Managing financial system stability and climate change - A preliminary guide

A report from the HSBC Centre of Sustainable Finance

Authors: Zoë Knight, Gaurav Ganguly

October 2018

HSBC

Together we thrive

About the Authors

Zoë Knight

Managing Director & Group Head of the HSBC Centre of Sustainable Finance

Zoë Knight leads the Centre of Sustainable Finance at HSBC, a central think tank established to lead and shape the debate on mobilising capital flows to address the world's major sustainability challenges. She has worked in financial markets since 1997, originally as an equity strategist, then in 2007 moving into socially-responsible investing with a focus on climate change. Since joining HSBC Zoë has co-authored reports on low-carbon opportunities in bond and equity markets, as well as long-term climate and water risks.

Gaurav Ganguly

Head of Group Risk Economics

Gaurav is the Head of Group Risk Economics at HSBC. He manages a global function that produces the macroeconomic scenarios and forecasts needed to run stress tests, calculate loan impairments and to set HSBC's business plan. Gaurav has over 13 years' experience in Banking and Insurance. He has worked in risk management for most of this time in a variety of roles including sovereign risk, credit risk modelling and economic analysis. Gaurav joined HSBC in 2014, prior to which he was at Barclays where he managed a research and analytics group in Portfolio Risk. He has a PhD in Economics from Oxford University.

Acknowledgements

This report is the product of collaboration and engagement with individuals in various businesses, functions and geographies across HSBC. The authors would like to thank the following colleagues for their particularly generous and thoughtful contribution and feedback:

Stephen King, Wai-Shin Chan, Alan Cathcart, Alan Smith, Ann Craig, Brendan McNamara, Jonathan Drew, Peter Blandamer, Rebecca Self, Stephanie Maier, Trevor Wells

Contents

Executive summary

The climate risk to financial stability is that a confluence of climate policy initiatives, technological innovation and improving economics for low-carbon activities prompt a much quicker than anticipated demand shift away from high-carbon activities, with wide-spread consequences for asset prices, activity, employment, trade and financial flows and associated financial contagion.

Banks facilitate fund flows between savers and investors, with financial stability a pre-requisite for well-functioning capital markets. At the end of 2017 the amount of credit extended to households and corporates globally was USD115tr, representing approximately 144% of global GDP[1]. Global efforts to respond to climate change, such as steering the existing energy system away from fossil fuels and addressing the consequences of warmer temperatures, mean banks are becoming alert to new types of risk factors.

This report provides a preliminary guide for how banks can apply a climate lens to existing risk management and scenario analysis processes and practices in order to support financial stability across the economic system. It aims to further the debate on these issues and provide an input to central banks and as part of the Network for Greening the Financial System initiative.

The purpose of this paper is to explore what banks can do to analyse macro-financial stability outcomes relating to climate factors. We concentrate on exploring themes related to the existing enterprise wide approach i.e. the global approach, but a more accessible starting point is for banks and other financial institutions to adopt a targeted portfolio level climate risk approach, such as analysing the potential for transition risk in high-carbon industries.

The potential for climate change to have extreme consequences is widely acknowledged, but the speed and scale of change is highly uncertain.

The Paris Agreement[2] of December 2015 aims for global temperature rises of less than 2°C. The financial system is now grappling with how to speed up the financial facilitation needed to build a 2°C resilient economy, as well as how to manage related risks[3].

Managing financial stability requires an appreciation of these risks and early recognition of the possibility that climate events may be extreme and with reinforcing negative economic feedback loops. Historically economists and risk managers have had a poor track record of both acknowledging unlikely outcomes and understanding risk transmission through the macro-financial system, as demonstrated by previous financial crises. For climate, there are many uncertainties about how the risks, which are relatively well known, could manifest through the economic and financial system, and knowledge gaps exist on the signals to look out for. Active dialogue on climate factors and early awareness of potential pathways and extreme events is essential to minimise disruption.

Types of climate risks are well articulated and understood, but the full economic manifestation of them remains uncertain – herein lies the challenge.

In essence, maintaining financial stability means identifying the levers that will be used to address the climate problem and assessing to what degree they impact financial institutions. This is easier said than done, since understanding how climate risks will transmit through the economy and financial system is relatively immature.

Climate risk factors are transverse in the sense that they affect many different types of activities necessary for functioning economies, and these span across the different risk categories banks face. At a high level, the main risks associated with climate change come from moving to a low-carbon economic framework so as to halt and reverse rising Greenhouse Gas emissions (transition risk), as well as the consequences of adjusting to the 1.1°C of warming already embedded in the system and further potential temperature rises (physical risk). These risks are multi-faceted and interdependent, and are intertwined with real-economy financing.

[1] Source: BIS

[2] UN Framework Convention on Climate Change: Report of the Conference of the Parties on its 21st session held in Paris from 30 November to 13 December 2015

[3] See HSBC Assessing Climate Risk at www.sustainablefinance.hsbc.com for a comprehensive discussion of the types of climate risks

Banks could be vulnerable to increasing non-performing loans as high-carbon activities are not as viable in the future, as well as operational disruption as extreme weather events become more likely and severe or sea levels rise. In addition, equity markets could re-price if expectations change on the viability of fossil fuel related corporate earnings and sovereign debt ratings could be downgraded to capture risk from country economic vulnerability to warmer temperatures or changes to fossil fuel export value.

The crucial point from a financial stability perspective is to identify the speed and scale of how the levers to address climate change manifest throughout the wider economy and the financial system, and take steps to reduce any value disruption associated with the wider socio-economic impacts of the response to climate change. The complexity is heightened because climate change is a global problem but the individual standpoint of countries makes for a local response.

On the positive side, it is relatively straightforward to identify the levers that address climate change, namely policy, investment flows in resilient economic infrastructure, technological innovation, and price differentials between high- and low-carbon energy sources for example. The negative news is that the tangible signals that the levers are working are less clear cut or transparent. Policy commitment and announcement is varied and infrequent, investment flows are opaque, beliefs around the pace of technological innovation are subjective and price differential analysis needs a huge volume of data to provide meaningful conclusions.

In addition, even if the signals were stronger, the speed and mechanism of how these factors transmit through the economy is unclear, as well as what the leading indicators for the financial response might look like. For instance, many countries have signalled a scale up of renewable energy capacity by setting out targets as part of their climate plans for the Paris Agreement. However, the age and therefore lifespan of existing power facilities and the price of renewables are some of the determinants of when, exactly, it makes economic sense to switch. In other words, the signal that change will occur is clear, but the data indicator that identifies the exact timing is missing, as well as what the ripple effects, such as potential job churn, might be.

Banks are clearly used to managing different types of risks in the normal course of activities and, since the global financial crisis, have faced regulatory drivers to step up the sophistication and systemic approach to examining risk, assessing impact and taking action.

This has led to progress on enterprise-wide risk management frameworks which are a good starting point from which to apply a climate lens. Traditional risk types for banks include those that affect lending portfolios, trading assets and operational assets.

Recommendation 1:

Banks should start mapping the risks related to efforts to halt climate change and adapt to the consequences of warmer temperatures. Climate risks are relevant across all the existing risk types that banks face. Banks should use existing scenario methodologies to start identifying the potential economic and financial transmission response to climate factors. Climate risk consequences may be indirectly linked to economic growth, and might be mainly income redistributive in nature. To get started, banks can gain initial insights from conducting sector based portfolio analysis.

Source: HSBC Centre of Sustainable Finance

Scenarios as signposts for the future

Scenario analysis is effective for managing and monitoring a variety of risk factors, as well as for effective planning, devising successful strategies, and booking provisions on loans for example. It provides the necessary starting narrative for quantitative assessments such as stress testing. Comprehensively assessing climate-related risks requires banks to make a large number of forward-looking assessments on the possible macro-financial consequences of climate triggers, and examine their impact on financial and non-financial risks.

Banks routinely assess individual risk impact and potential contagion effects by identifying scenarios.

According to the Prudential Regulation Authority of the Bank of England[4], stress testing typically refers to shifting the values of individual parameters that affect the financial position of a firm and determining the effect on the firm's financial position. Meanwhile, scenario analysis typically refers to a wider range of parameters being varied at the same time. Scenario analyses often examine the impact of adverse events on the firm's financial position, for example, simultaneous movements in a number of risk drivers affecting all of a firm's business operations, such as business volumes and investment values.

Enterprise wide scenarios are comprehensive, consistent and global and banks already have systems and processes in place to deploy these scenarios for a variety of uses.

In addition, scenarios are often created on a smaller scale either to examine more localised, idiosyncratic risks, or to identify and limit impact analysis to an operating entity, business segment or portfolio. This multitude of scenarios provides alternative views of the performance and resilience of the business at different levels of granularity and for different risk types. Scenarios are not always macro-financial in nature. For instance operational risk scenarios typically define non macro-financial events such as service outages or cybercrime. Types of climate-related scenarios could include assessing the vulnerability of real estate footprints to sea level rise or extreme storms, or the potential for loan impairment in high-carbon sectors.

Financial stability and climate scenarios

For financial stability purposes, a climate scenario needs to assess the economic and financial consequences of climate-related levers.

So far, climate scientists have created scenarios for predicting temperature[5] outcomes based on Greenhouse Gas (GHG) emission trajectories. Meanwhile, energy scenarios set out GHG emission profiles according to a set of input assumptions for the supply and demand of energy.

These approaches are indispensable for providing signals on how well reality is progressing versus what needs to happen to deliver a 2°C world, but on their own they do not help with the task of maintaining financial system stability. This is because they don't readily help us understand the speed and scale of the economic and financial disruption relevant for financial stability. For instance, substituting a high-carbon fossil fuel for a lower carbon option in power generation might not translate into a change in GDP growth. Rather, the economic and financial response to the climate factor could be sectoral job churn and a re-allocation of capital. These sorts of outcomes are not usually explored in financial stability assessments.

Recommendation 2:

Banks should engage with a wide range of national and supranational policymakers to better understand the levers that could be used to achieve climate goals. Further dialogue would help to close the current knowledge gap on pinpointing the macro-financial transmission risks associated with Greenhouse Gas emissions and temperature pathways.

[4] Supervisory Statement: The Internal Capital Adequacy Assessment Process and Supervisory Review and Evaluation Process, Bank of England Prudential Regulation Authority, December 2017

[5] The Intergovernmental Panel on Climate Change (IPCC) periodic assessment reports provide policy makers with temperature estimates

Knowledge gaps relate to the signals of risk crystallisation

The knowledge gap for climate scenario construction for financial stability purposes is not about identifying the types of climate risk nor the response required to address climate change. Instead, the knowledge gap is related to the signals to look out for that a risk type could crystallise, and identifying the metrics or indicators that represent the best manifestation of that risk.

