Sustainable Banking

TCFD reporting

Climate change is one of the most complex and defining issues of our time and there is a critical need for the world to reach net zero by 2050 in alignment with the Paris Agreement and the 1.5°C trajectory outlined by the Intergovernmental Panel on Climate Change (IPCC). As a leading financial institution in the region, we are committed to strengthening our portfolio resilience and to being a positive force in the fight against climate change.

Governance

Board's oversight of climate change-related issues

Climate change is a priority for our senior leaders. As part of UOB's sustainability governance structure, our Board provides oversight of climate change-related issues through the Executive Committee (Exco), with support from our Management and relevant business units. The Board receives twice-yearly updates on climate-related topics. These include, but are not limited to, regulatory developments, internal policies, direct environmental impact through our operations, indirect impact through our financing and investment activities, our initiatives to support our customers on their sustainability journey, as well as sustainability reporting disclosures.

Other Board Committees may also receive reports related to climate change-related risks and opportunities that come under their respective charters. The Board and relevant Board Committees consider climate change-related risks and opportunities in the context of our guiding principles and sustainability strategy pillars.

Climate change-related issues are integrated into the following sustainability governance mechanisms:

- strategy review;
- guidance on major plans of action;
- review and guidance on risk management policies;
- monitoring of implementation and performance of objectives;
- oversight of progress against goals and targets for addressing climate change-related issues; and
- review and approval of climate change-related disclosures in our annual reporting.

Amid the growing call for companies to demonstrate their prudent management of climate risk as well as demonstrate their commitment to net zero emissions by 2050, UOB announced our net zero commitment in October 2022 with endorsement from our Board. As part of this process, the Board reviewed and approved the principles for sector prioritisation, including emissions materiality, abatement horizon and portfolio materiality for each of the six sectors, namely power, automotive, O&G, real estate, construction and steel.

Management's role in addressing climate change-related issues

The Management Executive Committee (MEC) supports the Exco on climate change-related matters and provides strategic direction for our sustainability practices. The MEC is responsible for:

- guiding the development of ESG-related policies, including those related to climate change;
- managing and monitoring climate change-related risks and opportunities; and
- overseeing the progress, performance and reporting on climate change-related issues.

The GSC, which comprises senior management from business and support units across the Bank, identifies climate-related risks and opportunities and assesses emerging issues. The wide representation ensures that climate change-related issues – whether identified by ourselves, investors, customers, regulators and other stakeholders – are integrated into our decision-making, and addressed at the highest levels.

In 2022, the GSC provided the Exco updates on our sustainability strategy in the following areas:

- emerging climate change issues;
- UOB's direct environmental impact;
- enhancements to the Group Responsible Financing Policy; and
- our roadmap on implementing the TCFD recommendations to support our customers and other stakeholders in sustainable development.

Sustainable Banking

Implementing action to address climate change-related issues

The TCFD working group, which was established in 2019 under the GSC, is a cross-functional working group responsible for reporting and driving the implementation of disclosures in line with TCFD recommendations.

Together with the GSC, the working group ensures that UOB maintains a robust and integrated platform for governing, implementing and monitoring climate change-related targets and strategies. The working group comprises senior representatives who have specific responsibilities in the implementation of our overall sustainability strategy to address climate change-related issues. These representatives are from:

- Group Risk Management;
- Group Corporate Sustainability Office;
- Group Strategy and Transformation;
- Group Wholesale Banking;
- Group Retail;
- Group Finance and Corporate Services; and
- UOB's key overseas subsidiaries.

We are also guided by our Group Sustainability Framework, which is implemented through relevant policies and guidelines, including our Group Responsible Financing Policy that governs our review and approval of customer transactions in environmentally- and/or socially-sensitive sectors. Our financing teams work with customers to address climate change-related challenges and opportunities, and when necessary, also work in collaboration with non-governmenal organisations, certification bodies and other mutual stakeholders.

Internally, to manage our direct environmental impact, our Corporate Real Estate and Services unit has a specialised energy and sustainability team that works to mitigate our environmental footprint and to realise our green building targets. Our Sustainable Procurement Working Group oversees our indirect impact by ensuring that material suppliers act in compliance with our Group Supplier Sustainability Principles. In addition, we have dedicated environment specialists that work full-time on our initiatives in the relevant business units, ensuring ownership of the Bank's sustainability goals across our organisation.

Find Out More

Sustainability Governance

Direct Environmental Impact

Sustainable Procurement

Strategy

Climate risks, both transition and physical, can manifest through various risk drivers and materialise at different time horizons. As one of the regions most at risk to climate change globally, ASEAN is vulnerable to the growing intensity and magnitude of extreme physical weather events.

