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# Time to act on climate risks

Climate change is now a mainstream financial risk. The hour is apposite for bankers to draw up their course of action

October 2020

riSE
Risk Intelligence and Solutions Ecosystem

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# Contents

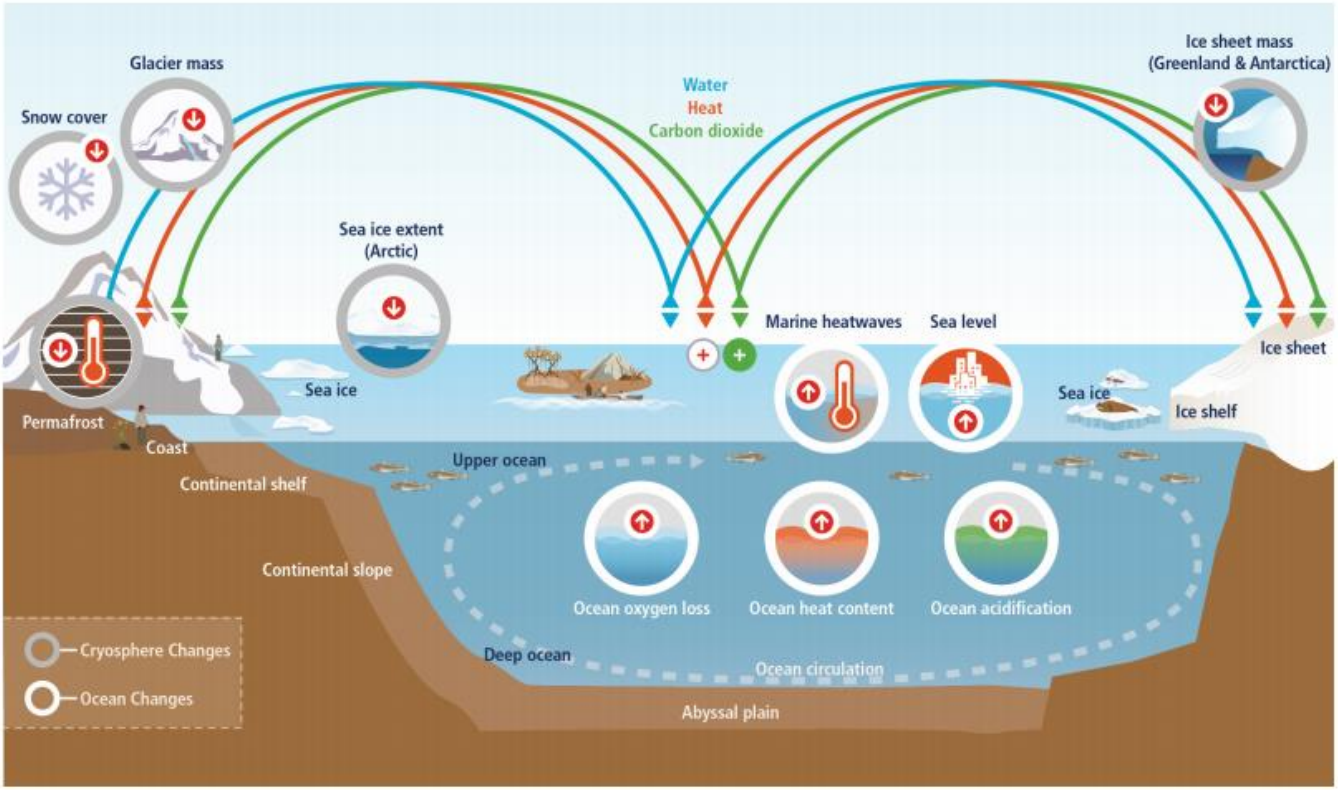
# Executive summary

- **Climate risk is now a mainstream financial risk**: Rising frequency and severity of natural disasters (for e.g., wildfires in California, Brazil and Australia), extreme weather events (e.g., supply chain disruption in 2018 in Germany following the low water levels in the Rhine river), and policy action to mitigate climate change (e.g., the ban on diesel cars in select major cities) have led to severe climate-related stress in major companies - a case in point being the high profile Chapter 11 filing of the US utility firm Pacific Gas and Electric (PG&E) in 2018. This report provides an overview of the key causes of climate change. It also expounds its growing impact on property and financial losses that the banking industry might have to bear directly or indirectly, calls out the vulnerable industries, risks and opportunities for banks in climate change mitigation, and related transition financing.
- **Literature on the macro-financial impact of climate risk is expanding**: Several institutional bodies such as the Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA), and the Network for Greening the Financial System (NGFS) have published significant research over the past 5-10 years, which have helped to improve the understanding of interconnectedness between climate system changes, and the trickledown effect on various industries and the economy as a whole. They have also provided various quantifiable long-term climate change pathways which provide a good starting point to carry out scenario analysis to estimate its potential impact on underlying portfolios.
- **Regulators are upping their ante**: The Bank of England (BoE)'s publication of the supervisory statement SS 3/19 in 2019 set the tone for regulators in other major jurisdictions to follow suit. This year, several regulators including the European Central Bank (ECB), Monetary Authority of Singapore (MAS), and Hong Kong Monetary Authority (HKMA) issued guidelines for banks to incorporate climate risk practices. Furthermore, the BoE and Autorité de Contrôle Prudentiel et de Resolution (ACPR, the French banking regulator) have issued formal guidelines for climate risk stress testing, and the exercise for the latter is currently underway. While the US has hung back, the Commodities Future Trading Commission (CFTC) recently released a blueprint on climate risk urging regulatory action.
- **European banks are leading the pack**: Several European banks and select banks in other major developed markets have made progress in climate risk integration and set benchmarks by implementing best practices around elements of governance, strategy, risk management and disclosures. We have highlighted several examples of these observed across global banks.
- **But several hurdles remain**: Climate risk management is still in its early days and multiple challenges exist. These include: non-availability of adequate data, especially outside of large companies; difficulty in interpretation of transmission risks (i.e., conversion of climate risks into financial impact); the multi-decade horizon requirement for stress testing; lack of harmonisation of taxonomy; and shortage of appropriate talent.
- **What to expect going forward?** We expect the ecosystem around climate risk management to continue evolving at a rapid pace. While banks have begun to make strides around governance and reporting, we expect the momentum to accelerate in the areas of risk management, client engagement, climate risk stress testing, and generally, increasing interest in boardroom conversations. We also expect to see more high quality data and tools in the market.
- **How RISE and CRISIL can support banks**: We can support global banks across a wide range of climate risk-related activities. These could be broadly categorised into a) sector-specific playbooks; b) borrower level climate assessment reports; and c) portfolio-specific scenario analysis and stress testing.

# Introduction to climate risk

First, is climate change real? There is a broad consensus among the scientific community that the prolonged period of fairly stable climate conditions with moderate variations, known as the 'Holocene' period, which started nearly 11,600 years ago, may be at risk of changing. Humans, and more broadly, all living beings on earth have thrived during the Holocene period, thanks to the delicate balance of several elements, one of which relates to the concentration of gases in the atmosphere. Changes in atmospheric concentration of greenhouse gases (GHG) such as carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$) are widely believed to be influencing changes in temperature (commonly referred to as global warming), which in turn leads to heating up of oceans, melting of ice, rising sea levels (or coastal land erosion) and more frequent extreme weather events. The graphic below highlights the interconnectedness between the various components.

**Key components of, and changes in, oceans and cryosphere, and their linkages to heat, water and carbon**



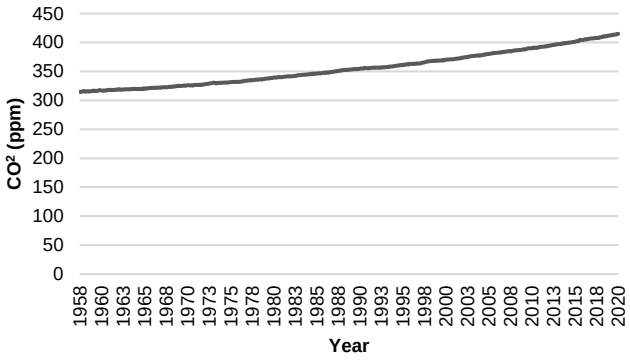

*Source: Technical Summary of the IPCC Special Report on Ocean and Cryosphere in a Changing Climate (June 2019)*

In its fifth assessment report published in 2014, the IPCC stated that "human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."