For example, establishing key variables that provide macro (e.g. policy ambition) and micro (e.g. plant level emission data) signals of the current climate trajectory would be helpful in the same way that, for instance, economic survey data or interest rates can guide financial or economic expectations. This would spur thinking about the link from climate to economic consequences.

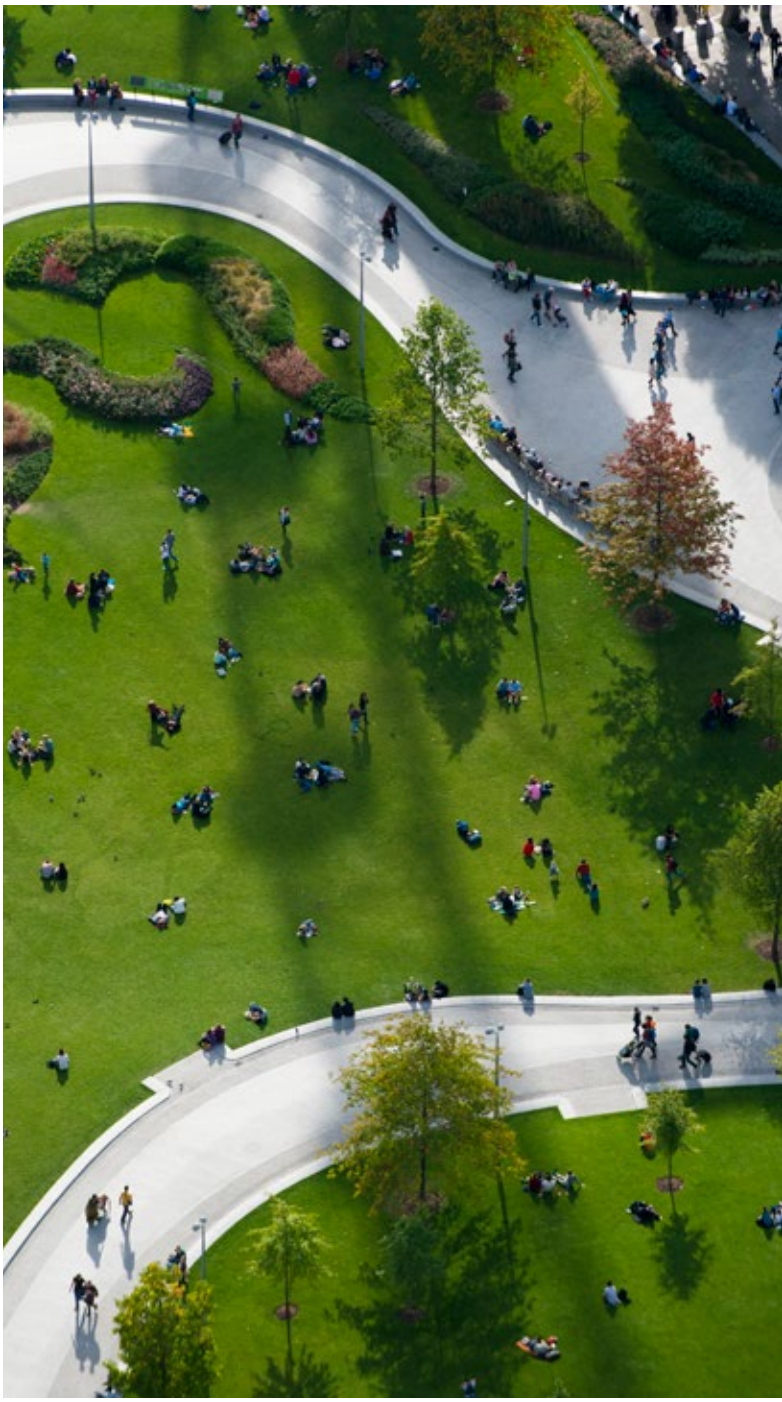
The obstacles to full implementation however, are that energy system economics, country comparative advantage (in relation to fossil fuel and other natural resources) and growth volatility (in relation to the location of physical change, e.g. increased average rainfall during the monsoon season) are not yet widely used in financial scenario response mechanisms. Efforts to address climate change are directly applicable to these categories.

Identifying scenario methodologies that capture wealth re-distribution effects rather than pure growth consequences would be a large step forward for climate risk modelling

We expect these to be developed separately from standard growth models by a combination of academics and central banks and see banks as actively engaging in this process. On the data front, much work is already underway on recording GHG emissions but accelerating these initiatives would help unify a scenarios based approach for banks. In the meantime we think an immediate approach for banks is to start incorporating climate risks on a portfolio basis, (as a stepping stone on the path to an enterprise wide approach) where there are clear near term materiality factors, such as in credit analysis on high-carbon sectors.

Fundamentally there are two key factors to consider for how climate risks manifest through the wider economy and financial system.

First, identifying whether broader economics would win or lose from climate factors on a regional basis. This could impact investment flows. Second, the potential for technological change and policy drivers to make incumbent energy systems redundant. Greater transparency and disclosure on the materiality of climate risks will provide further context to minimise these effects. This approach is supportive of the aims of the Task Force on Climate Related Financial Disclosure.



Recommendation 3:

Banks should become actively engaged in identifying the different channels of risk transmission mechanisms by engaging with cross-discipline subject matter experts such as energy economists, environmental scientists, as well as other academics and associations furthering greenhouse gas accounting methodologies.

[6] The use of scenario analysis in climate related risks and opportunities. Task Force on Climate Related Financial Disclosures (TCFD). June 2017

Climate change and financial stability: setting the scene

Financial stability and responding to climate change

The global focus on understanding, addressing and managing climate change factors has undergone a step change since the adoption of the Paris Agreement in December 2015.

For country negotiators at UN talks the conversation is focusing on what the rulebook looks like for implementing the country plans put forward as part of the Agreement ratification process. For corporates, the emphasis is more on increased disclosure about contribution to the climate problem in the course of day-to-day activities, and strategic thinking that addresses how a low-carbon future might affect income generating potential in the future. The financial system is grappling with how to speed up the financial facilitation needed to build a 2°C resilient economy as well as how to manage any potential risks relating to economic disruption resulting from moving to a low-carbon economic framework and adjusting to warmer temperatures.

Comprehensive reporting on causes, observations and likely impacts related to climate change to guide policy makers have been published since 1990 by the Intergovernmental Panel on Climate Change (IPCC). Since the industrial revolution, greenhouse gas emissions (GHGs) resulting from human activity have been the primary cause of a shift in the Earth's atmospheric regulating system which, if left unchecked, will lead to a significant increase in global temperatures with the potential to disrupt human life and economic activity on an unprecedented scale.

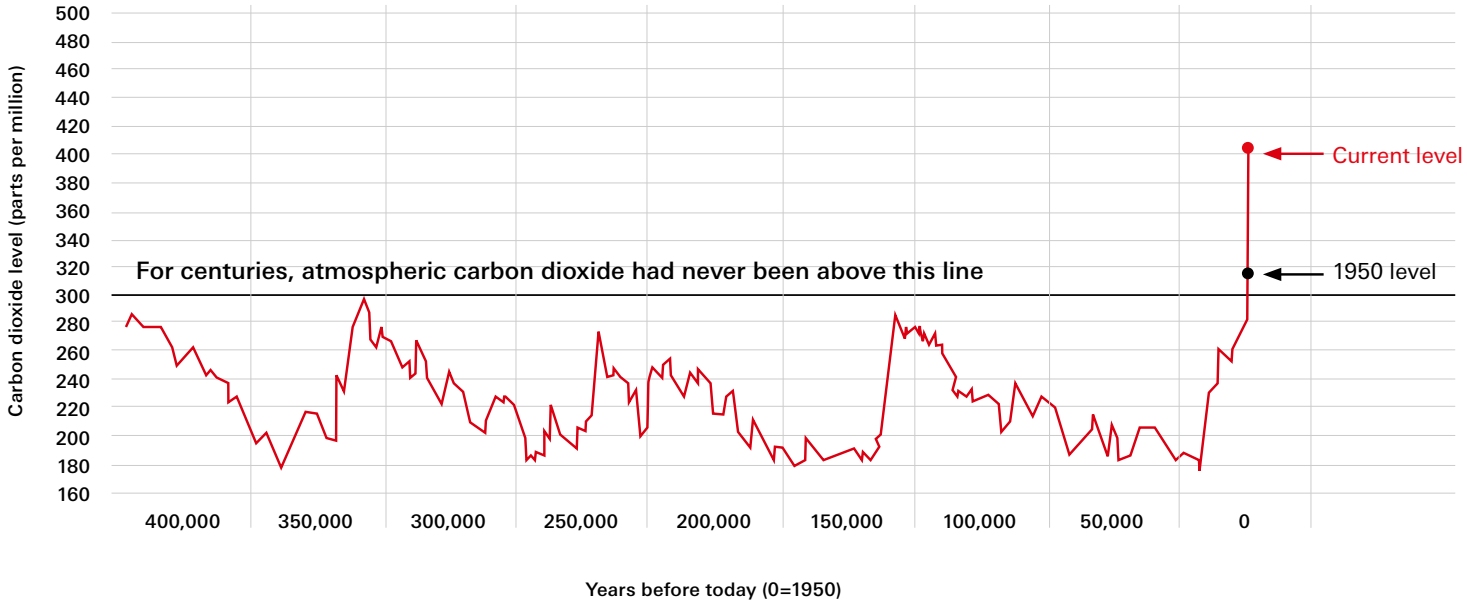
Both natural processes (e.g. vegetation cycles), and human activities (e.g. industrial production) change the Earth's natural energy regulating mechanisms and both are drivers of climate change.

The data below demonstrates that CO_2 concentrations in the atmosphere are the highest they have been through the historical record[7]. The greater the increase in average temperature, the worse are the estimated effects. The main disruption is related to water availability, with its associated adverse effects on food, health, livelihood and mortality. Since climate change acts as a threat multiplier on existing stress factors, such as droughts and rainfall, the IPCC acknowledge that the most severe effects will be felt in lower income economies and segments of society.

The original rationale for the IPCC assessment report was to provide a scientific basis to inform governments to develop climate-related policy.

Assessment reports remain a key input for the ongoing work of the UN Framework Convention on Climate Change, the secretariat for the Paris Agreement climate deal that aims to keep temperature rises under 2°C. Ahead of the deal, 188 countries signalled their support for addressing climate change by submitting climate plans for the 2020 – 2030 period. Work is now underway on a series of special reports that provide input into the sixth assessment report. These types of reports are useful because they provide a

Figure 1: Satellite data confirm annual carbon dioxide minimum above 400 ppm



Source: NASA, Vostok ice core data/J.R. Petit et al.; NOAA, Mauna Loa CO_2 record

[7] Four climate cycles in Vostok ice core. Nature volume 387, pages 359–360 (22 May 1997)

more comprehensive picture on evidence related to climate change, which is important for scenario construction.