While chronic physical risk is expected to materalise in the long term, acute physical risk is event-driven and may manifest in the shorter term, evidenced by the physical risk events witnessed in the past few years such as the severe floods in Malaysia and Thailand.

The economic, environmental and social impacts resulting from climate change threaten to undo decades of developmental progress. As climate mitigation and adaptation measures scale up, these may also result in unintended consequences. Notably, while phasing out fossil fuels is a critical step to curb temperature rise, it may threaten energy security if implemented too abruptly.

Sustainable Banking

Key climate-related risks and potential impact identified over various time horizons

Classification	Risk drivers		Examples of potential impacts	Expected time horizon
Transition risk	Policy and legal	• Policy or regulatory changes to mitigate climate change impacts and to encourage shift towards renewable energy sources. E.g. implementation of carbon pricing, tighter energy efficiency standards and more stringent regulation of products and services • Exposure to environmental litigations amid increased stakeholder expectations	Policy changes such as the phase-out of internal combustion engine vehicles and single-use plastics, or the Extended Producer Responsibility that could lead to structural business disruption and loss of competitiveness of our clients	Short / medium term
			Growing adoption of carbon pricing in the region may increase operating cost, particularly for heavy emitters, potentially leading to credit deterioration of our clients	Short / medium term
			Development of regional and national Green Taxonomies may restrict heavy emitters' access to funding	Short / medium term
	Technology	Technological improvements or innovations may lead to rapid changes in costs of production, competitiveness, and demand-supply dynamics of certain sectors and necessitate the write-off of existing assets and increased capital expenditure	Technological advances have improved the viability and cost competitiveness of green technologies, such as electric vehicles and solar/wind energy, which could disrupt demand for fossil fuel-based businesses and trigger early write-offs	Short / medium / long term
			Investment in technology, and research and development expenditure to reduce emission or to improve energy efficiency could stress the balance sheets of affected clients	Short / medium / long term

Sustainable Banking

Classification	Risk drivers		Examples of potential impacts	Expected time horizon
Transition risk	Market	Increased volatility and uncertainty in market trends and signals caused by changing customer behaviours, increased cost of raw materials, etc.	Shift in consumer preferences towards more sustainable products and services could lead to demand destruction for higher-carbon businesses and increased costs to adapt to market trends	Short / medium term
			Sourcing restrictions for carbon-intensive raw materials and surge in demand for critical minerals needed for EV batteries could lead to increased volatility and costs	Short / medium term
	Reputation	Increased expectations and scrutiny from consumers, regulators, communities and other stakeholders on climate and emissions reduction	Reduced demand for products/services, availability of funding to stigmatised sectors and our counterparties, as well as the ability to attract/retain talent	Short / medium / long term
			Banks may face heightened scrutiny and reputational impact from financing/ investing in unsustainable businesses, insufficient progress in meeting emissions reduction commitment and greenwashing	Short / medium / long term
			Litigations associated with greenwashing or misrepresentation of green/sustainability credentials	Short / medium / long term
Physical risk	Acute	Increased severity and frequency of extreme weather events, such as heat waves, typhoons, floods and bushfires	More frequent and severe climate events, such as floods and droughts, in ASEAN could disrupt operations and damage physical assets, resulting in lower revenues, increased recovery/insurance costs and asset value impairment	Short / medium / long term
			Increased frequency and severity of heat waves could have wide-ranging economic effects including damage to infrastructure, crop failure and lower labour productivity	Short / medium / long term
	Chronic	Long-term shift in climate patterns, such as temperature rise, sea level rise and sustained lower average precipitation	Shifts in climate, such as rainfall patterns, rising temperatures and sea levels could result in reduced crop outputs, affecting food production and security, as well as deterioration in living and working conditions	Long term
			Decrease in asset values in vulnerable regions, such as coastal areas in ASEAN that are susceptible to flooding	Long term

Note on materialisation timeline:
Short term: <3 years; Medium term: 3-10 years; Long term: >10 years

Sustainable Banking

To better assess our portfolio resilience under various plausible outcomes, we continued to strengthen our capability in climate scenario analysis, building on our efforts over the past few years. We partnered an internationally-recognised consultancy to enhance our methodology to holistically assess the impact of both transition and physical risks on borrowers' financial performance, taking into consideration the differentiated responses and drivers for different sectors (See Appendix – Climate Scenario Analysis Methodology).