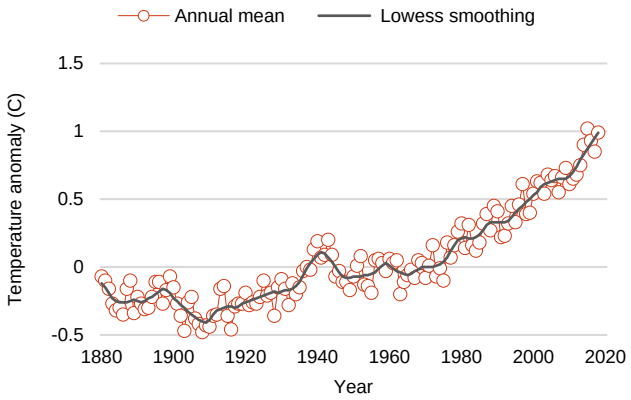
The rapid global industrialisation over the past 5-6 decades have led to an increase in mean global temperature of close to 1.0°C. Furthermore, each of the last few successive decades have been warmer than the previous ones. September 2020 was noted to be the hottest September on record, and July 2019, the hottest month, according to the National Oceanic and Atmospheric Administration. The increase in temperatures are believed to be driven by an increase in atmospheric $CO_2$ concentration level, which has jumped to 415 parts per million (ppm) in September 2020 from just 317 ppm in six decades ago, largely due to human action.

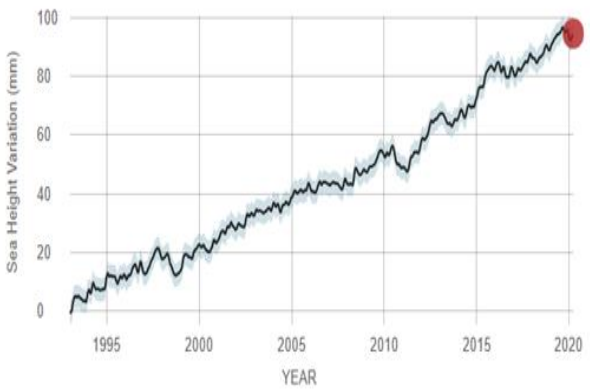
Swiss Re estimated a total of $75 billion economic losses from catastrophes in the first half of 2020, of which $44 billion were uninsured, up by 33% and 30%, respectively, from last year. It is quite likely that a good chunk of these uninsured losses may result in losses for banks, either directly or indirectly.

### Climate change trends



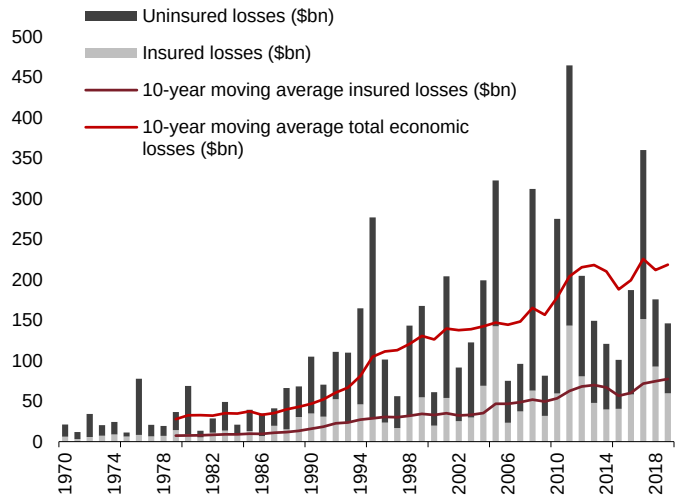


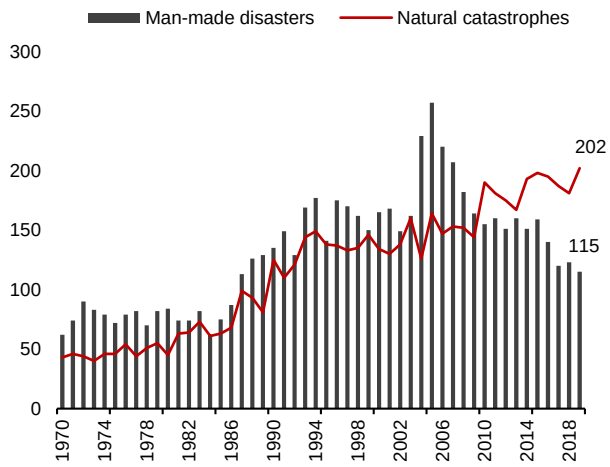



*Source: NASA Global Climate Change*

### Historical catastrophic events and associated losses (1970-2019)




*Source: Swiss Re Institute*

**Overwhelming changes spawn significant risks to the economy, and hence, the banking system**

| | |
|---|---|
|  | **Physical risks:** These arise from damage to property, infrastructure and land resulting from climate change catastrophic events (acute) or long-term shifts (chronic) in climate patterns |
|  | **Transition risks**: Those faced by companies due to changes in climate policy, technology, and market sentiment in order to transition to a lower-carbon economy |
|  | **Stranded assets**, where the commercial lives of assets are reduced due to economic, physical and/or regulatory stranding associated with the energy transition |

While the United Nations (UN) has long been at the forefront of attempting to drive a global consensus to act, it initially met with limited success. In 2016, however, a major milestone was reached with what is famously known as the Paris Agreement, wherein several countries committed to limit the increase in global temperature to well below 2.0°C (of pre-industrial levels) and strive for containing it further to 1.5°C by the turn of the century. In 2018, however, an IPCC report warned that at the current trajectory, 1.5°C warming would be reached by 2030. Other studies indicate that by 2025, 1.8 billion people would live in water scarcity (source: UN), 100 million pushed to poverty (source: Global Commission on Adoption) and 800 million at risk from rising sea level (source: C40 Cities). Further, the Climate Disclosure Project (CDP) highlighted an analysis of the world's 500 biggest companies, of which 215 reported potential climate change implications with $970 billion estimated to be at risk in the next 5 years.

**Key past meetings and their outcomes**

| Year | Initiative | Objective |
|---|---|---|
| **1992** | United Nations Framework Convention on Climate Change (UNFCCC) | To stabilise GHG concentrations and prevent human induced interference with the climate system |
| **1997** | Kyoto Protocol | To bind developed countries with the $CO_2$ emission reduction target |
| **2016** | Paris Agreement | To contain the global temperature rise this century at well below 2°C and strive for 1.5°C (189 countries were signatories to this Agreement) |

*Source: UN publications*

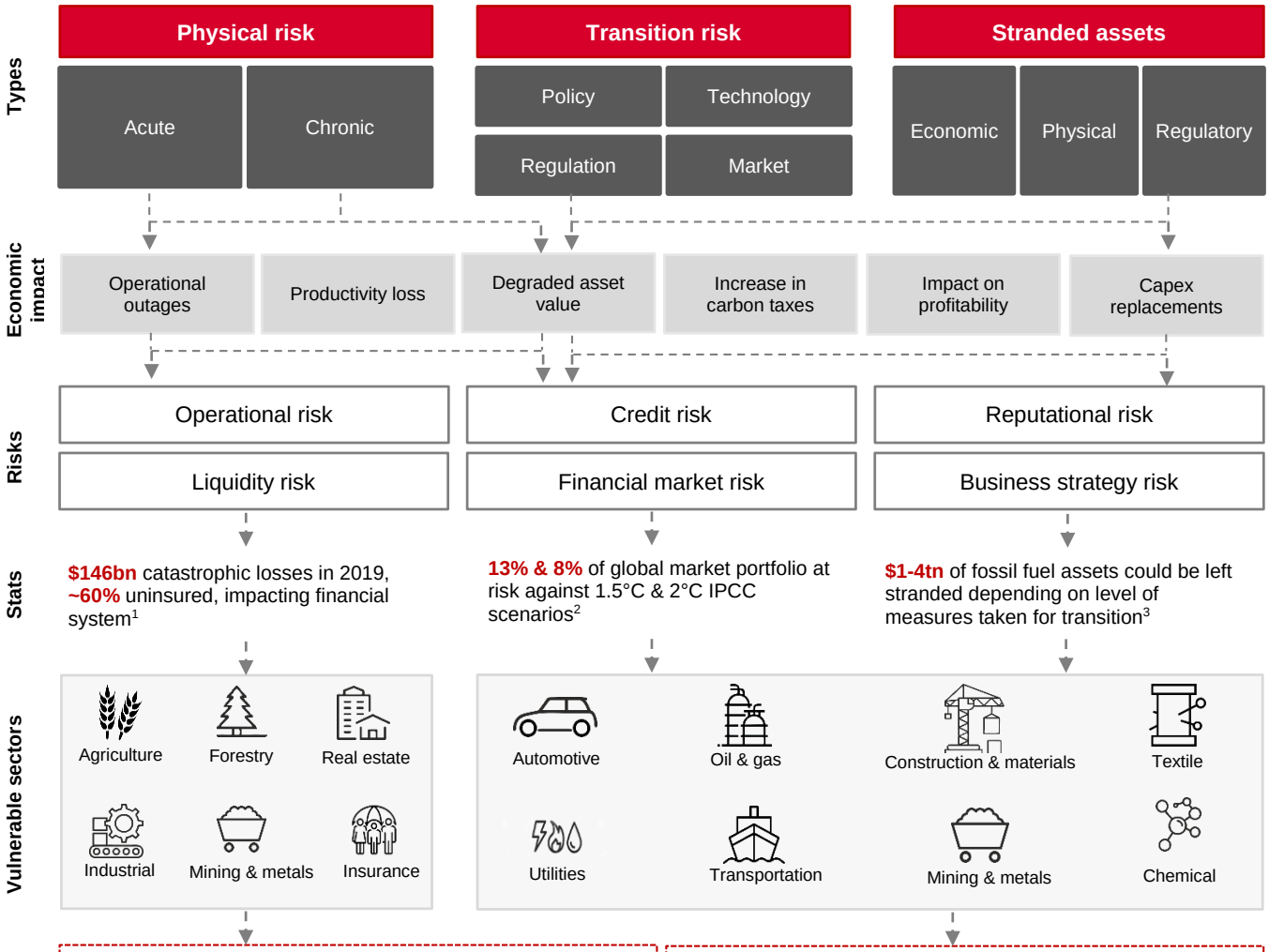
## Sources of climate risk and impact on banks

