of which can be used in setting KRIs and Risk Limits. Data gaps and possibilities of proxy methodologies will be assessed. Grant Thornton has the internal knowledge and expertise to support throughout this process.



Contact

Our team would be delighted to discuss your challenges and opportunities in any aspect of climate risk. Our services are flexible and efficient, designed to facilitate and support your business model. Contact us today to discuss.

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