Our assessment covered the following long-term scenarios referencing the 2021 Network for Greening the Financial System (NGFS) Phase II scenarios:

	Orderly Transition	Disorderly Transition	No Additional Policies
NGFS reference	**Net zero 2050 scenario** Stringent climate policies and innovation that limit the impact of physical risks and allow for gradual economic adjustment	**Delayed transition scenario** Concerted climate policy actions will commence only in 2031 causing an abrupt structural shift in the global economy. Physical risk will be slightly elevated but remain limited overall	**Current policies scenario** Due to business as usual, the materialisation of acute and chronic physical risks will result in permanent impact on both labour and capital productivity, and consequently on economic output
Transition risks	Moderate	Moderate to high	Limited
Nature of transition	Early and orderly	Delayed and disorderly	Only policies in place as at the end of 2021
Physical risks	Limited	Limited	High

The scenarios were applied on our Corporate, Sovereign, Banks, Retail Mortgage and Auto portfolios, which accounted for more than 90 per cent of UOB's total exposures. In particular, the assessment for our Corporate portfolio focused on six sectors most relevant to climate risk, namely fossil fuels, utilities, heavy industries, building and construction, transportation and agriculture[2]. Top borrowers in each of these sectors were subject to bottom-up analyses using granular data such as production outputs, business mix and detailed asset locations. Using our credit rating models, the financial impact under each scenario on the borrowers' credit rating was simulated.

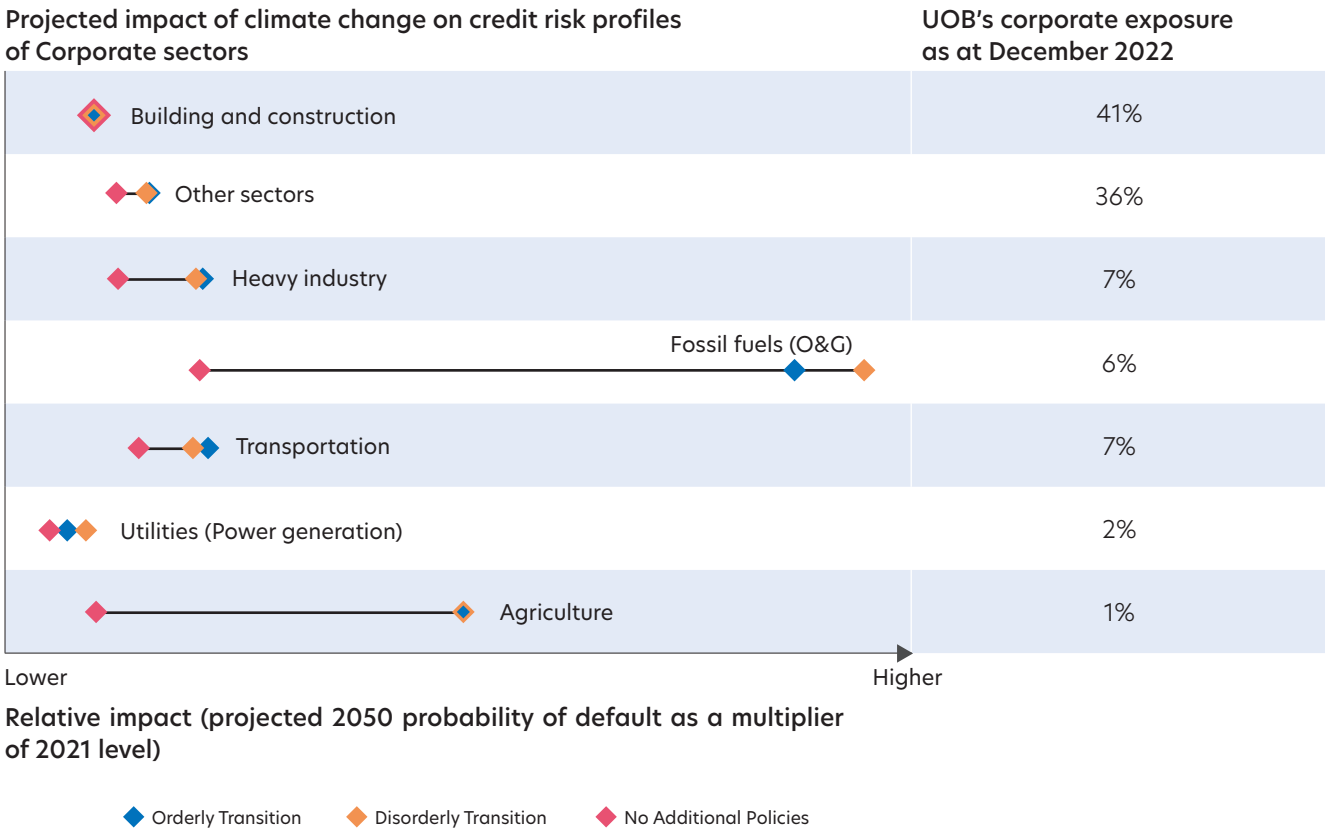
Overall, average change in projected credit risk profile of our assessed portfolios over time was not significant across all the three scenarios. Stress impact was mainly contributed by some sectors in the Corporate portfolio, notably O&G and agriculture, triggered by the transition pathways under the 'Orderly Transition' and 'Delayed Transition' scenarios.