Physical catastrophes have always been one of the key risk drivers for insurance firms and the focus is intensifying with growing instances of acute events due to climate change. But climate risk in banking got real only with the first 'climate change bankruptcy', of California-based utility PG&E due to the wildfire in 2018.

In banking, climate risk materialises directly, through banks' exposures to corporations, households, and countries that experience physical and transition climate shocks, or indirectly, through the effects on the wider economy and feedback effects within the financial system.

Climate-related financial risks are expected to only escalate in the years to come, with climate change events on the rise and the need to move towards a low-carbon economy to align with the global climate goal of 2°C this century. All this will magnify banking risk exposure significantly.

## Climate-related risks associated with the banking industry




**Examples**

**Acute events**

- The yields of municipal bonds associated with climate risk appear to decline relative to that of conventional bonds with lengthening maturities[4]
  In 2018, PG&E filed for Chapter 11 due to wildfires

**Chronic impacts**

- 2018 drought and heatwave lowered Rhine river level, impacting German water supply chain; chemical maker BASF reported impact of €250mn in 2018 earnings on reduced utilisation and high transportation cost
- Property values in the 18 US states fell by $15.9bn between 2005-17 due to rising sea level[5]

**Transition impacts**

- Increase in Canadian carbon taxes likely to lower net income for the average Saskatchewan farmer by ~8% in 2020 & ~12% in 2022[6]
- September 2019 imposition of the Worldwide Harmonized Light Vehicle Test Procedure (WLTP), led to:
  - 3.1% y-o-y decline in EU vehicle sales in H1 2019
  - Volkswagen AG reported impact of €900mn on cash flows in 2018

**Stranded assets**

- In 1H 2020, BP plc reported impairment charges of $12.9 billion on expectations of accelerated low-carbon transition
- In 2018, Schweizer Group filed for bankruptcy, driven in part by a ban on old diesel cars in German cities

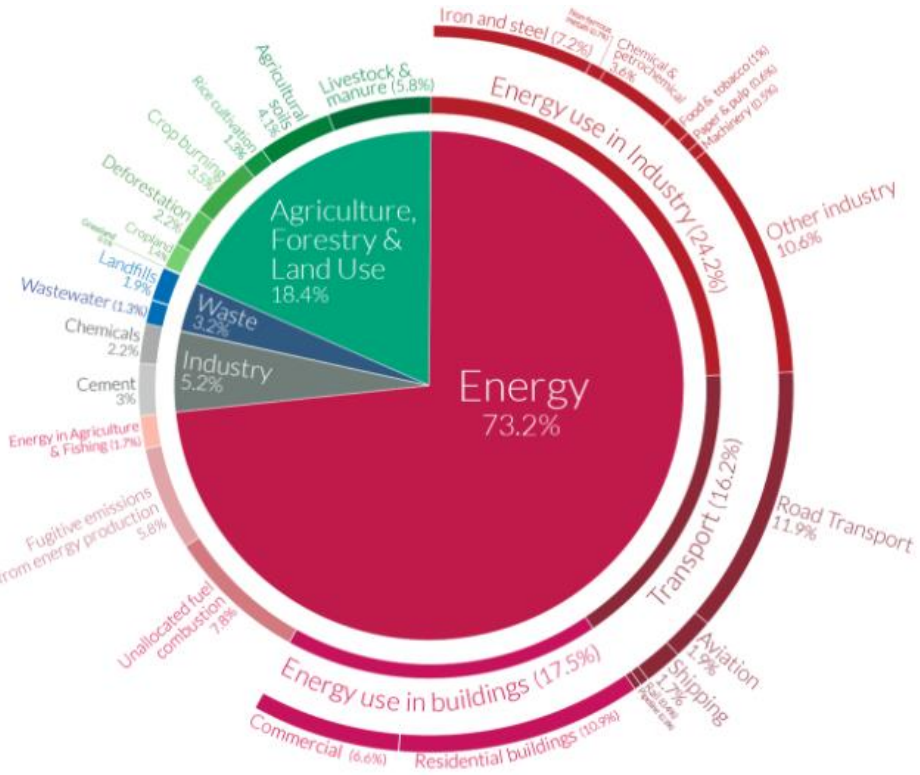
*Source: [1]Swiss Re Institute; [2]UNEP FI Changing Course (May 2019) – market portfolio represents 30,000 listed companies and risk estimated using REMIND model leveraging IPCC scenarios; [3]Mercure, J., Pollitt, H., Viñuales, J.E. et al. Macroeconomic impact of stranded fossil fuel assets. Nature Clim Change 8, 588–593 (2018); [4]Research by Journal of Investing (2020); [5]Report by the First Street Foundation and Columbia University (August 2019); [6]APAS Estimates (February 2020)*

# Risks and opportunities in impacted sectors

## Who are the largest GHG emitters?

The infographic below shows the key sources of GHG emissions. Energy use and agricultural activities are the largest sources of emissions.

**GHG emissions by sector (2016)**




*Source: OurWorldinData.org, Climate Watch, the World Resources Institute*

While several industries are vulnerable to the transition to a low-carbon economy, the impact of climate risks vary by industry, as do the opportunities for engagement and transition financing available to banks. The table below highlights both.

**Risks and opportunities for industries exposed to climate risks**

| Sector | Key risks | Financing and engagement opportunities |
|---|---|---|
| Real estate / buildings | • Risks from pluvial flooding and proximity to wildfire hotspots. Properties in coastal areas are vulnerable to sea level rise<br>• Potential decline in value of legacy properties on policy changes related to emission norms | • Refurbishments to strengthen resilience against extreme weather events<br>• Eco-friendly upgrades or re-developments |
| Infrastructure | • Vulnerable to increases in frequency and intensity of extreme weather events | • Smart power grids<br>• Changes/upgrades for eco-friendly mobility |
| Utilities | • Coal-fired plants likely to be phased out<br>• Policy changes that mandate emission reductions | • Renewable energy projects<br>• Green hydrogen to buffering / seasonal balancing<br>• Carbon capture and storage technology |

| Sector | Key risks | Financing and engagement opportunities |
|---|---|---|
| Oil & gas | • Consumption of end product by downstream users results in carbon emissions<br>• Susceptible to demand shifts from oil towards renewable sources (e.g., electric vehicles) | • Carbon capture and storage technology<br>• LNG projects |
| Coal | • Accounts for nearly a third of all $CO_2$ emissions, and hence, significantly sensitive to transition risks | • Capture or prevention of fugitive methane emissions |
| Cement | • Second-largest industrial $CO_2$ emitter, and hence, highly sensitive to low-carbon transition | • Replacement of clinkers with fly ash, blast furnace snag<br>• Carbon capture and storage technology |
| Metals & mining | • A high volume user of fresh water, sensitive to increasing water stress in certain regions | • Materials for electric vehicle batteries (nickel, cobalt, lithium) |
| Steel | • The largest industrial consumer of coal, and hence, highly susceptible to low-carbon transition | • Increase durability of finished products<br>• Emission reduction through use of bioenergy an direct electrification |
| Chemicals | • Production leads to soil and water pollution<br>• Susceptible to policy changes | • Recyclable plastics and biodegradable materials |
| Transport | • Sensitive to tightening of emission standards, especially as freight transport (trucks and rail) are heavy consumers of diesel | • Energy efficient options (electric, hydrogen, LNG)<br>• Re-designing of engines and tyres for fuel efficiency |
| Automobiles | • Road transport accounts for over a tenth of all GHG emissions<br>• Highly susceptible to mandated cuts in $CO_2$ emissions and growing trend of bans on diesel vehicles<br>• Increasing costs of compliance with standards | • Growing demand for electric vehicles<br>• New design and equipment for fuel efficiency |
| Aviation | • Potential reduction in demand as short hauls may be replaced by high-speed trains | • Shift to synthetic fuels derived from hydrogen<br>• Lightweight aircraft components for energy efficiency |
| Shipping | • Highly exposed to transition risks given its high emissions of nitrogen oxide and sulphur oxide | • Shift from fossil fuels to cleaner fuels such as LNG or methanol |
| Agriculture | • Agriculture, forestry and land use account for nearly a quarter of all GHGs<br>• Crop yield is susceptible to extreme weather events in the short run, and to gradual changes in temperature in the long run | • Carbon sequestration through gene editing, drought-resistant seeds<br>• Methane inhibitors, variable rate fertilisation |