The global consensus to act on climate change is relevant for financial stability because climate factors are multi-faceted and interdependent, and are intertwined with financing the real economy.

At a high level, the main risks associated with climate change come from moving to a low-carbon economic framework so as to halt and reverse rising GHGs, as well as the consequences of adjusting to the 1.1°C of warming already embedded in the system, and further potential temperature rises.

The crucial point from a financial stability perspective is to identify the speed and scale of how the levers to address climate change manifest throughout the wider economy, and take steps to manage the value disruption associated with these wider socio-economic impacts of the response to climate change.

Climate expectations versus economic futures

A crucial distinction when looking at climate change from a managing financial stability standpoint compared with a problem solving one, is that understanding the financial transmission mechanism of climate factors is equally important as taking a view on what needs to happen to meet a temperature goal. Understanding the financial transmission mechanism of activities related to responding to climate change is clearly very different to identifying what the future pathway of emissions should look like in order to limit temperature rises. While the questions to ask are consistent for both aims, the answers are used for different purposes. The two key questions to ask when identifying how the future will unfold when looking at climate change are;

1) **How can atmospheric concentrations of GHG emissions be reduced? (Mitigation)**

2) **What will the physical and social consequences of warmer temperatures be? (Adaptation)**

For financial stability, the answers are an input into deriving expectations around what the global and local response will be in order to set out the most-likely future. For problem solving, the answers provide insights into what should happen to deliver specific outcomes.

Establishing expectations on future pathways to address climate change, and therefore taking a view on the risks related to the future pathways, is complicated because of the inter-dependency of mitigation and adaptation.

By this we mean that the speed and scale of addressing the climate problem (i.e. mitigation) will affect how much damage is caused by warmer temperatures (i.e. adaptation). For instance, if the move to a low-carbon world happens quickly, the likelihood of disruption from changing weather norms will be reduced, but the risks related to the transition to a low-carbon world, like lower demand for high-carbon goods and services, will be higher. If no effort is made to become more energy efficient and decarbonise energy supply, the risks in relation to transitioning to a low-carbon economy are lower, but the risks related to the physical disruption potential later are higher.

Understanding the drivers for pace of change is therefore an important aspect of climate risk assessment.

The mitigation pathway

The pathway to stabilise temperatures by reducing emissions depends on a number of factors that are relevant for financial stability, including trends in socioeconomic activity and human development, current and anticipated technological progress, and regulatory drivers.

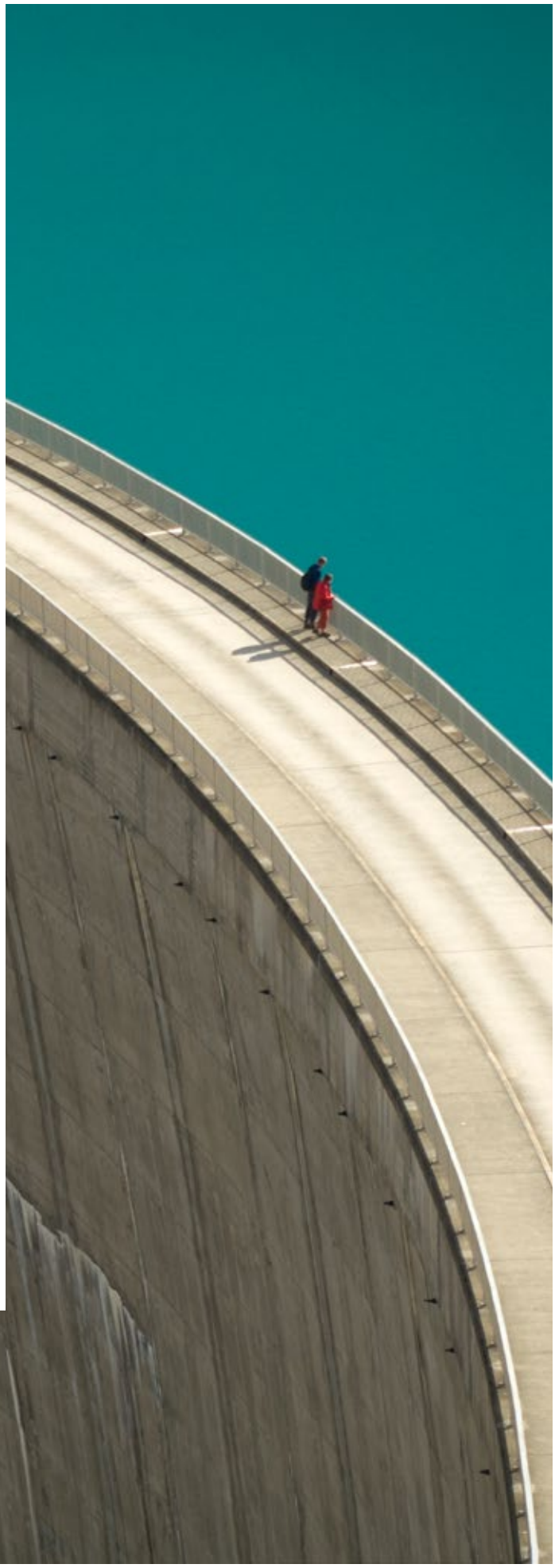
The ways to address GHGs arising from human activities are well known. They include becoming much more energy efficient per unit of economic output produced, and decarbonising the energy system. Within the energy system, the most effective starting point is to substitute away from coal as a feedstock in power provision.

GHGs are widely recognised as an externality, namely a phenomenon where the actions of economic activities affect others but the source of the activities bears neither the cost nor reaps the benefits of this wider impact. Crafting a response to climate change has long recognised that there are social as well as private costs related to the climate externality and that these lead to global welfare loss, and much work has been devoted to working out how to apply carbon pricing. While some carbon pricing schemes are in place, usually based on taxation rather than trading, they are not universal.

Nonetheless carbon pricing is an important means to change behaviour in favour of reducing CO_2 emissions and is an important input factor in thinking about future pathways.

The more difficult areas to address are energy use in industry and transport. What is not very well understood is the potential pace of energy transition. This is in part down to the market failure problem of GHGs being an externality in the first place, and in part down to the lack of a comprehensive view of solutions to decarbonise some sectors, such as cement and steel.

A key obstacle for why mitigation hasn't been more forcefully implemented historically is the externality and global co-ordination challenge, as climate change is a global problem but the effects are felt locally elsewhere, as well as the financing requirements of delivering new low-carbon infrastructure.



The adaptation pathway

Future adaptation pathways look at physical disruption linked to temperature rises associated with a given level of GHGs. Scientists produce climate scenarios which predict temperature and weather effects resulting from the current stock of GHGs and a future assumed emission path. The most recent official IPCC guidance on the emission pathways that correspond with different temperature outcomes was published in the Fifth Assessment Report in 2013 and is charted below.

From these estimates the IPCC assesses the likely localised physical effects from warmer temperatures.

These emissions trajectories and resulting climate outcomes are indispensable as an indicator for the potential temperature consequences of alternative emission pathways, but on their own do not help with the task of maintaining financial system stability.

In essence, maintaining financial stability means identifying the levers that will be used to address the climate problem and assessing to what degree they have the potential for value loss in the fixed capital stock and for impact on the real economy.

Location is an important factor for adaptation considerations. Several lower per-capita income countries are located in geographies where warmer temperatures act as a threat multiplier on existing factors such as drought or monsoon. Climate change is likely to have a large impact on living conditions, health and welfare, and on the organisation and location of economic activity.

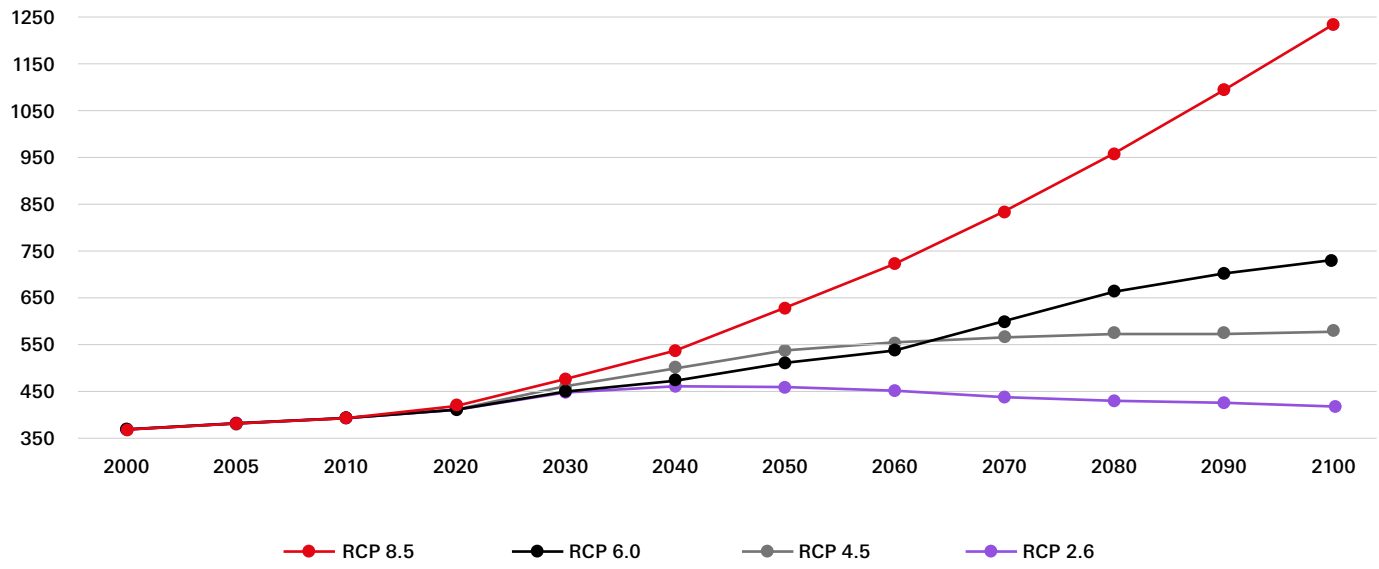
Countries will probably have to incur high costs to protect against the impacts of climate change and the poor are likely to be disproportionately affected. A recent study completed by Imperial College London pointed out that climate vulnerability has already raised the average cost of debt in a sample of developing countries by 117 basis points. This translates into USD40bn in additional interest payments over the past 10 years on government debt alone.

Figure 2: RCP temperature

AR5 Global warming increase (°C) projections

	2046-2065	2081-2100
Scenario	**Mean and** likey **range**	**Mean and** likey **range**
RCP2.6	1.0 (0.4 to 1.6)	1.0 (0.3 to 1.7)
RCP4.5	1.4 (0.9 to 2.0)	1.8 (1.1 to 2.6)
RCP6.0	1.3 (0.8 to 1.8)	2.2 (1.4 to 3.1)
RCP8.5	2.0 (1.4 to 2.6)	3.7 (2.6 to 4.8)

Figure 1: RCP CO_2 concentration



Source: IPCC Fifth Assessment Report, The Physical Science

Transition risks and mitigation pathways

Transition risks are those that surround the mitigation pathway adopted to combat climate change.