While we saw relatively milder impact under the 'No Additional Policies' scenario, this could be due to the assessment horizon until 2050 that does not cover the second half of this century, when impacts from physical risks are expected to be more pronounced. In addition, this may also be attributed to data, scenarios and methodological limitations, with climate scenario analysis still relatively nascent despite significant progress made the past few years.

2 Sectors identified in "A climate stress-test of the financial system", by Battiston et al, 27 March 2017. These were also adapted by the MAS in the 2022 Industry-wide Stress Test exercise.

Sustainable Banking

Scenario analysis results for our Corporate portfolio by sector



In recognition of the common industry challenges associated with climate risk assessment such as data availability, we will continue to work with regulators, industry associations, consultants and climate specialists to progress collectively to a more robust approach as methodologies and tools evolve and mature.

As a responsible lender, we are cognisant of the key role we play to help channel the resources needed and to support our clients in seizing climate-related opportunities on their decarbonisation journey. In October 2022, we published our net zero commitment, detailing key opportunities for us to support our customers in building a sustainable ASEAN through a just and equitable transition to a low carbon future.

Sustainable Banking

We identified climate opportunities across six focus sectors in two key carbon-emitting ecosystems – energy and built environment. These opportunities have already materialised in some markets and are expected to continue growing as more segments of the economy start decarbonising in the medium to long term.

Identified climate-related opportunities across sectors

Ecosystem	Focus sector	Opportunities
Energy	Power	Working with power generation companies and equipment manufacturers to adopt decarbonisation targets and increase financing for new renewable energy projects
	Automotive	Working with equipment manufacturers, dealers, and financial leasing companies to support EV supply chains and increase financing for EV-focused businesses and activities
	O&G	Working with companies in hard-to-abate sectors to finance renewable energy, low emissions fuel alternatives, emissions reduction technologies, efficiency improvements in refining and other processes
Built environment	Real estate	Working with property developers, operators, investment companies and real estate investment trusts (REITs) to encourage the adoption of energy efficiency standards for buildings and to finance more energy-efficient buildings and installation of renewable energy and energy efficiency retrofits
	Construction	Working with companies engaged in construction and demolition to encourage the deployment of low-carbon construction processes, to improve their emissions intensity profile and to finance installation of on-site renewable energy
	Steel	Supporting crude steel and fabricated metal producers and traders to encourage the shift towards electric arc furnace production methods, to research and develop new technologies and to improve plant efficiencies

To harness these opportunities, we will increase our engagement with our clients on climate change and transition, as well as develop tools to facilitate better monitoring and reporting as part of our net zero commitment.

Find Out More

UOB's commitment to net zero

Sustainable Banking

Risk management

Climate risks are complex and transverse in nature, and may potentially translate into known financial risk types for banks including credit risk, market risk, liquidity risk and operational risk. We have assessed the various climate risk transmission channels using either a qualitative or quantitative approach, and considered potential credit risk impact to be the most material.

Climate risk is identified, assessed, managed and monitored through our Group ENRM Framework, which is approved by the Board Risk Management Committee.

In 2022, no material climate-related financial losses were incurred, either through our corporate lending activities or damage to the Bank's assets and associated business disruptions. Minor physical damages were adequately insured.

Climate risk assessment

Secondary risk	Transition risk			Physical risk		
	Short term (<3 years)	Medium term (3-10 years)	Long term (>10 years)	Short team (<3 years)	Medium term (3-10 years)	Long term (>10 years)
Credit						
Market						
Liquidity						
Operational						

Legend:
Low Moderate High

We manage **credit risk** associated with climate and ESG risk through our Group Responsible Financing Policy, which covers risk identification, assessment, mitigation and monitoring. Sectors with inherently higher ESG risk are subject to enhanced due diligence with sector-specific requirements. Based on our climate scenario analysis, the impact of transition and physical risk was not expected to be material in the short term, but may manifest more prominently in the longer term.

Banks may be exposed to **market risk** arising from the increase in volatility in investments and potential declines in valuations, due to impacts from severe physical climate events and shifts in investor preferences, particularly in carbon-intensive sectors. However, the short-dated nature of such exposures suggest that the impact is likely to be contained. Our trading desks conduct stress testing daily using scenarios depicting various climate events. These scenarios have a horizon of 10 days as trading activities are reactive to short-term market movements and portfolio exposures are rebased frequently.