*Source: IEA, IPCC, RISE analysis*

## Regulators have started laying the groundwork

Climate risk regulations are evolving. Most supervisory bodies have started to raise risk awareness with financial institutions through different channels. They have issued, or are in the process of issuing, formal guidance on management of climate-related financial risks. The expectations set out thus far are not legally binding nor set capital requirements. Rather, they seem to assess feasibility of and provide guidance to institutions on climate risk identification, measurement, and management.

The pace of adoption across countries also differs. In the US, while the federal government is yet to take any material action, select states have begun taking steps unilaterally. For instance, California, Colorado, Louisiana, and Rhode Island have developed their climate action plans to better adapt to and mitigate the effects of climate change. However, it was New York that took the first major step to influence the financial services industry. The

New York State's Department of Financial Services (NYDFS) issued a circular on September 22, 2020 stating that it expects all NY-based insurers to commence integration of climate-related risks into their governance frameworks, risk management processes and business strategies. The US CFTC also released a report in September with a recommended blue print for regulators, urging them to initiate the ground work on spelling out issue climate-related responsibilities for financial institutions.

**Emerging regulatory consensus on climate risk**

| | | |
|---|---|---|
| Sep 2020 |  | **JFSA**<br>Planned a pilot climate stress test for large banks |
| |  | **New Zealand**<br>Declared climate reporting mandatory for financial sector by 2023 |
| Jul 2020 |  | **HKMA**<br>Released best practices for climate risks management, and announced plan for pilot climate stress test in 2021 |
| |  | **ACPR**<br>Published scenarios for its pilot climate change stress testing exercise for banks and insurers |
| Jun 2020 |  | **MAS**<br>Consultation on environmental risk management guidelines for financial institutions |
| May 2020 |  | **ECB**<br>Consultation on its guide on climate-related and environmental risks for EU institutions |
| Apr 2020 |  | **DNB**<br>Good practices on 'integration of climate-related risk considerations into banks' risk management' |
| Feb 2020 |  | **APRA**<br>Outlined plans to develop a guide focused on climate risks and its vulnerability assessment |
| Dec 2019 |  | **Danmarks Nationalbank**<br>Announced the next stress test for banks likely to focus on climate-related risks |
| |  | **BOE**<br>Discussion paper on its proposed BES 21 stress test including climate risk for banks and insurers |
| Nov 2019 |  | **Bank of Canada**<br>A study to understand the economic consequences of climate change |
| Apr 2019 |  | **BOE**<br>SS3/19 on approaches to manage financial risks from climate change |
| Oct 2018 |  | **DNB**<br>Conducted an energy transition risk stress test for banks and insurers |

*Note: APRA - Australian Prudential Regulation Authority; ECB - European Central Bank; MAS - Monetary Authority of Singapore; HKMA - Hong Kong Monetary Authority; JFSA – Japan Financial Services Agency; DNB - De Nederlandsche Bank.*
*Source: Central banks' publications, The Japan Times, press sources, RISE research*

The table below summarises recent guidelines on climate risk integration prescribed by four major regulators.

**Recent guidelines on climate risk practices by key regulators**

| Parameters | BOE | ECB | MAS | HKMA |
|---|---|---|---|---|
| Publication | • SS3/19: Enhancing banks' and insurers' approaches to managing financial risks from climate change<br>• Published April 2019 | • Guide on climate-related and environmental risks<br>• Published May 2020 | • Proposed guidelines on environmental risk management<br>• Published June 2020 | • Range of practices for management of climate risks<br>• Published July 2020 |
| Report category | • Supervisory statement | • Guidelines | • Consultation paper | • Guidelines |
| Stated objective | • To embed measurement, monitoring of climate risk management into existing supervisory framework | • To prepare for managing climate-related and environmental risks | • To enhance resilience to and management of environmental risk | • To address climate-related issues |
| Applicability | • Banks and insurers | • Banks | • Banks, asset managers, insurers | • Banks |
| Modules | • Governance, risk management, scenario analysis, disclosures | • Business strategy, governance, risk management, disclosures | • Governance, risk management, disclosures | • Governance, strategy, risk management, disclosures |
| Governance | • Board oversight<br>• Senior management led risk function, linked to statement of responsibility<br>• Adequate resources, skills & expertise | • Risk consideration by management<br>• Effective oversight<br>• Aggregated exposure reporting enabling decision making | • Risk consideration by management<br>• Effective oversight | • Organisations' accountability in climate resilience<br>• Effective management oversight |
| Strategy | • NA | • Short, medium, long term strategy basis estimated impact | • NA | • Action plan to manage risks at portfolio, client, and operational level |
| Risk management | • Risk identification and measurement using stress testing / ICAAP<br>• Monitoring of climate risk exposure vis-à-vis overall strategy & risk appetite<br>• Mitigation plan or policies for managing exposures<br>• Risk & mitigation plan reporting to the board | • Risk quantification by stress testing<br>• Two scenarios (IPCC/IEA transition pathways):<br>– Credible baseline<br>– Adverse (institution-specific)<br>• Scope: Credit, market, operational, reputational, liquidity risk | • Environmental risk impact assessment on risk profile and business strategies<br>• Stress testing considering base and stress scenarios | • Risk quantification by stress test at sector and customer level<br>• Monitoring and timely reporting |
| Disclosures | • As per TCFD recommendations | • As per the EC's non-financial reporting directive (NFRD) | • As per TCFD recommendations | • As per TCFD recommendations |
| Timeline | • Full implementation by end 2021 | • Significant institutions: reporting on the guide from end 2020 | • Implementation: 12 months post the issuance of final guidelines | • Consultation in H1 2021<br>• Climate change stress test in 2021 |

*Note: ICAAP - Internal Capital Adequacy Assessment Process*
*Source: Official guidelines as per the respective publications*

Apart from issuing formal guidelines, climate risk has also begun to occupy increasing amount of space on the websites of regulators:

**Number of distinct webpages with mentions of climate risk*, by year**

| Regulator | 2015 | 2016 | 2017 | 2018 | 2019 | 2020** |
|---|---|---|---|---|---|---|
| ECB | 147 | 196 | 280 | 295 | 266 | 275 |
| BoE | 22 | 44 | 48 | 87 | 156 | 93 |
| MAS | 1 | 0 | 1 | 9 | 29 | 26 |
| HKMA | 0 | 0 | 0 | 3 | 19 | 17 |
| APRA | 0 | 0 | 5 | 3 | 12 | 16 |
| US Federal Reserve Board | 2 | 2 | 0 | 6 | 10 | 9 |
| Swiss FINMA | 1 | 0 | 0 | 0 | 8 | 7 |
| Canada's Office of the Superintendent of Financial Institutions | 0 | 0 | 1 | 1 | 6 | 7 |
| JFSA | 0 | 1 | 1 | 7 | 9 | 6 |

*** For 2020, the data is for webpages published until October 16, 2020*
*Source: Site search for number of unique webpages that contain any of the phrases * "climate change", "climate risk" "global warming"*

Two European regulators have already issued formal guidelines for climate risk stress testing. While the BoE was the first to publish its paper in December 2019, it postponed the exercise to 2021 due to the Covid-19 pandemic. On the other hand, the French regulator ACPR published its guidelines in mid-2020 and has since launched the exercise. Both exercises are exploratory pilot tests and do not aim to assess capital adequacy.