Enabling a 2°C outcome means significant change to the supply and use of energy and land over the next few decades. Given that the impact of warmer temperatures on the planet will evolve and that climate change is a market failure of unparalleled magnitude with impacts, understanding the financial transmission mechanism of transition risk is key for maintaining financial stability.

It is important to remember that the focal point for financial stability purposes is not about abrupt changes in emissions, but about shifts in the levers that drive emissions, such as policy, demand substitution, or technological innovation and their knock-on effects into financial markets and real economy financial flows, which potentially lead to the need to adapt to a different economic equilibrium. The types of risks relevant for financial stability include a loss of value for high-carbon assets as demand for them falls, a rise in unemployment as skills are made redundant and disruption to trade flows.

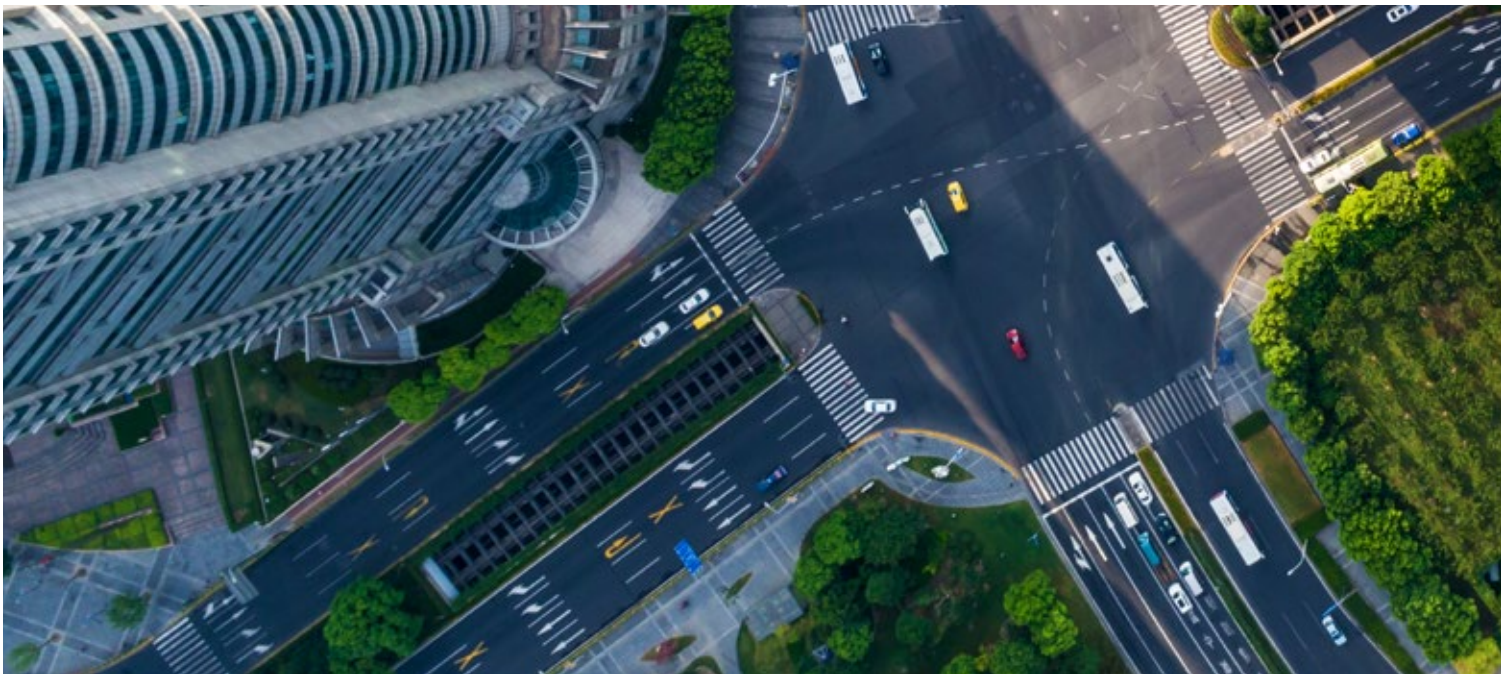
Global interconnectedness and the fact that banks are exposed to the broad economy implies that a sudden realisation of transition risk could also ripple across to other sectors and even cause contagion across countries.

For example, financial feedback loops could also exacerbate the business cycle response. As climate change is a global problem but the individual standpoint of countries makes for a local response, coordination and pace of change factors add to the complexity surrounding transition risk assessment. Countries have attempted to provide co-ordinated responses (through the European emissions trading scheme for instance), but overcoming the issue that pricing carbon often makes necessary activities more expensive as carbon prices are passed on (e.g. power provision) has been politically difficult, which in turn has led to a lack of belief from the financial system that action will be implemented. Nonetheless, previous examples of policy initiatives to change behaviour away from perceived 'bads' include taxation on tobacco and alcohol, and banning indoor smoking. As awareness of the negative effects relating to warmer temperatures grows, social acceptance of initiatives to address the problem may increase.

Physical risks and adaptation pathways

Physical risks relating to climate change can manifest both directly and indirectly, and are already being felt.

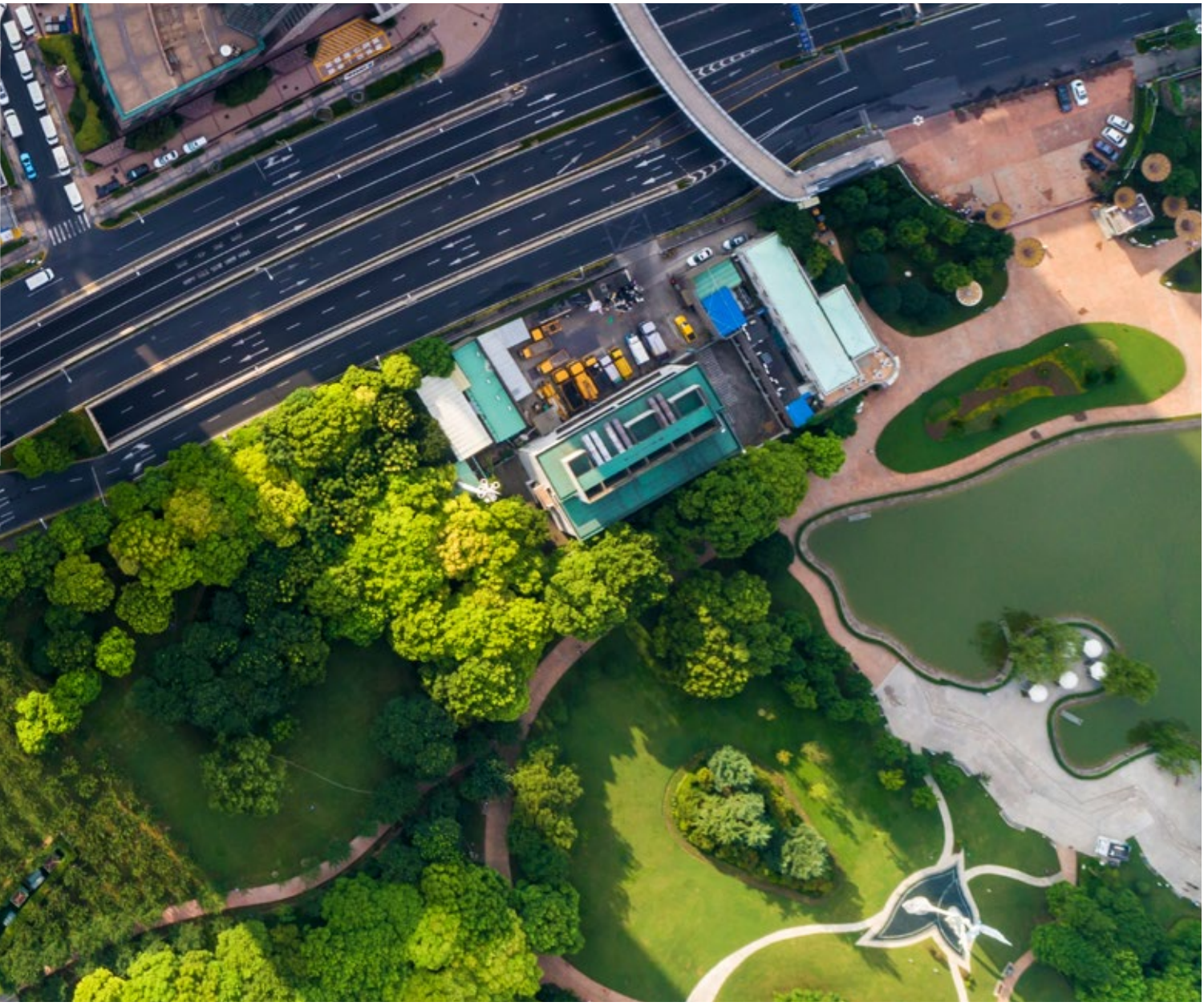
For instance frequent, and increasingly extreme flooding affecting operational facilities could directly affect a borrower's credit score, whereas indirect effects, such as citizens not being able to travel to work, impact economic growth and social systems. In some extreme cases population displacement can occur. While the effects of climate change will be felt globally, the extent of the economic impact will be unequal. First, because the impact of a changing climate on human life and economic activity is not the same everywhere (exposure) and secondly, because the capability to cope and adapt varies across nations (vulnerability). Localised disruption may also have spill over effects on other countries, if, for instance, supply chains are disrupted. In worst case scenarios population migration could occur as subsistence livelihoods are no longer viable because of climate-related factors.



Mapping the transition risk factors

Key transition risk factors	Evidence	Potential consequences
Regulatory: • Climate policies • Carbon markets	• Policy momentum • Subsidy/tariffs • Carbon price	• Erosion of stock value • Underperformance of the conventional energy stocks • Potential for stranded assets • Decline in yields • Re-pricing of the asset • Employment churn • Trade flow disruption
Demand/supply: • Demand destruction, e.g. fossil fuel, ICE vehicles • Competition from low-carbon businesses	• Change in revenues and profitability • Capex – low vs high carbon	

Source: HSBC



Uncertainty and climate factors

Uncertainty refers to fundamental unknowns and there is much work in economics on assessing risk versus uncertainty. Banks deal with uncertainty all the time, but the difference with climate, compared with geopolitical uncertainty for example, is that while the different types of risks are well known, the drivers of what will catalyse risk realisation are not fully understood.

This is problematic because generally the signals of risk form the input assumptions to help model the risk. For instance there is plenty of observational data, such as temperature readings, demonstrating that climate change is happening. The direction of travel is clear, but the specific indicators to monitor how quickly change is happening are vague.