Liquidity risk stems from the inability to raise funds to meet the Bank's obligations due to various factors including those relating to climate change. Acute physical risk events may cause widespread physical damage and lead to a surge in client's deposit withdrawals to finance damage repair and demand for emergency loans. In addition, decarbonisation of the economy over time may lead to difficulty in liquidating liquid assets issued by carbon-intensive corporates held by the Bank. However, this portfolio forms a limited part of our overall liquid assets. UOB manages both short-term and long-term liquidity implications of climate risk through stress testing.

Extreme weather events may also result in **operational risk** through disruptions to business continuity, due to adverse impact on the Bank's infrastructure, systems, processes and employees. The risk is particularly relevant to UOB given our footprint in ASEAN, a region commonly associated with elevated physical risk. To mitigate this, our key critical facilities are equipped with high resiliency and critical systems are built with high availability.

Sustainable Banking

UOB's business continuity plans set out the recovery strategies, action plans and resources needed following a crisis to recover critical business processes within an expected timeframe and to a planned acceptable level that minimises significant impact to the Bank, as well as to restore our operations to normalcy. We have in place a Business Continuity Management and Crisis Management Framework, and recovery efforts are overseen by a Business Continuity Management Task Force that reports directly to the Group Recovery Plan's Crisis Management Team headed by our Group CEO.

Banks have generally made more progress in integrating environmental risk, including climate risk, into credit and reputational risk management processes and less so in other risk areas[3]. As such, we will continue to strengthen our understanding of the manifestations of climate risk in non-credit risk types and will direct our efforts towards strengthening our risk management approach. This includes progressing towards quantitative assessments of potential climate risk impacts over longer time horizons.

We expect that as climate risk becomes increasingly mainstream, methodology, data quality and availability will continue to improve, leading to more accurate and insightful assessment outcomes in the future. We are committed to continuing our engagement with regulators, industry associations and climate specialists, as well as actively participating in and supporting various initiatives such as the ASFI, the MAS Project Greenprint and the MAS GFIT to improve our capabilities in climate risk management.

Further, as our business and operations span multiple jurisdictions, we will closely monitor international developments such as the UN Climate Change Conference, the Basel Committee on Banking Supervision's (BCBS) initiative on climate risk management, as well as new initiatives by the NGFS and local regulators. This will enable us to stay ahead of potential new regulatory requirements and to keep abreast of best industry risk management practices.

Management of wider environmental and nature risks

Scientific research suggests that climate change and nature loss are intertwined and cannot be addressed independently. Climate change events such as rise in temperature and changes in precipitation patterns have a range of impacts on nature[4]. The importance of nature and its health is increasingly recognised, particularly as half of the global economic activity is assessed to be moderately or highly dependent on natural capital or the world's stock of natural assets.

For example, the building and construction sector, one of the major emitters globally, depends heavily on nature to provide materials for building such as sand, iron ore for steel, and limestone for cement. Therefore, there is increased urgency to address nature loss alongside efforts to support the global transition to net zero.

In 2022, UOB, together with several financial institutions in Singapore, participated in a pilot study organised by Global Canopy on the implementation of the Taskforce on Nature-related Financial Disclosures (TNFD) beta framework within the palm oil sector. Insights into the current practices, barriers and challenges experienced during the pilot contributed to further refinement of the framework.

3 Source: *Information Paper on Environmental Risk Management (Banks)*, MAS, May 2022, and *Climate-related financial risks – measurement methodologies*, BCBS, April 2021.

4 Source: *Integrating climate and nature: The rationale for financial institutions*, University of Cambridge Institute for Sustainability Leadership, 2022.

Sustainable Banking

Metrics and targets

In 2022, we established our financed emissions baseline, setting science-based targets and commitments for six focus sectors. Our approach is in line with the guidance from the Glasgow Financial Alliance for Net Zero (GFANZ) and we have applied standards by the Partnership for Carbon Accounting Financials (PCAF) to account for the greenhouse gas emissions associated with our financed portfolio.

Energy

Power
Reduce emissions intensity by 61% by 2030 and 98% by 2050

Automotive
Reduce emissions intensity by 58% by 2030 and net zero by 2050

Oil and gas
No new project financing for upstream oil and gas projects approved for development after 2022

Built Environment

Real estate
Reduce emissions intensity by 36% by 2030 and 97% by 2050

Construction
Reduce emissions intensity by 31% by 2030 and 85% by 2050

Steel
Reduce emissions intensity by 20% by 2030 and 92% by 2050

In determining our clients' emissions, three key design decisions were made:

1. **Emissions metric**
   With our goal to achieve net zero and to support sustainable growth, our primary objective is to support more economic output for lower emissions. As such, our targets are to reduce emissions intensity, or reduced emissions per unit of sector output.