**Comparison of stress-testing guidelines of the BoE and ACPR**

| Parameters | BOE | ACPR |
|---|---|---|
| Publication | • Discussion paper dated 18 December, 2019 | • Final scenarios for the climate exercise dated July 16, 2020 |
| Objective | • To test the resilience of the UK financial system to the physical and transition risks from climate change<br>• Primary focus on sizing up risks and not capital adequacy | • To build awareness and measure the risks associated with climate change<br>• Exploratory exercise, no focus on solvency |
| Applicability | • Large UK banks and insurers (mandatory) | • French banks and insurers (voluntary) |
| Scope | • Three climate scenarios<br>• Variables: physical and transition pathways and their impact on macro and financial factors<br>• Counterparty-level modelling expectations<br>• Modelling horizon: 30 years, 5-year milestones to 2050<br>• Balance sheet treatment: Constant as on June 30, 2020 | • One physical and three transition risk scenarios<br>• Variables: macroeconomic & financial, and physical<br>• Coverage: 80-85% of exposure across geographies<br>• Modelling horizon: 30 years, focus - 2025, 2035, 2040, 2050<br>• Balance sheet treatment: Constant - 2020 to 2025 as on December 31, 2019, dynamic - 2025 to 2050 |
| Scenarios | **Three proposed climate scenarios**<br>• Early policy action: transition starts early, climate goal met<br>• Late policy action: transition delayed by 10 years, compensated with deeper adjustments, climate goal met<br>• No additional policy action: no additional policy adopted than already announced, insufficient transition to meet the climate goal | **Three transition risk scenarios and one physical risk scenario**<br>• Reference: transition starts early, climate goal met<br>• Adverse (variant 1): transition delayed till 2030, requiring aggressive adjustment, climate goal achieved<br>• Adverse (variant 2): reference transition not matured, hence negative productivity gains<br>• Business as usual' physical risk scenario: all measures taken have very limited impact on the physical risk |

| Parameters | BOE | ACPR |
|---|---|---|
| Modelling approaches | **Credit risk**:<br>• Corporates: bottom-up modelling of cash flows and collaterals for 80% of exposures<br>• Retail: modelling of country-level economic impacts and mortgage for physical risks (at least for 4-digit postcode)<br>**Market risk**: Analysis of corporate bonds, equities, sovereigns | **Credit risk**: Expected credit loss (ECL) calculation for all geographical areas<br>• Corporates: impact on counterparty rating for 20 sectors<br>• Retail: modelling on macroeconomic & financial assumptions<br>**Market risk**: Loss calculation through revaluation of portfolios at fair value and counterparty default risk |
| Metrics for impact assessment | • Banking book: impairment charges in reporting year and cumulative 5 yrs., compared with 2020 baseline scenario<br>• Trading book: change in fair value of assets over already priced in by firms and markets | • Measurement of risks and vulnerabilities across geographies and sectors using tools and a methodological framework<br>• Results to assess the feasibility of regulatory capital as a tool to manage climate change risks |
| Timeline | • Final guidelines expected in H2 2020<br>• Stress test exercise slated for 2021 | • Banks to submit results by end-2020<br>• Final aggregate (round 1 & 2) results expected to be published by April 2021 |

*Source: BoE's BES 21 report; ACPR's climate risk stress testing guidelines; RISE analysis*

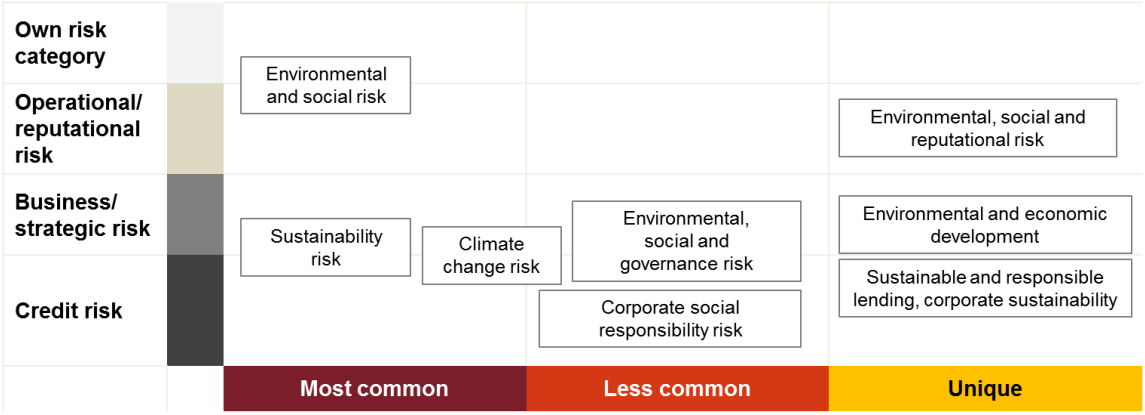
## Some banks are also showing the way…

The table on Page 11 describes how regulators are increasingly acknowledging the implications of climate-related risks on the financial system. But where do banks stand on this?

According to the Global Association of Risk Professionals (GARP), May 2020 survey that included 43 banks, ~90% of institutions voted that their boards have oversight of climate related risks and are engaging in the matter. Though fossil fuel financing continues to grow, especially in US banks' portfolios, banks are becoming cognizant about these risks and are starting to commit to exposure reductions over time. For example, in July 2020, JPMorgan Chase, Bank of America, Wells Fargo and Goldman Sachs partnered with the Rocky Mountain Institute, a clean energy nonprofit to launch the Center for Climate-Aligned Finance.

We are seeing relatively more action in Europe, with a recent ECB report indicating that nearly three out of four banks consider climate risk as part of their formal risk identification process, albeit only one-third of them concluded that such risks are currently material. However, risk taxonomies used by the European banks are somewhat inconsistent, mainly due to climate risk being bundled with other risk categories.

**Observed clustering of climate risk with other risk types**




*Source: ECB report on banks' ICAAP practices (August 2020)*

Select large banks, especially in Europe, have begun to make good progress in integrating climate risk management practices and these are now becoming the benchmarks for the industry to follow. Banks and regulators are also seen involved in joint industry initiatives, collaborating and sharing best practices, particularly to address the challenges and complexity and bring consistency in the climate risk assessment process.

**Climate risk integration: current maturity levels of banks**

| |  **Beginners** |  **Intermediate** |  **Leaders** |
|---|---|---|---|
| **Governance** | • Climate risk policy framework<br>• Stated commitment to UN sustainability development goals | • Board oversight<br>• Engaging with regulators<br>• Aggregated exposure reporting | • Integrated committee on climate risk agenda<br>• Inducting external climate risk specialists in the bank's climate risk committee<br>• Remuneration linked climate related key performance indicators (KPIs) |
| **Strategy** | • Understanding and integrating climate risk impact in short, medium, long term | • Participation in working groups to enhance climate risk management in the industry | • Organisation-wide climate alignment strategy (Scope 1, 2, 3)<br>• Action plan to manage risks at portfolio, client and operational level |
| **Risk management** | • Focus on negative screening of vulnerable sectors | • Considering climate change risk while assessing financing opportunities<br>• Part of task forces for developing climate change risk modelling | • Incorporating climate risks in underwriting and risk pricing of transactions<br>• Running scenario analysis for physical and transition risks<br>• Quantifying potential portfolio value erosion across multiple climate scenarios |
| **Disclosures** | • Climate disclosures based on any one recognised framework (TCFD, CDP, SASB, etc.)<br>• Disclosure of lending exposure to companies with fossil fuel-related revenue<br>• Disclosure of exposure to environment-friendly companies (such as renewable energy) | • Climate disclosures based on more than one framework<br>• Disclosures of GHG emissions for Scope 1 and 2<br>• Disclosure of proportion of portfolio exposed to select vulnerabilities such as flood risk or water stress or carbon pricing | • Disclosures of GHG emissions based on Scope 1, 2 and 3 emissions<br>• Reporting carbon intensity of portfolio (mt. $CO_2e$/$1 million revenue)<br>• Proportion of exposure to clients with explicit climate risk mitigation / adaptation plans |