For climate the uncertainty relates to assumptions regarding the science, for instance that a given level of CO_2 will actually align with a given temperature outcome and that the physical response is as expected, as well as socio-economic factors, such as how much fiscal income will be lost from high-carbon activities or gained from an increasing productivity from higher temperatures (e.g. agricultural yield improvement). Going forward, a resolution of uncertainty, in science for example, could lead to large-scale revision of climate change predictions and point to the need for abrupt re-scaling of the mitigation required.

Climate uncertainty leads to imprecision in estimating climate and economic outcomes. This implies not only imperfect understanding of the ability of mitigation pathways to deliver temperature outcomes, but also suggests that there is a significant possibility that the tails of the distribution are considerably fatter than currently estimated. Fat tailed climate events could not only significantly damage growth and welfare, but economic mechanisms may also be ineffective in responding appropriately. This could result in structural economic changes and banks may find themselves facing abrupt adjustment which could be severely financially disruptive.

Climate factors in risk management

The future pathways for emissions and temperatures set out by climate scientists embody both risk and uncertainty. The risk element can be quantified and captures the probabilistic nature of temperature and weather outcomes given a set of assumptions about the underlying drivers. Statements about emission pathways that lead to a 2°C or a 3°C world can therefore be calibrated into probabilities and provide a basis for the most likely future. Uncertainty refers to the possibility that the underlying assumptions don't go far enough to identify specific worst case scenarios in terms of timing and magnitude.

Both risk and uncertainty are important for financial stability management because they provide a starting point to guide future expectations.

Mapping the context and the nature of risk is important for assessing their impact. In a climate context this means identifying how the direct and indirect impacts of transition and physical risk impacts the asset base of banks both from a financial and operational perspective and sizing the extent to which climate uncertainty can disrupt these views.

Depending on the size and complexity of a bank, such risk analysis could require a considerable degree of sophistication, but it makes sense for banks to view climate-related risks as just another source of risk and subject them to similar analysis.

Traditional risk types for banks include those that affect their lending portfolios, their trading assets, operations, reputation and so on. Banks typically use their risk management framework to examine the ability of external risks to impact on these internal risk types and devise a response. Climate risks are a transverse risk for banks as transition and physical climate factors could impact on all risk types relevant for a bank unless appropriately managed. Banks will need to embed climate risks into their enterprise wide risk management framework and examine their standard risk types through a climate lens.

Source: HSBC Centre of Sustainable Finance

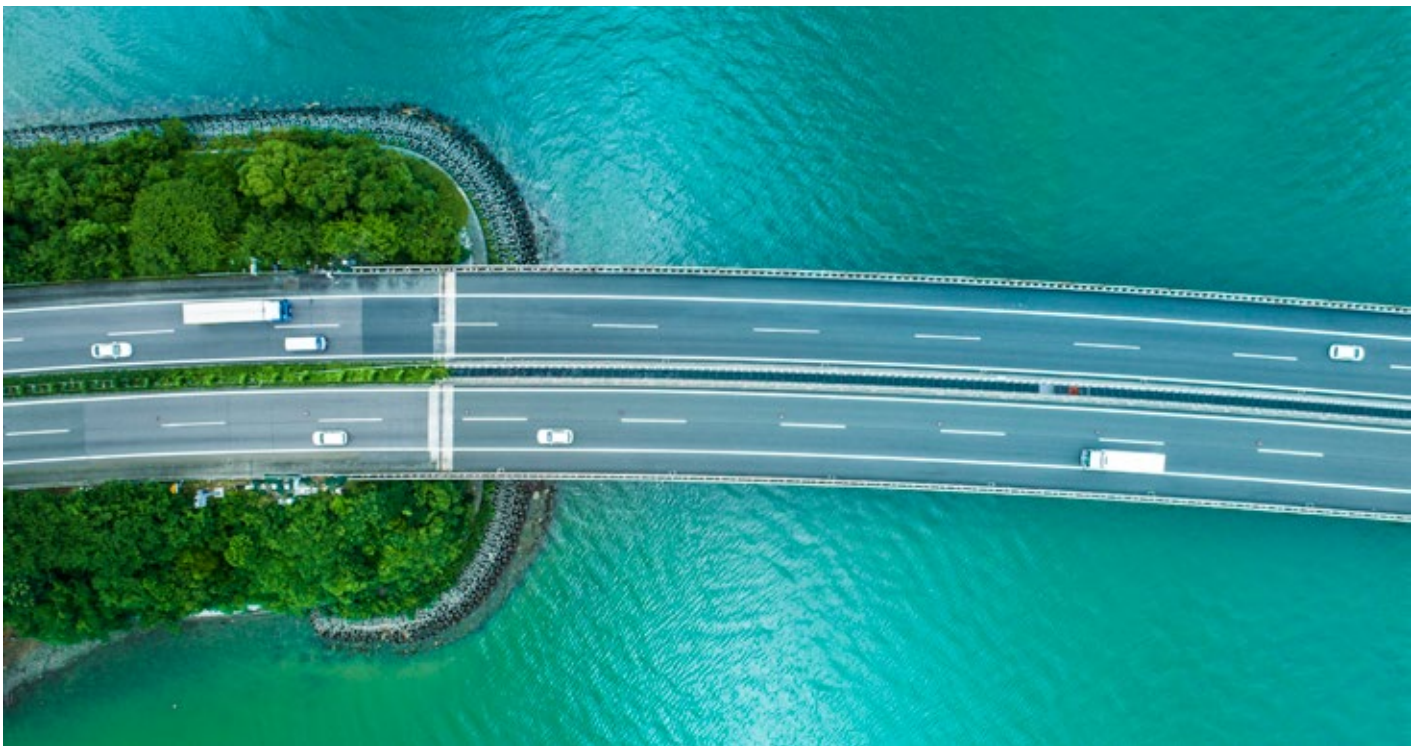
In existing frameworks risks are contextualised by nature, as well as type. For macro-financial risks the following categories could be used.

- **Cyclical:** a shock that dies out with economic growth reverting to a stable trend rate and with fundamental economic relationships unaltered, e.g. temporary oil outages;
- **Structural:** a risk that has the capacity to fundamentally alter an established economic structure including inter-relationships between economic agents, the location of industry, the quality of economic and political institutions, the through-the-cycle perceived level of riskiness of an economy and so on. This can exert permanent effects on rates of growth, the performance of industries, the level of savings and investment in an economy, amongst others, e.g. secular stagnation;
- **Idiosyncratic:** this is a risk that has a narrow effect, usually confined to a specific sector or at most economy wide, e.g. company profit warning; and
- **Systemic:** this is a risk that has the potential to have far-reaching effects. It is a risk, which if it crystallises, can spread across sectors, regions or even affect the global economy. A risk may even cross-trigger others, e.g. political instability.

Climate risks can be any of the above. Different manifestations on climate and other risks, will map to different risk classifications. Understanding the nature of climate risk helps banks map the climate factors to risk types, e.g. country incentives to increase demand for electric vehicles could be cyclical in nature, whereas a widespread adoption of high-carbon prices to shift demand away from high-carbon activities could be systemic. Banks can use existing risk management frameworks to monitor the evolution of these factors and take appropriate action.

To conclude, the way the world addresses the climate change problem is relevant for financial stability because the main solutions to climate change – namely becoming more carbon and energy efficient and decarbonising the energy system – are intertwined with financial flows and the real economy.

It makes sense for climate risk to be integrated into existing enterprise-wide risk management frameworks. Emission and temperature forecasts are helpful in providing overall guidance on the direction of travel on climate, but are not useful on their own for financial stability management. The relevant point for banks when helping to facilitate financial stability is to identify the financial transmission mechanism of climate factors. This is to assess the potential routes that would lead to crystallisation of widespread transition and physical risks. We look at the use of scenario planning to model and manage risk in the next chapter.



Climate risk assessment: using scenarios

Scenarios set out a range of potential futures

Banks already use extensive scenario analysis to manage and monitor a variety of risk factors.

In order for banks to make climate-related risk assessments relevant to their strategy, profitability and capital adequacy both climate science and economics need to be brought into the scenario framework.

Banks routinely assess individual risk impact and potential contagion effects by identifying scenarios.

At its most basic, a scenario is a coherent set of projections that is the result of set input of assumptions. Scenarios can be qualitative or quantitative, may focus on a single or multiple risks, may capture the bank's view of the most likely outcome of a risk or set of risks, or may provide pathways for less-likely or even tail outcomes. Most scenarios are focused on the macro-financial impact as this affects income, funding, liquidity, asset values and possibility of default.

These scenarios are typically quantitative and take the form of a set of macro-financial variables projected over the horizon of interest, e.g. a planning horizon, usually accompanied by a narrative that motivates the scenario. Scenarios generally project a set of conventional macro-financial indicators, e.g. GDP, which users know and trust, either because they interact well with downstream models that predict revenues and/or losses or because they provide the necessary intuition for users to be able to qualitatively gauge business implications.

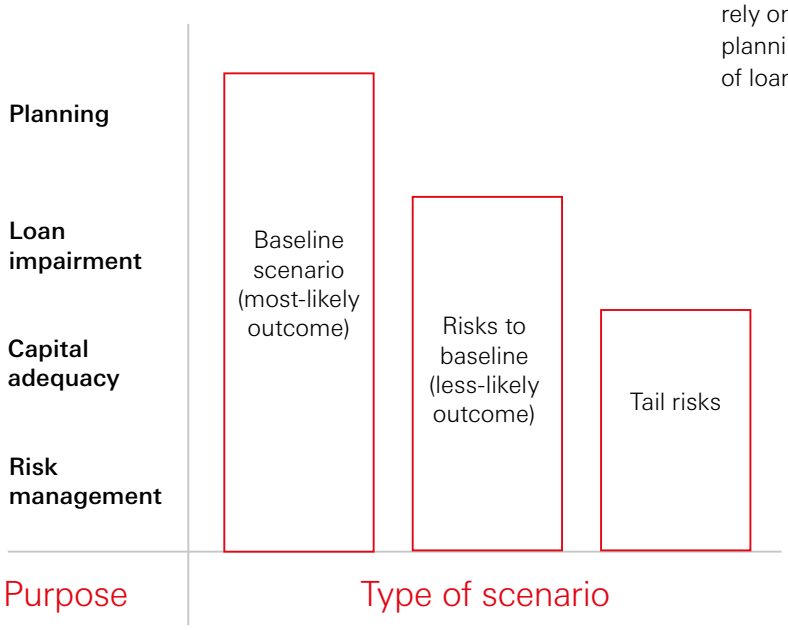
As banks have economy-wide exposure, they seek to use the macro-financial indicators that correlate most strongly with their business. For large banks this can result in creating consistent projections for several hundred variables. Typically, the parts of the economy covered include:

- **Real economic activity**: GDP growth is usually an important driver for a bank, but sub-components of GDP and other aspects of activity may also be important, e.g. trade, consumption, industrial production etc;
- **Monetary and fiscal policy**. Central bank monetary policy and fiscal policy variables will usually feature in a scenario as well as monetary aggregates; and
- **Consumer and asset prices.** Consumer price inflation as well as growth in different financial asset prices will drive both business growth and losses. Clearly, banks also think about the behaviour of equity prices, interest rates, commodity prices and house prices in any scenario.