   Where possible, we have used physical-based emissions intensity metrics, such as emissions per tonne of crude steel produced for the steel sector, and per square metre of floor space for the real estate sector, to reflect the direct relationship between the emissions-generating activity and the resulting emissions. Where data on physical activities were not available, for instance within the construction sector, we have used a revenue-based emissions intensity metric in this initial target-setting exercise. For fossil fuels, we have set policy restrictions rather than targets, in recognition that the path to net zero for these sectors is more about a managed phase-down and less about reducing emissions intensity. There is also the critical priority to limit new supply so that price incentives for the switch to alternatives are maintained.

   These approaches are tailored to our selected sectors and we are supporting net zero through our portfolio by making progress against our targets.

2. **Value chain inclusion**
   Within each of our selected sectors, we focus on the parts of the value chain that generate the most emissions and where we have the most material exposure and influence on the emissions level. These decisions are made on a sector-by-sector basis, taking into account what is practical. In some instances, we have focused on areas that have the best available data; in others we have focused only on certain parts of the value chain in order to maintain comparability within the sector and with the available reference scenarios.

Sustainable Banking

3. **Emissions scope**
   We have focused on the most material scopes of emissions for each sector and the emissions within the control of the clients for which we are setting targets, while ensuring that the scope included in our baseline is the same as defined by the science-based reference scenarios.

   After we have calculated the emissions data for each client, we aggregated the data to form an overall sector-level emissions baseline based on the weight of the exposure in our portfolio:

$$\text{Emissions intensity} = \sum_{i} \frac{\text{Exposure}_i}{\text{Total sector portfolio exposure}} \times \text{Emissions intensity}_i$$

where i is a borrower or investee company in each sector.

When creating the weighted averages, we aggregate the emissions data at an overall sectoral level and include the following products in the calculation of exposure:

- business lending;
- specialised lending, including project finance;
- investment securities; and
- debt capital markets underwriting.

Selecting reference scenarios

To understand the required levels of emissions intensity reductions, we have relied on science-based models that chart out the most credible pathways to net zero by 2050 across sectors and countries. These are from Integrated Assessment Models, including International Energy Agency Net Zero Emissions by 2050 Scenario (IEA NZE), NGFS – REMIND and NGFS – Global Change Assessment Model (GCAM), or specialised industry research bodies such as Carbon Risk Real Estate Monitor (CRREM) for the real estate sector and Mission Possible Partnership (MPP) for the steel sector.

We have considered the appropriate and best available pathway on a sector-by-sector basis and in view of the following:

- ensuring scientific credibility and alignment with 1.5°C warming by 2050;
- ensuring an appropriate level of regional granularity for our portfolio. As we operate across Southeast Asia, we need to ensure that we select pathways that are realistic and fair for the emerging economies in which we operate as well as the developed countries we serve. Where possible, we have derived a region-specific net zero pathway that extract the scientific projections for our markets;
- ensuring the right level of sector granularity, especially in highly heterogenous sectors such as real estate, for which we have adopted an industry-specific pathway; and
- adopting pathways that assume continued economic growth and which do not overly rely on reduced growth or unrealistic assumptions around carbon removal to achieve net zero by 2050.

We recognise that the science of sector-based prescriptions towards net zero is an emerging and uncertain field. Of the scenarios we consider, the steel reference scenario from MPP was published in late 2021, while the IEA NZE scenario was published in mid-2021.

As actual circumstances and government policies shift, or when technologies come to the fore or fail to deliver the impact expected, new reference pathways will likely be needed.

Our approach will need to evolve with the science. To ensure comparability, we will continue to report against the targets until there is a pressing need for new reference pathways. This will likely happen several times between now and 2050.