*Source: NGFS, RISE analysis based on observations of banks' disclosures*

## Notable best practices in implementing various elements of climate risk management

| | |
|---|---|
| **Governance** | • **A European bank** established a climate risk committee with internal and external experts on board, such as scientists from relevant disciplines, to review climate risks and sector financing policies to determine targets for exposures to certain sectors<br>• **A French bank** has its Board of Directors directly determine its climate strategy, which, in turn, is assisted by multiple specialised committees. It has also incorporated corporate social responsibility (CSR) goals into the variable performance structure of the executive management team, with a weightage of 10%.<br>• **A European bank** set up a remuneration linked change programme to understand climate risk exposure in short and longer term supervised by the management board. Key elements were: climate impact on risk profile, strategy adapted to manage banks' exposure, responsibilities across levels to implement change including targets, planning, and budget<br>• **A Brazilian bank** established a climate working group in a squad format where the Sustainability Department is the leader operated by relevant sustainability department members (bimonthly), and topped up by the Superior Ethics and Sustainability Committee (semiannually) and the Board (annually) |
| **Strategy** | • **A European bank** integrated climate related KPIs to make its strategy measurable. For each metric, respective time horizons are set and progress measured against a base year. KPIs include: assets carbon emission footprint, mortgage portfolios energy label vs. homes that saw improvement, and share of assets as per green investment mandate<br>• **A Swiss bank** has been using scenario-based approaches since 2014 to assess exposure to physical & transition risks, performing both top-down balance sheet stress test across the firm, and bottom-up analysis of specific sectors in short, mid, long term horizons. In 2017, it carried out a drought stress test on its energy portfolio, and in 2019, participated in an industry working group where it tested the potential vulnerabilities in its utilities lending portfolio<br>• **A UK bank** announced that it was moving a few senior bankers into its sustainable and impact banking team, with the objective of strengthening its capabilities in the sustainable financing segment. It also made similar rotations into its leverage finance team to oversee its ESG agenda (August 2020) |
| **Risk management** | • **A Dutch bank** adopted a methodology to analyse its lending portfolios with the objective of establishing the change that each sector would need to undergo to meet climate alignment goals. It leverages two methodologies - the Paris Agreement Capital Transition Assessment (PACTA) and Science-based Target-Sectoral Decarbonization Approach (SBTi SDA), and uses client asset level data from global databases<br>• **An Australian bank** provided climate awareness training to more than 1,000 of its corporate and institutional banking front office staff in 2019. The programme included modules illustrating how climate-related risks and opportunities could affect their clients, and also the key ingredients to look for when assessing a transition plan. Also in 2019, it analysed the carbon disclosure of its top 80 emitters and engaged with 29 of them to provide support to their low-carbon transition plans<br>• **A Brazilian bank** implemented social and environmental risk monitoring of customers and projects in its credit granting process, leveraging specific checklists, geo-referencing tool (satellite images) indicating Brazilian biomes, conservation units & Indian lands, natural cavities, contaminated areas, biodiversity, and social and environmental rating |
| **Disclosures** | • **A Dutch bank** discloses a granular breakdown of annual GHG emissions for each of its lending portfolios (e.g., agriculture, retailing, transport, etc.) by leveraging the Partnership for Carbon Accounting Financials (PCAF) methodology. The methodology accounts for three forms of GHG emissions; 1) generated emissions - carbon emitted into the atmosphere 2) avoided emissions - due to renewable energy, but does not remove existing ones from the atmosphere, and 3) sequestered emissions – carbon stored in trees, plants, soil; actual removal from atmosphere<br>• **Another Dutch bank** reports the breakup of sustainability performance of its domestic corporate clients by grading them into five buckets. It also discloses examples of several engagement efforts with clients, and the status against each issue. In select cases, the bank terminated the relationship with those who fail to resolve the issue |

*Source: Banks' annual reports and sustainability disclosures; RISE research*

# …but hurdles abound

Though climate risk management is gaining focus by the regulators and banking industry, it comes with quite a few challenges due to its complex nature and requirements.

In April 2020, the Basel Committee on Banking Supervision (BCBS) member's survey report concluded that the industry faces operational challenges in developing a robust framework to assess climate related financial risks, with 'data insufficiency' and 'methodological challenges' topping the list. The table below discusses the key challenges that we have observed from a combination of published studies and our conversations with several banks.

**Observed challenges in climate risk management**

| | | |
|---|---|---|
| **Data** |  | • Climate hazards data is available from multiple sources, but banks face the challenge of source selection, differences in data depth across regions, and to some degree, in interpretation<br>• While climate data providers are emerging, some provide only historical data and while some provide forward-looking estimates, the adaptation effects are often not captured<br>• Sourcing company-specific data is also a challenge, which gets exacerbated outside of the large corporates universe |
| **Taxonomy** |  | • Lack of clear and standardised taxonomy between 'green' and brown' assets, in order to assess the sensitivity of different assets to climate-related risks<br>• Some bodies are taking steps to address this, though;<br>- The EU published 'Taxonomy Regulation' in June 2020 around climate change mitigation and adaptation<br>- Global Covenant of Mayors for Climate & Energy published Climate Risk and Adaptation Framework and Taxonomy (CRAFT) in September 2020 for member regions and cities to report local climate hazards and impacts |
| **Analytical framework** |  | • Lack of harmonised and robust modelling methodologies and analytical framework for risk assessment<br>• Both, top down and bottom methodologies have their fair share of shortcomings, either on depth or scalability |
| **Transmission channels** |  | • Difficulty in standardisation and understanding of modelling transmission risks across sectors, regions, markets, and the financial system as a whole<br>• Translation of climate risks into financial risks is still in an evolutionary phase |
| **Time horizon** |  | • Risk modelling professionals are typically well-versed with modelling outcomes over a 2-3 year period but climate risks require modelling over much longer horizons of 30-50 years<br>• The long-term horizon also poses challenges in incorporating adaptation plans of obligors in the portfolio |
| **Talent and capacity** |  | • Limited availability of skilled talent since this is a new area<br>• While climate risk management should enhance profitability in the long-run, banks face an uphill task on the short term trade-offs between risk and rewards, especially given the highly uncertain economic environment |

*Source: BCBS climate-related financial risks: a survey on current initiatives (April 2020); Financial Stability Board (FSB) - Stocktake of Financial Authorities' Experience in Including Physical and Transition Climate Risks as Part of Their Financial Stability Monitoring (July 2020); EU publications, Global Covenant of Mayors for Climate & Energy reports; RISE analysis, based on observations from discussions with various banks*

# What to expect going forward

Climate risk management is still somewhat in its infancy as far as banks are concerned. While the past 12 months have marked a significant milestone for banks across developed markets, we believe there is still a long way to go.

While the ECB, in its May 2020 discussion paper "Guide on climate-related and environmental risks" encourages banks to carry out scenario analysis and assess its impact on capital adequacy, this is extremely hard to implement in practice. That's because:

- Unlike traditional stress tests, which are typically modelled for a period of 2-3 years, the effects of climate risks are likely to be felt in the very long-term, often over multiple decades. This gives banks significant leeway to make adjustments over time
- The data, tools and standards to measure climate risk are still evolving, due to which the level of certainty in estimation is currently not as high as one would like it to be

For these reasons, both the BOE and ACPR have clearly excluded solvency testing in their climate risk stress testing execution plans. Their clearly stated objectives are to encourage banks to familiarise themselves with identification and measurement of risks, rather than apply the same for capital planning at present.

Over the next few years, we expect to see a lot of action in the following areas:

| | |
|---|---|
|  | **Regulation**: We are likely to see growing global convergence around the regulatory push for climate risk management at banks. In the US, the pace of change may be dictated by the outcome of the upcoming general elections as both running candidates have somewhat divergent views on tackling climate change. However, as stated earlier, state-level policy makers may continue to drive climate risk practices in the US |
|  | **Governance and culture**: Banks are likely to continue strengthening their internal governance and management of climate risks, albeit the pace may vary across regions and scale of banks. There is likely to be an increasing push to sensitise banks' workforce on the effects, risks and opportunities from climate change. Furthermore, banks are also likely to include climate risk targets in the compensation structure of senior management |
|  | **Risk management**: We see three key themes in risk management and to some degree, a few banks have already started moving in this direction<br>• Policy level targets around portfolio mix may become more mainstream<br>• Incorporation of climate risk factors in the lending activities of transaction underwriting and risk pricing; and instrument selection in their trading portfolios, and<br>• Increased engagement with borrowers to encourage better climate change adaptation practices |
|  | **Data**: While some level of progress has been made in recent years, we expect quite a bit more in the medium term. On the one hand, data providers should continue to make progress in introducing new data sets to the market by leveraging innovative sourcing methods. On the other, we expect to see continued improvement in company-level disclosures driven by regulatory push for listed companies, the need to manage reputational risks, and owing to direct and indirect influence from banks as climate risks are likely to get factored into underwriting and transaction pricing |
|  | **Tools, methodologies and models**: We expect both, banks and consulting firms to invest significant time and effort in developing new tools |

# How CRISIL/RISE can support your journey

**Solutions offered by CRISIL and RISE**

|  |  |  |
|---|---|---|
| **Sector playbooks** | **Obligor-level assessment** | **Scenario analysis, stress tests** |
| • Sector-specific playbooks for climate risk evaluation by portfolio managers<br>• Documentation of key assessment parameters<br>• Documentation of guidelines on engagement opportunities to encourage climate risk mitigation | • Obligor-level climate risk assessment for wholesale borrowers<br>• Differentiation between active measures and greenwashing<br>• Evaluation of quantifiable metrics and qualitative measures<br>• Peer comparison to identify relative pace of transition | • Multi-decade scenario analysis to assess portfolio impact on varied climate pathways<br>• Incorporation of physical and transition risks, and mitigants from adaptation<br>• Top-down and bottom-up methodologies |

To know more about our solutions and services, please write to rise@crisil.com

# Annexure

## Deconstructing the climate-risk jargon

Policy makers and regulators are at different stages of adopting measures to drive behavioural change through the banking system, given its large influence in financing the global economy.