In addition, bank-wide scenarios attempt to capture the full financial transmission mechanism of risks including spillover and contagion effects.

Banks are generally used to creating scenarios that either preserve historical patterns of behaviour and interactions or modify these assumptions and "explore the unknown".

Enterprise wide macro-financial scenarios provide the most comprehensive assessments of the macro-financial environment. These scenarios describe the macro-financial environment applicable to all parts of the business under a consistent set of assumptions. Reliance on enterprise wide scenarios has greatly increased since the Global Financial Crisis of 2008-09 as financial regulators worldwide have implemented stress testing regimes. In addition to stress testing, banks also rely on such comprehensive forward looking assessments for planning purposes and more recently, to record the impairment of loans in financial statements under IFRS9 requirements.



Applying a climate lens to scenario thinking now does not provide assurance that a negative financial outcome can be avoided. Clearly, there are no guarantees that the most severe scenarios considered so far actually turn out to be the most catastrophic case, and, as already mentioned, there is also uncertainty on the relationships between variables. Nonetheless, ignoring the climate problem is not a viable option. Initiatives that promote more transparency and disclosure on climate risks are in place, such as the recommendations of the Task Force on Climate Related Financial Disclosure (TCFD). These are currently voluntary, but they provide a useful framework for banks' own development of scenarios and, potentially, for regulators if they wished to formalise a climate approach.

Enterprise-wide scenarios are comprehensive, consistent and global, and banks already have systems and processes in place to evaluate the impacts of scenarios considered to date such as regulatory scenario, and can deploy systems and processes for alternative uses such as a climate change scenario. Scenarios are also often created on a smaller scale either to examine more localised, idiosyncratic risks or to limit the impact analysis on an operating entity, business segment or portfolio. This multitude of scenarios provides alternative views of the performance and resilience of the business at different levels of granularity and for different risk types.

Such scenarios are not always macro-financial in nature. For instance, operational risk scenarios typically define non macro-financial events such as service outages or cybercrime.

Scenarios are useful to provide a consistent way to explore different states of the world, with associated likelihood as a means to investigating the robustness of a bank's operating model.

The most-likely outcome is the scenario a bank constructs planning around and is a central scenario that is a reference point for analysis on less-likely outcomes. Depending on the size and complexity of a bank, creating the central scenario can be an extensive and non-trivial exercise. A bank will need to assess market conditions at a sufficient level of granularity over its planning horizon in order to be able to quantitatively assess its ability to deliver on its business strategy under the conditions laid out in the central scenario. A central scenario usually articulates a bank's belief in the most likely view of the future, which is different to a reference scenario that embodies a desirable outcome.

The last point is critically important when thinking about climate change scenarios: a central scenario is not necessarily a best-case or most desirable, or most optimistic scenario.

For financial stability, it is important for banks to identify scenarios for the financial transmission mechanism of what they expect to happen to address climate change, not what they think should be done to fix the problem.

Of course, understanding what should happen to facilitate a 2°C world is critically important in order to form a view on what the most likely future outcome will be. However, it may not be the central scenario.

Scenario analysis is a powerful tool for exploring a range of less likely outcomes.

Reiterating points of principle often made by regulatory bodies and practitioners, scenarios exploring less-likely outcomes and tail risks are most useful when they are consistent, differentiated, relevant and challenging. A baseline scenario is an estimate, and at any point in time there will be an infinite number of future outcomes around any baseline assessment, though possibly with limited variation. This occurs not only because any number of different outcomes could be consistent with one set of assumptions about the future but also (and more importantly) because risks can crystallise in different ways.

Scenarios that explore this range of outcomes are valuable if they contribute to a greater understanding of this variation and help identify outcomes associated with clearly different states of the world. Some of these outcomes and associated states of the world will be much less likely than others and successful scenario analysis will probe these tail risks and articulate plausible channels of transmission. Exploring a range of outcomes is crucial to assessing the sensitivity of a business strategy to different states of the world, evaluating robustness of the capital plan and in actively managing risk, even if the full range of tail risks is not incorporated.

Scenarios are the only way to explore risks that could fundamentally alter economic structures.

Banks are at times faced with having to understand events or risks that have little or no precedent and which have the capacity to fundamentally alter economic structures.

Typical examples include risks with a geo-political flavour (e.g. escalating military action), but they also arise from changing patterns of population, (e.g. aging population) country shifts in the location of industry or the impact of new technology (e.g. artificial intelligence). Analysis of past historical relationships may be insufficient given the lack of experience, fundamental assumptions about the nature of economic inter-relationships may be wrong and the knock-on effects from the crystallisation of such risks (especially the ability to cross-trigger risks) may be difficult to see.

Many such risks are likely to be transverse, in the way that climate risks are, as they cut across the risk types relevant to a bank and require multi-level impact assessment.

In these situations, scenarios serve a powerful purpose which is to develop a cross-functional or even an industry dialogue to develop appropriate narratives to express the collective opinion diversity. We provide an example of scenario setting for a low-growth environment below.

Case Study

Developing scenarios for a sustained low-growth environment

The risk of entrenched lower growth in major economies has concerned central banks for a number of years. The Bank of England tested the resilience of the UK financial system to this as part of its annual stress testing cycle in 2017.

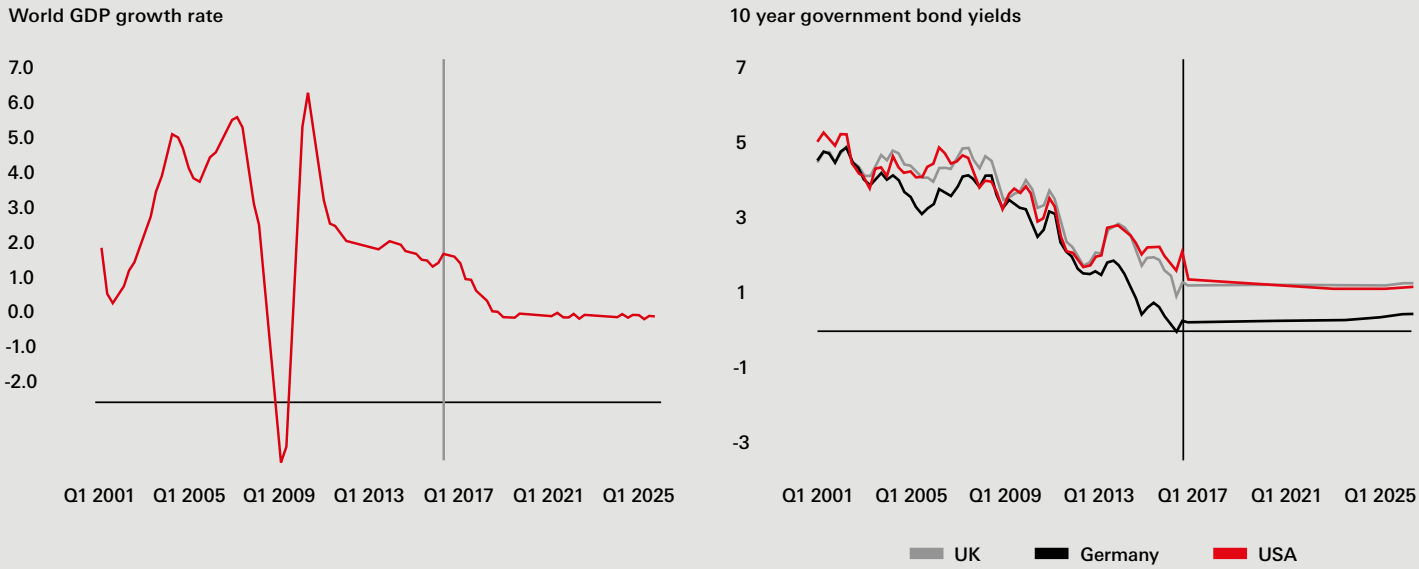
Risk analysis: Secular stagnation leads to lower growth. Lower productivity, rising inequality, low or even negative interest rates and lower wage growth rates were identified as the risk manifestation. This affects financial institutions through profitability challenges in an extended low-growth environment.

Key factors: Secular stagnation is a structural risk which leads to scenarios of long-run growth and inflation rates being meaningfully lower than historical observations. There is no obvious key event that would tip the world into secular stagnation though any number of risks that result in lower growth could reinforce the phenomenon. Unlike many other macro-financial risks which impact financial markets, secular stagnation does not provide an obvious signal that leads to a re-set of asset prices.

The underlying assumptions to assess future states under secular stagnation include declining productivity, aging demographics and lower investment. Monetary and fiscal policy cannot easily offset its effects and the risk plays out over a long period of time. Secular stagnation is a gradual journey to long-run economic equilibrium characterised by lower growth, lower productivity and interest rates.

Macro financial transmission: The risk transmits into lower consumption, investment, trade and interest rates. Lower rates of growth in Advanced Economies transmit to Emerging Markets which fail to catch up. Lower interest rates reduce returns available to savers and investors.

Re-calibration: Secular stagnation is sometimes characterised as an "alternative baseline view", in the sense that it reflects a switch to permanently changed economic equilibrium, as opposed to a shock whose effects are mainly temporary. A number of different factors that lead to a recalibration of central expectations should also lead to a reassessment of the conditions under which lower growth becomes more persistent.



World GDP growth and interest rates in the Bank of England's 2017 secular stagnation stress test.

Source: Bank of England

Scenario lifecycles have four components

Scenarios follow a dynamic lifecycle with continual re-assessment of risks and re-calibration from the time the risk is identified. The key steps in the process are:

1. **Risk identification and analysis.** Emerging risks tend to be poorly defined and require exploratory analysis. The purpose of such analysis is to develop a high-level narrative of the risk that captures the key dimensions of it, e.g. cyclical, structural, idiosyncratic or systemic, and views of the channels through which the risk would propagate through the macro-financial system. The risk analysis stage would also capture the key events that could crystallise the risk.
2. **Key events and primary shocks.** The risk usually manifests through specific channels, such as the variables that move first in response to a key event. Determining the magnitude of the initial shock helps to frame the overall impact. Typical channels through which risks transmit include expectations of market participants and are reflected in futures markets, which in turn affect financial asset prices and the risk premium attached to assets.
3. **Macro-financial transmission.** This is the engine of scenario analysis. Macro-financial transmission captures the propagation of the shock through the economic system. Scenarios address a range of technical issues including timeline, spillover effects and reliance on historical relationships.
4. **Recalibration.** Scenarios are typically refreshed as risks evolve and expectations change. Scenarios conceived as risks emerge may look very different compared to scenarios developed as risks mature. Such periodic re-measurement is built into the lifecycle of a risk management and means that scenarios may go through a number of iterations while a risk remains relevant.