Find Out More

UOB's commitment to net zero

Climate Scenario Analysis Methodology

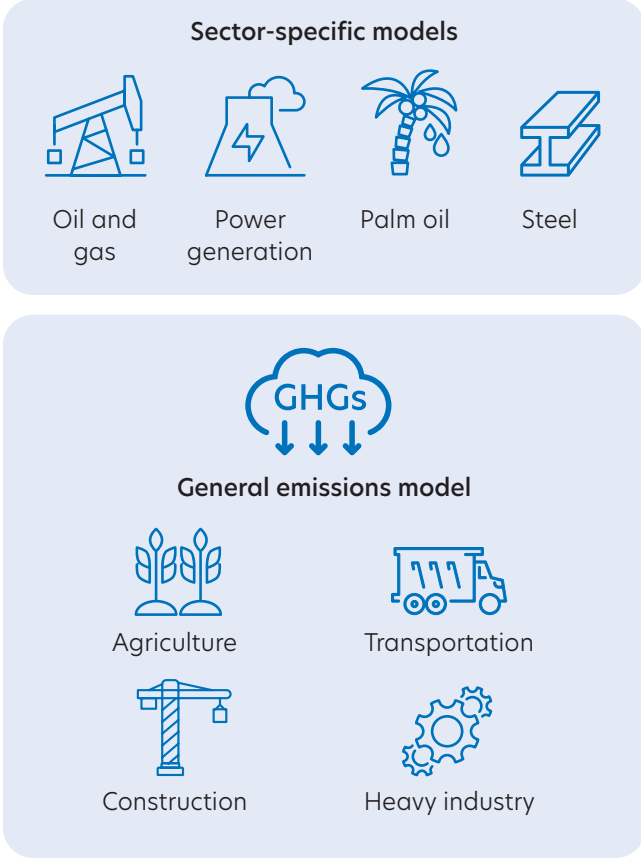
Our approach

We employ climate scenario analysis models to assess the impact of both transition and physical climate risk on our risk profile and business strategies, as well as resilience of our corporate borrowers to financial losses under a range of outcomes. These models translate the transition risk impacts of policy and legal changes, technological advancements and demand-supply shifts associated with a particular climate scenario to key financial drivers of a business. At the same time, impacts of acute physical events, such as floods, typhoons, heat waves, cold waves and forest fires, and chronic climate pattern changes, such as sea level rise and land subsidence, are converted into additional business costs and expenses. We used this bottom-up approach, which enables us to holistically assess climate risk impacts at the individual borrower level, to conduct the climate stress test as part of the Monetary Authority of Singapore's 2022 Industry-wide Stress Test exercise.

We have developed four sector-specific models and one general emissions model. The sector-specific models are designed to incorporate more differentiated dynamics across real economy sectors. For example, power is typically produced and distributed in national or regional-level markets, thus subject to more localised dynamics. Its price and production volume tend to be more controlled in fully-regulated markets, such as Malaysia and Indonesia, while sensitive to competitive forces in unregulated markets, such as Singapore.

In addition to requisite data on borrowers' financials, carbon emissions (Scopes 1, 2 and 3), carbon prices and asset locations, sector-specific models therefore require further data inputs such as fuel mix, generation volume, electricity price and market electricity capacity in the case of companies in the power generation sector.

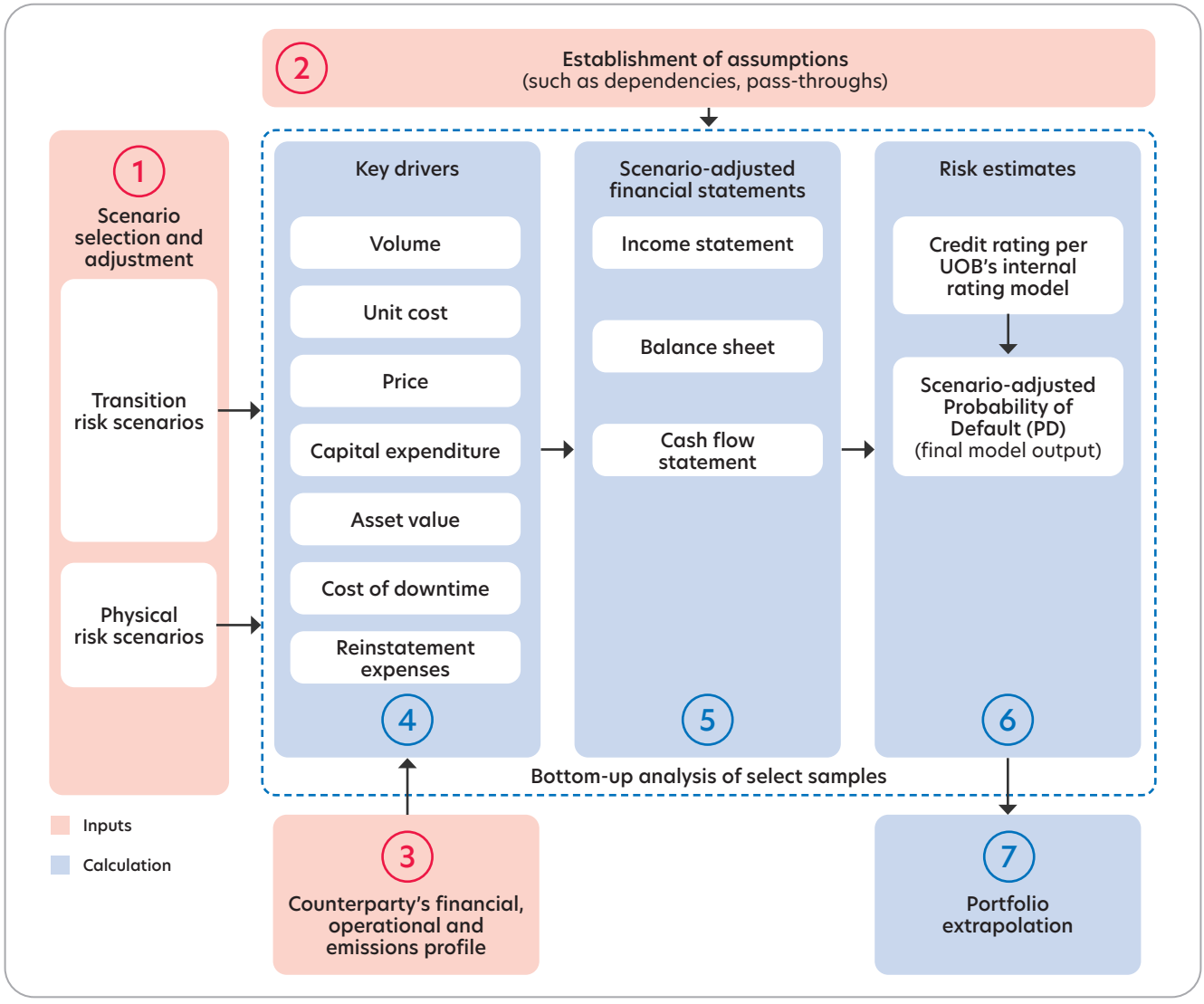
Climate stress test models used in various sectors