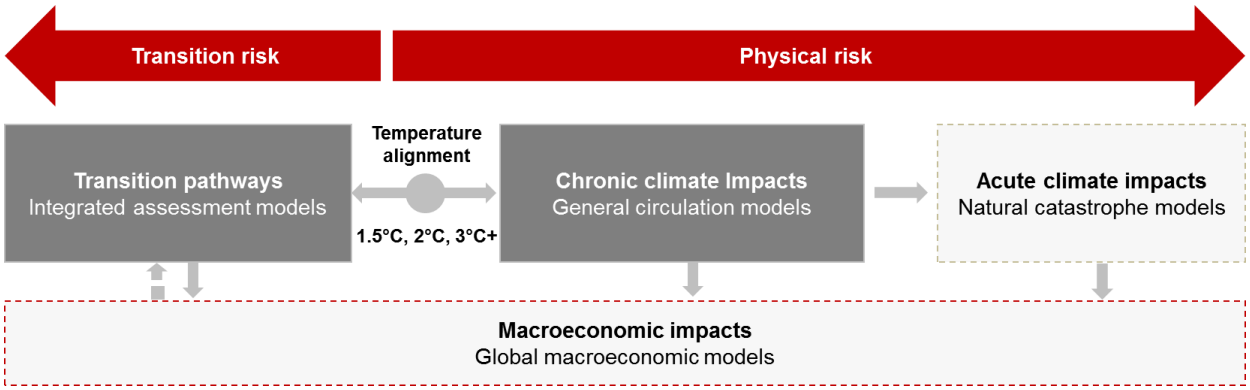
In this section, we elucidate some key facts that bankers need to be aware of relating to: a) climate models, b) climate pathways or scenarios; c) recognised climate scenarios that banks can leverage; and d) company reporting standards.

## Climate models

Three key categories of climate models are used to model climate change and related effects:

- **Integrated assessment models (IAMs) for transition risk**: These models are used to understand the interaction between climate systems, energy, land and economic performance. The most commonly used models in this category are the global change analysis model (GCAM), the regional model of investment and development (REMIND) and the model of agricultural production and its impacts on the environment (MAGPIE)
- **General circulation models**: These models use mathematical equations to establish how energy and matter interact in different layers of land, atmosphere, ocean and cryosphere. One of the most popularly used models is the coupled model inter-comparison project (CMIP5), which is a standard protocol for coupled atmosphere-ocean general circulation models
- **Natural catastrophe models**: These models are used to forecast physical risk from extreme weather events

**Typical categories of climate risk models**




*Source: NGFS climate scenarios for central banks and supervisors*

**Types of economic models used to assess climate risks**

| Lineage | Model type | Description | Example |
|---|---|---|---|
| Integrated climate-economy models[7] | Cost-benefit IAMs | Highly aggregated model that optimises welfare by determining emissions abatement at each step | DICE, DSICE (Cai et al., 2012, Barrage, 2020) |
| | IAMs with detailed energy system and land use | Detailed partial (PE) or general equilibrium (GE) models of the energy system and land use. GE types are linked to a simple growth model | PE: GCAM, IMAGE GE: MESSAGE, REMIND-MAgPIE, WITCH[8] |
| | Computable general equilibrium (CGE) IAMs | Multi-sector and region equilibrium models based on optimising behavior assumptions | G-CUBED, AIM, MIT-EPPA, GTAP, GEM-E3 |
| | Macro-econometric IAMs | Multi-sector and region model similar to CGE but econometrically calibrated | E3ME, Mercure et al., 2018 |
| | Stock-flow consistent IAMs | Highly aggregated model of climate change and the monetary economy that is stock-flow consistent | Bovari et al., 2018 |
| Other climate-economy models | Input-output (IO) models | Model that tracks interdependencies between different sectors to more fully assess impacts | Ju and Chen, 2010<br>Koks and Thissen, 2016 |
| | Econometric studies | Studies assessing impact of physical risks on macroeconomic variables (e.g. GDP, labour productivity) based on historical relationships | Khan et al., 2019<br>Burke et al., 2015<br>Dell et al., 2012 |
| | Natural catastrophe models and micro-empirical studies | Spatially granular models and studies assessing bottom-up damages from physical risks | SEAGLASS (e.g. Hsiang et al., 2017) |
| Modified standard macroeconomic models | DSGE models | Dynamic equilibrium models based on optimal decision rules of rational economic agents | Golosov et al., 2014<br>Cantelmo et al. 2019 |
| | E-DSGE | Slightly modified standard frameworks (that allow for negative production externalities) | Heutel, 2012 |
| | Large-scale econometric models | Models with dynamic equations to represent demand and supply, coefficients based on regressions | NiGEM (e.g. Vermeulen et al., 2018) |

*[7]IAM taxonomy adapted from Nikas et al., 2019; [8]Model documentation available at www.iamcdocumentation.eu/index.php/IAMC_wiki*
*Source: NGFS Guide to climate scenario analysis for central banks and supervisors (June 2020)*

## Climate pathways

According to the IPCC, human activity has been responsible for increasing the mean global temperatures by 1°C above pre-industrial levels. While the Paris Accord targets to limit the mean global temperature increase to well below 2°C above pre-industrial times, this would require a combination of measures such as policy action on emission mitigation, adaptation strategies, and also perhaps technological advancement (for both, emission reduction and $CO_2$ removal from the atmosphere).

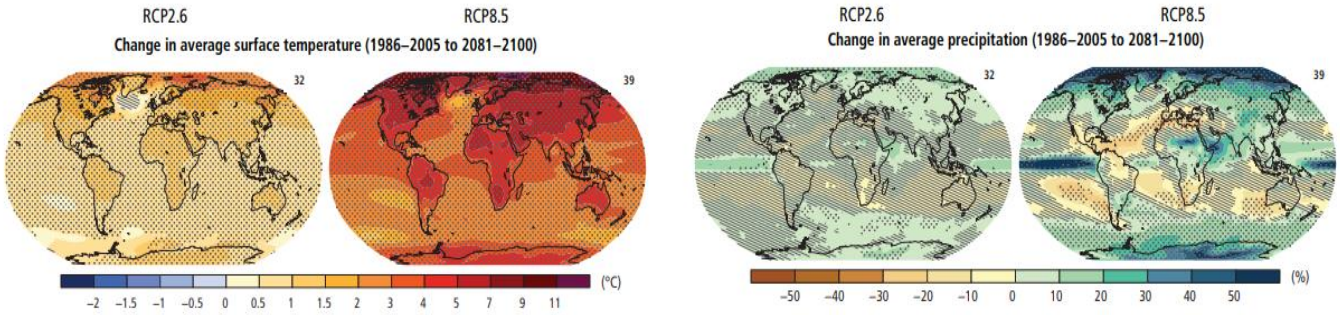
The IPCC has estimated pathways for temperature increase ranging from 1.5°C to 4°C by the turn of this century. These pathways of temperature increase also correspond to representative concentration pathways (RCPs). RCPs refer to GHG concentration trajectories over time and are quantified in terms of watt/$m^2$. The relationship between mean temperature increase and RCP is highlighted below.