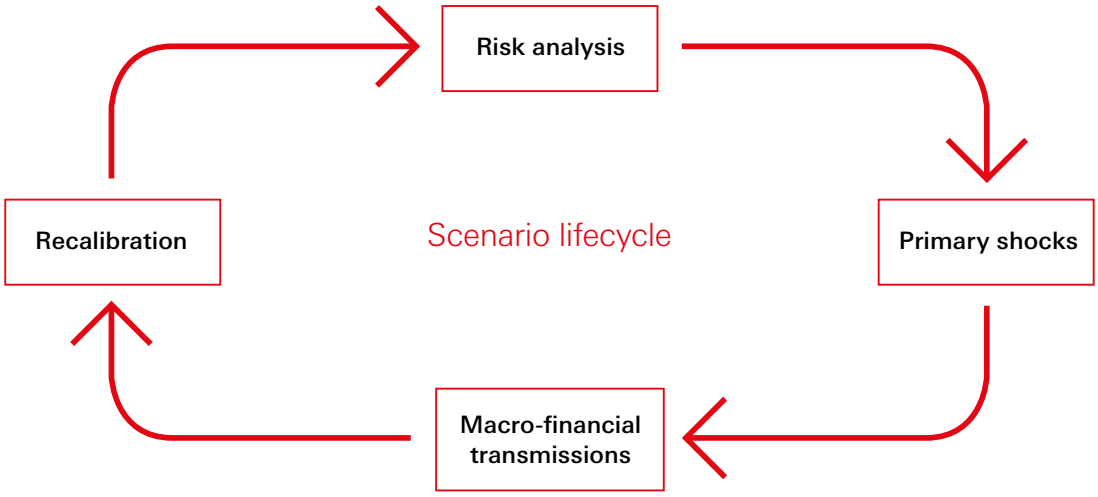
Applying climate to the scenario lifecycle

The complex and evolving nature of climate risks implies that banks will need to rely extensively on scenario analysis to think through the transmission of climate risks to the key risk factors relevant to them and use the insights provided by such analysis to consider their climate strategy.

The objective of climate integration to risk management for a bank is to understand the resilience of strategy, profitability and capital adequacy under different manifestations of climate risks. This in turn helps regulators manage system wide financial stability.

A financial sector climate scenario needs to assess the economic consequences of climate-related policies and other levers that are designed to achieve certain mitigation and adaptation goals. The focus of this type of analysis moves away from temperature outcomes to climate policies, implementation possibilities, the realised consequences of climate change and their economic consequences.

The aim is to understand the potential for asset value disruption associated with climate factors, ultimately so as to facilitate an assessment of system-wide financial stability and a bank's strategy.



In the previous chapter we pointed out that emission trajectories and resulting climate outcomes on their own do not help with the task of maintaining financial system stability. This does not mean they are not useful. In fact, they provide an important checkpoint for assessing the state of the world in terms of energy configuration and emissions trajectories compared with expectations.

Below we compare the differences of climate scientist and energy economist modelling. In addition, information from these scenarios is useful for defining the types of risks related to transitioning to a low-carbon future and managing the impact of warmer temperatures.

Constructing meaningful scenarios for banks means thinking about what the real economy response mechanism will be on action against climate change as well as the resilience of economies to physical risks. The climate scientist looks at temperature outcomes based on the GHG stock today and alternative future energy transition pathways. This is used at the policy level to determine country climate plans and implement domestic legislation to achieve targets. Corporates also use the scientific guidance to set out climate commitments. Banks manage risks by anticipating the most likely response to policy aims and by looking at other signals of climate response, e.g. technology innovation, or the cost differential between fossil fuels and renewable sources.

Risk Analysis

In the previous chapter we summarised the types of risks associated with transitioning to a low-carbon economy and adjusting to higher temperatures. Below we highlight the broader factors to consider when creating the risk narrative and identifying potential events and signals that trigger risk.

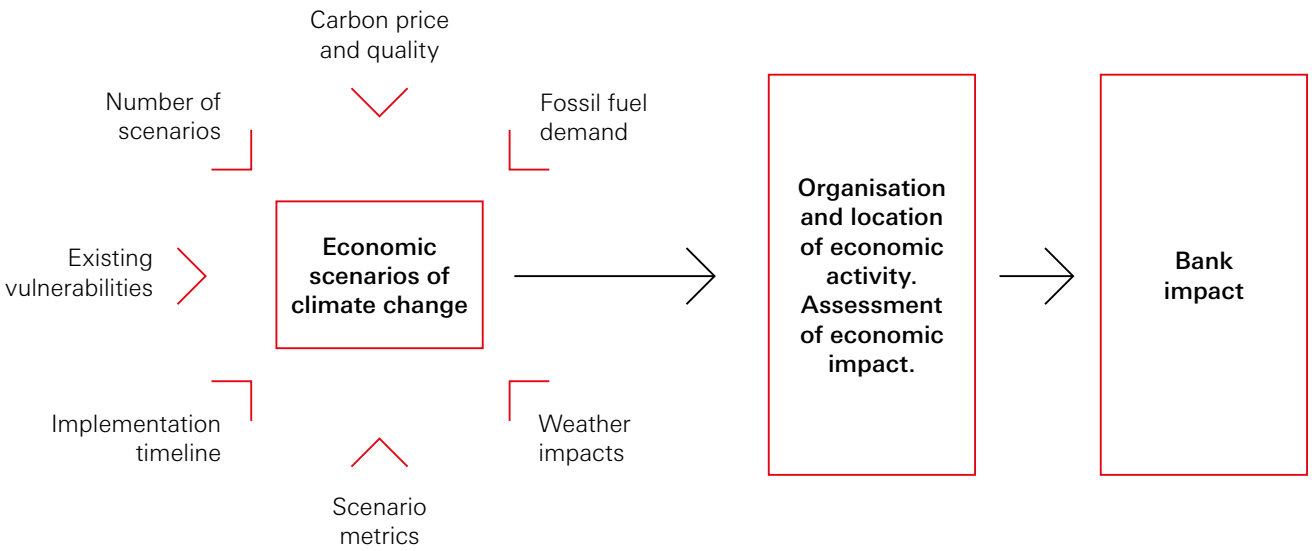
Comparing science and energy scenarios

Science: a climate science scenario aims to predict temperature outcomes as a result of socio-economic activity and associated GHG emissions, usually over a long time period. The temperature outcome is in turn consistent with a range of climate effects that impact human activity. The purpose is to provide guidance on range of climate interventions necessary to achieve a desired temperature outcome. Climate scientists tend to take the complete planetary ecosystem scope of greenhouse gases into account when assessing the future (e.g. CO_2 from deforestation and land use change), as well as industrial activity.

Example scenario providers: IPCC, Potsdam Institute

Energy: an energy scenario aims to set out GHG emission profiles according to a set of input assumptions for energy supply and demand for power, transport, industry and heat use. These can be standalone (i.e. do not have a link to temperatures), or can be reverse engineered to demonstrate how energy could evolve to meet a 2°C goal.

Example scenario providers: International Energy Agency, oil and gas companies



Ultimately, banks are trying to understand the transmission of climate risks through the financial system to more conventional risk events such as corporate/sovereign default, asset market corrections etc. and use historical experience of such events to guide assessment of the probability, the likely severity and possible contagion impact of climate risks as they transmit through the financial system.

Climate science suggests that the temperature consequences of an increasing stock of GHGs will be felt over a reasonably long time period, but risk management and planning typically operates over a 3-5 year time period. However, transition risk factors could play out within this time frame, if abrupt technological and/or regulatory change facilitates a structural shift in industry.

Differing levels of ambition on Paris Agreement implementation both over time and across countries make very near-term mitigation pathways difficult to describe. As we pointed out earlier, less mitigation now will require more aggressive mitigation in the future to get emissions aligned with a 2°C future, and suggests higher temperature rises. Taking a view on the global commitment to the long-term view (i.e. the delivery of the Paris Agreement) is part of determining the most likely outcome for scenario planning.

Key events and primary shocks

Identifying the likely key events and shock triggers for climate risk crystallisation is currently problematic because of limited data, limited data frequency if data is recorded, and a lack of understanding of the correlation of scientific observations and measurements with real economy impacts. In addition, physical risks can manifest quickly with little warning but create large scale disruption, e.g. extreme rain leading to landslides. The types of events that would trigger a risk are new scientific evidence, or changes to policy. We expect much work to focus on data gathering and knowledge building.

Macro financial-transmission considerations

Several factors relevant for climate scenario setting are not commonly used in standard macro financial scenario setting, such as energy system economics, growth distribution and price volatility, country comparative advantage, and weather related economic disruption. Climate scenarios may not have direct GDP growth considerations, but instead have other outcomes that are relevant to banks relating to demographics and income distribution (e.g. pensions and mortgages).

Energy system architecture: A key component for 2°C delivery is transitioning the energy system away from high-carbon sources. This can be enabled by demand and supply side interventions, but there is a large number of different end state energy system configurations that are consistent with a 2°C world.

Energy supply and demand are not factors that are currently given specific consideration by banks in scenarios constructed for planning, profitability analysis or financial stability but will need to be made explicit for incorporating climate. Energy supply scenarios already exist, and banks may wish to incorporate these directly rather than develop their own. However, existing energy scenarios may not be granular enough for specific purposes. For instance, banks might want to consider transition risk factors for particular countries or sectors where data may not be widely available. In addition, assumptions about the rate of technological progress are likely to be key factors for setting most likely outcomes. In a post-carbon world, historical country competitive strengths may no longer be valid.

In addition, a further complication is that energy reconfiguration could occur without growth effects, but instead could lead to wealth re-allocation.

For instance, policy that forces substitution of coal to renewables in power provision would not have a direct GDP impact, because power provision remains in place to service the economy, but the associated job loss in the coal value chain could result in an income redistribution effect. Banks will need to develop a class of scenarios that examine re-allocation effects while acknowledging that this re-allocation could be global, including across countries, and systemic.

Scenarios of re-allocation will require specific expertise and are likely to be developed separately from standard growth scenarios. In addition, some scenarios involving physical risks could be wealth re-distributive in nature especially where risks are insured, damage is localised and economies have sufficient capacity to respond to the incidence of such risks and also to adapt to changing physical conditions. More work on establishing how a just transition to a low-carbon economy can be achieved is critical. Responses to climate change are also interlinked with sustainable development goals.