### Description of common climate risk reporting frameworks

| RCP level (Watt/m2) | Mean temperature increase* | Emission trajectory requirements |
|---|---|---|
| 1.9 | 1.5 °C | 2017 |
| 2.6 | 2.0 °C | $CO_2$ emissions begin declining from 2020 and reach net-zero by 2100 |
| 4.5 | 2.4 °C | Emissions peak by 2040 and begin declining thereafter |
| 6.0 | 2.8 °C | Emissions peak only by 2080 |
| 8.5 | 4.3 °C | Emissions continue to increase up to 2100 |

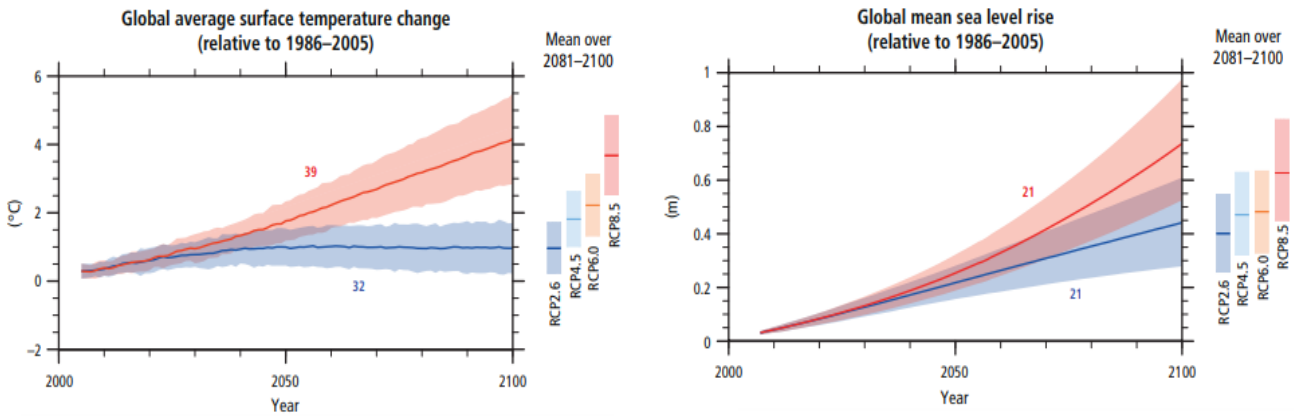
*Source: IPCC; * mean temperature increase refers to the change from pre-industrial levels to 2100*

### Estimated impact of RCP scenarios on changes in average temperature and precipitation




*Source: IPCC*

### Estimated impact of RCP scenarios on changes in average temperature and sea level rise




*Source: IPCC*

RCPs can also be combined with socioeconomic pathways (SSPs) in integrated assessment models to model future mitigation pathways with different levels of GHG mitigation trajectories and related socio-economic assumptions.

## Recognised climate scenarios that banks can leverage

While the IPCC has published extensive research around climate scenarios and the measures needed to limit temperature increases to 1.5°C, our conversations with global banks reveal a high degree of interest in the International Energy Agency's (IEA) sustainable development scenarios (SDS). However, the NGFS looks set to

become the benchmark for scenario design, as both the BoE and ACPR have adopted them as the starting point for their respective climate risk stress test exercises. Key features of both, IEA's and NGFS' scenarios are highlighted below.

**Overview of key climate risk scenarios**

| Framework | IEA (October 2020) | | | NGFS (June 2020) | | |
|---|---|---|---|---|---|---|
| Scenarios | SDS | DR | STEPS | Orderly transition | Disorderly transition | Hot house world |
| Models used | Proprietary world energy model with three modules – energy consumption, energy transformation, other transformation | | | GCAM, REMIND-MAgPIE, and MESSAGEix-GLOBIOM | | |
| Temperature increase by 2100 | 1.5- 2.0°C | N/D | N/D | 1.5- 2.0°C | Below 2°C | 4°C |
| Carbon price estimates | Introduction in 2025 $140/tonne (advanced economies) and $125/tonne (emerging) by 2040 | N/D | By 2040: EU: $52/tonne China: $35/tonne | Introduced in 2020; annual increase of $10/tonne | Introduced in 2030; annual increase of $35/tonne | No carbon taxes |
| Assumptions of $CO_2$ removal technology | Assumed to be available | N/D | N/D | Fully available | Limited availability | N/A |
| Net-zero targets | 2050-2070 | N/D | N/D | 2050-2070 | 2050 | Not achieved |

*Notes: STEPS = stated policies scenario; SDS = sustainable development scenarios; DR = disorderly recovery scenario; N/D = not disclosed*
*Source: IEA and NGFS, RISE analysis*

## Reporting standards for companies

Over the past two decades, several independent bodies have developed frameworks for companies to report their performance metrics on sustainability and environmental, social and governance (ESG) factors. The Task Force on Climate-related Financial Disclosures (TCFD) framework launched by the Financial Stability Board (FSB) in 2017 has recently been gaining traction with global banks, as it is solely focused on climate risks. Key features of the most notable frameworks are highlighted in the table below.

**Common climate risk reporting frameworks**

| Framework | Owner | Framework launch | Adoption | Description |
|---|---|---|---|---|
| TCFD | Financial Stability Board | 2017 | 1,440 companies committed support; disclosure followed by many | A framework to report climate-related financial disclosures across four elements – a) governance, b) strategy; c) risk management, and d) metrics and targets |
| SASB | SASB Foundation (not for profit) | 2018 | >400 companies | A framework to report financially material ESG metrics and disclosures, customised for 77 industries |
| CDP | CDP Global (not for profit) | 2002 | >8,400 companies | A Q&A type report where companies provide answers to a list of standard questions related to sustainability |

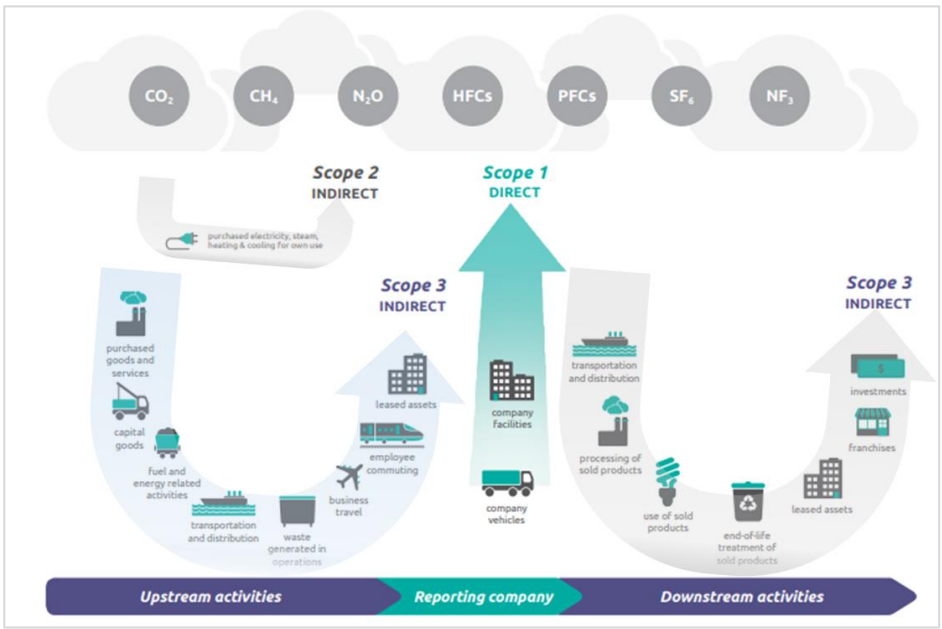
| Framework | Owner | Framework launch | Adoption | Description |
|---|---|---|---|---|
| CDSB | CDSB (consortium of NGOs) | 2010 | 374 companies | A framework to disclose environmental and climate-related issues in annual reports |
| GRI | GRI | 2000 | 15,100 companies | A framework to report material ESG risks |

*Source: Company websites, press sources, RISE analysis*
*TCFD = Task Force on Climate-related Financial Disclosures; CDP = formerly Carbon disclosure project; CDSB = Climate disclosure standards board; SASB = Sustainability accounting standards board; GRI = Global reporting initiative*

The GHG protocol is widely regarded as the global gold standard for reporting GHG footprint. The protocol was established in a report published by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) in the late 1990s. The definition of GHG is consistent with the Kyoto protocol and hence only includes six gases – $CO_2$, $CH_4$, $N_2O$, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride ($SF_6$). It does not include CFCs and NOx. The GHG emissions are reported in tonnes of $CO_2$ equivalent, as the five other gases are calculated separately and then converted into $CO_2$ equivalents based on their respective global warming potential.

The emissions are reported under three categories as highlighted in the infographic below. Scope 1 includes direct emissions from sources that are owned and controlled by the company. Scope 2 refers to indirect emissions from the consumption of purchased electricity, and can be reported under two methods (location-based, i.e., GHG energy intensity o the grids where a firm's sites operate; and market-based, which factors in emissions from energy contracts and instruments. Scope 3 refers to those indirect emissions occurring from sources not owned or controlled, typically upstream or downstream in the supply chain. Scope 3 is generally far more challenging to source than Scope 1
and 2.

**GHG protocol scopes across the value chain**




*Source: ghgprotocol.org*

Apart from GHG emissions, companies also typically report water use, paper consumption, waste, and business travel.

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