Growth and price volatility: Climate-related disruptive effects might lead to an increase in both growth and price volatility. Growth volatility could have spill over effects for attracting investment flows. Price volatility, particularly for food, could spill over into civil unrest in extreme cases. This is difficult to capture in scenario planning.

Comparative advantage: A lot of climate market and non-market influences transmit through productivity and comparative advantage factors. Weather-related events may affect this comparative advantage. For example, urban areas with poor infrastructure getting too hot may lead to business disruption, labour force moving away and health factors. This can lead to locational shifts in industry and changes in the organisation of economic activity.

Assessing comparative advantage is also relevant for mitigation strategies. Countries with a first mover advantage on innovation and technology and enforcement of emission standards, e.g. development of fuel cells, hydrogen technology, and incorporating renewable sources of energy, will naturally gain market share. This could lead to new markets and wider trade flows for these economies. On the flip side however, countries could back the wrong technology.

Sovereign risk: Changes to comparative advantage driven by climate change may impact adversely on sovereigns through a drain on fiscal balances and an increase in debt, which could be driven by transition and physical factors. Fiscal balances for sovereigns reliant on fossil fuel revenues may find primary balances under pressure, and/or governments might need to earmark funds for the direct costs of combating weather events and/or building in resilient infrastructure. This could directly affect credit-worthiness.

Weather linked economic activities: Much economic activity is weather dependent, e.g. agriculture and tourism. These activities may not be high value add as a contribution to overall GDP, but they can be critical for local livelihoods. These factors are easy to identify but tricky to pin down at a localised level, thus making the economic impact of them hard to tease out. This could ultimately lead to socio-economic outcomes, like population migration.

Financial feedback loop: Understanding feedback loops is a core component of scenario setting, but for climate it is unclear how feedback loops might transmit. This is linked to the current knowledge gaps around levers, data signals and types of events that trigger climate risks.

Recalibration: Uncertainty on the financial transmission mechanism of climate change is due to uncertainty around climate science and the reality that while the low-carbon transition strategies for power are relatively well understood and can be practically implemented, the spectrum of risk type, pace of change and scale of mitigation action across transport, industry and buildings is immense. Picking a most likely outcome will clearly be wrong. Thus frequent re-calibration is an essential key feature of climate scenario analysis while data availability and advanced financial and econometric modelling is developed.

This approach is not significantly different to those taken for other large macro-financial risks faced by banks. These will also typically be subject to close monitoring and re-assessment. Banks have the risk governance framework in place to monitor and assess risks. From a recalibration perspective this means creating a set of key metrics to monitor climate risks and understanding the economics and geo-politics of climate mitigation implementation.

Potential factors prompting a re-evaluation of climate risks and a refresh of scenarios are listed below. These re-calibration prompts could result in a re-assessment of views on carbon price and the GHG emissions. They may also require a re-assessment of growth and welfare impacts.

These factors are difficult to use as distinct trigger point signals for risk modelling however, because interpretation of their emphasis as a driver for climate action is mainly subjective.

- Scientific predictions are likely to change
- Country commitment to the aims of Paris Agreement will likely vary with economic cycles
- Domestic regulatory drivers will likely vary with political cycles
- Corporate and investor action will likely vary with economic cycles
- Momentum on carbon pricing
- Comparative energy pricing effects in favour of low carbon to spur technological and global economic activity
- Spill over effects of physical and transition risk into other risk types (e.g. unemployment) are unknown

Despite all these difficulties it makes sense for banks to become alert to the types of factors that could create structural economic shifts.

Conclusions and key recommendations

In this report we have set out the areas to consider for fully integrating a climate approach to scenario planning for financial stability purposes. The obstacles for integration currently fit mainly into two categories.

1. A lack of understanding on how the levers to address greenhouse gases in the energy system will translate into macro financial economic variables, as well as how the physical factors will manifest throughout the economy.
2. A lack of sufficiently frequent and granular data in areas like emissions, carbon pricing and physical observations to track the timing, speed and scale of response to climate factors

As time goes on we expect that a bank's most-likely scenario will automatically factor in the transmission from climate risks to growth, because as ongoing climate change affects the location of economic activity and impacts the level and volatility of growth, growth forecasts and other macroeconomic indicators will automatically feature cyclical and structural elements that incorporate the economic effects of climate change.

Similarly, forecasts will start to reflect a re-configuration of the carbon system to the extent that this changes trade patterns (e.g. fossil fuel imports and exports) and growth (e.g. low-carbon industrial growth). However, being alert to these changes now means taking an anticipatory stance rather than adopting a wait and see attitude. Our current assessment is that conventional macro-financial economic indicators do not provide sufficient information for banks to understand fully the evolution and potential impact of climate risks.

We also pointed out that banks typically associate scenario analysis with visible macro-financial effects, and currently many scenario outcomes are focused on growth. This will not always be the case for climate assessments where energy reconfiguration could occur without growth effects, but instead could lead to wealth re-allocation.

Physical and transition risks may both have greatest effect at the sector level rather than in aggregate. This micro vs macro distinction is important to draw out. An energy transition to a low-carbon economy may lead to stranded assets in some sectors or structural decline in certain technologies without having a noticeable aggregate impact on growth.

It is also possible that physical risks manifest economically through negative effects on the vulnerable in society, such as by increases in income inequality or through falls in agricultural yields. This may have an immediate impact on the quality of growth or the development trajectory of a country but it may take a longer period of time before the effects are obvious in indicators such as GDP growth.

A slower pace of transition may have implications for long-run growth as it increases the probability of stronger temperature increases in the longer term and may even have short-term welfare consequences e.g. through an increase in local pollution levels, but these consequences would not necessarily be visible in headline macroeconomic indicators.

To understand the impact on such effects on financial stability, banks should gain a deeper understanding of the direct and indirect effects of climate change on their portfolio and step up external engagement to deepen knowledge of climate policy and the interaction with financial stability. It makes sense to form the building blocks towards an enterprise wide approach by capturing climate risks on a portfolio basis, for instance, by incorporating climate risks into standard credit analysis.

Engagement at the national and supranational level with policy making bodies and industry forums is important for furthering understanding of how regulatory drivers and further carbon pricing might play out (especially at the sectoral level). This is important because it helps create a scenario narrative that takes the subjective nature of policy goals into account. It is also important to engage early with banking supervisors and central banks to understand the evolution of thinking around financial stability. This would cover a number of issues such as climate stress testing for capital adequacy, regulatory views of banking exposures to fossil fuel and high-carbon consumption sectors. Thirdly, sector level engagement is important to understand technological development and the possibility of technological disruption.

A useful step forward would be for the banking industry to provide ideas on the types of data sets and metrics that would be useful for tracking and monitoring progress on the timing, speed and scale of low-carbon economic transition. This could cover areas like more granular carbon intensity metrics at a country and sector level, and could be provided by national statistics offices. In addition, more widespread disclosure of emissions at the corporate level is equally important and we expect the aims of the Task-Force on Climate related Financial Disclosure (TCFD) to help with this. We provide three recommendations for banks to get started.

Recommendation 1:

Banks should start mapping the risks related to efforts to halt climate change and adapt to the consequences of warmer temperatures. Climate risks are relevant across all the existing risk types that banks face. Banks should use existing scenario methodologies to start identifying the potential economic and financial transmission response to climate factors. Climate risk consequences may be indirectly linked to economic growth, and might be mainly income redistributive in nature. To get started, banks can gain initial insights from conducting sector based portfolio analysis

Recommendation 2:

Banks should engage with a wide range of national and supranational policymakers to better understand the levers that could be used to achieve climate goals. Further dialogue would help to close the current knowledge gap on pinpointing the macro-financial transmission risks associated with Greenhouse Gas emissions and temperature pathways.

Recommendation 3:

Banks should become actively engaged in identifying the different channels of risk transmission mechanisms by interacting with cross-discipline subject matter experts such as energy economists, environmental scientists, as well as other academics and associations furthering greenhouse gas accounting methodologies.

Glossary

IPCC

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988. Its main objective was to assess scientific, technical and socio-economic information relevant to the understanding of human induced climate change, potential impacts of climate change and options for mitigation and adaptation.

Fat tails

A fat-tailed probability distribution displays properties of skewness or kurtosis. These are distributions where extreme events e.g. those that lie more than 3 standard deviations from the mean have a higher probability of occurrence than in a symmetric, normal "bell-shaped" distribution. In finance, this is often seen as undesirable as extreme events are associated with higher loss.

Fifth Assessment Report (AR5)

Climate Assessment Reports have been issued by the IPCC in 1990, 1995, 2001, 2007 and 2014. Each Assessment Report synthesises the latest climate research findings produced by climate experts in peer-reviewed scientific publications. The Fifth Assessment Report (AR5) issued in 2014 covered the scientific basis of climate change and assessed the scientific, technical, environmental, economic and social aspects of vulnerability to climate change. It also assessed various options mitigating climate change through limiting or preventing greenhouse gas emissions and taking actions to remove them from the atmosphere.

GDP

Gross Domestic Product is the most widely used measure of the value of economic activity in a country over a period of time (typically a quarter or a year).

Paris Agreement

The Paris Agreement adopted by 195 countries in December 2015, is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC). Signatories to the Paris Agreement accept a long term goal to keep the increase in global average temperature to well below 2°C above pre-industrial levels.

RCP

Representative Concentration Pathways (RCPs) are four greenhouse gas concentration trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014

About the Centre of Sustainable Finance

"Each and every one of us has a stake in developing a sustainable economic system. It is the combined responsibility of all players in society to respond to climate change, rapid technological innovation and continuing globalisation to secure a prosperous future. Yet addressing these changing forces is by no means straightforward. More work is needed to provide the financial system with the right toolkit to solve sustainability challenges.

Working with internal and external partners, this central think tank is uniquely positioned to lead and shape the debate. We will promote the sustainable finance agenda using our global network which covers the world's largest and fastest growing trade corridors and economic zones. We can provide the connections needed to foster sustainable growth across borders and geographies. We aim to mobilise the capital flows needed to address the world's major sustainability challenges."

Zoë Knight, Group Head,
HSBC Centre of Sustainable Finance

"For more than a decade, HSBC has been at the forefront of the sustainable finance market. In November 2017, HSBC made five sustainable finance pledges. We committed to provide USD100 billion of sustainable financing and investment by 2025, source 100 per cent of electricity from renewable sources by 2030, reduce our exposure to thermal coal and actively manage the transition path for other high carbon sectors, adopt the recommendations of the task force on climate related financial disclosures to improve transparency, as well as leading and shaping the debate around sustainable finance and investment.

Taken together, these commitments reflect the scale of the challenge of delivering the Paris Agreement and UN Sustainable Development Goals. They also demonstrate the heights of our ambition to be a leading global partner to the public and private sectors in the transition to a low-carbon economy."

Daniel Klier, Group Head of Strategy and
Global Head of Sustainable Finance

www.sustainablefinance.hsbc.com

HSBC