The general emissions and sector-specific models share a common underlying assessment methodology. In these models, the abovementioned data sets are used to project the climate risk impact on borrowers' financials under various climate scenarios via key financial drivers. The financial impact would then be translated into changes in the borrowers' credit rating over the forecast time horizon up to 2050. Due to data challenges, this bottom-up modelling is performed for a representative sample of borrowers from each industry segment and the insights derived from the analysis are then extrapolated to the rest of the borrowers in the sector.

Climate Scenario Analysis Methodology

Climate scenario assessment methodology



Step 1: Selection of climate scenarios and corresponding scenario variables

Climate scenarios are typically constructed using scientific data and methodologies by reputable international organisations, such as the Network for Greening the Financial System (NGFS), the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC), that facilitate better comparability and consistency across industries.

Each climate scenario is a simplified representation of how the global economy would evolve under a set of climatic conditions, economic and climate policy assumptions. A transition risk scenario provides the range of information and parameters needed to assess the impact of the transition to a low carbon economy, such as the trajectory of gross domestic product (GDP), inflation, property prices by geography, and market dynamics such as energy demand and supply of resources. A physical risk scenario defines possible climate consequences resulting from increased greenhouse gas emissions such as the likelihood, frequency and magnitude of climate events and patterns.

Climate Scenario Analysis Methodology

Step 2: Determination of assumptions
General and sector-specific model assumptions are determined by subject-matter experts and supported by available literature and market insights. Generally, we assume that companies will react rationally to economic and market conditions introduced by scenarios so as to minimise cost and to remain competitive and profitable. For example, companies would seek to pass through any cost increases to the extent possible depending on the price elasticity of demand of the sector it operates in. They are also assumed to distribute profits in excess of the amount required for reinvestment to their shareholders.

Step 3: Counterparty data collection
Financial, emissions and activities data of sampled companies are obtained from various sources, prioritising information directly acquired from our customers. Where direct information is not available, proxies or secondary data from credible third-party data providers serve as alternatives.

Step 4: Projection of scenario-adjusted financial drivers
Changes in the key financial drivers are projected based on the counterparty's starting position and the expected impact on its business as per the scenario. For example, the models incorporate the effects of:

- carbon tax increase on a company's cost of production due to its direct emissions and indirectly through carbon tax pass-through from their upstream supply chain, which in turn impacts the price and volume of goods sold;
- changes in consumption patterns on the volume of demand;
- investment needed to decarbonise on borrowers' balance sheet strength, which determines its ability to grow; and
- damage and disruption due to climate physical hazards on the company's revenue and operational costs.

Step 5: Development of scenario-adjusted financial statements based on key drivers
Financial statements, including balance sheet, income statement and cash flow statement, are then stressed based on changes in the key financial drivers.

Step 6: Counterparty's credit rating using UOB's internal credit rating models
Credit rating for each sampled counterparty over the forecast horizon is obtained using the stressed financial statements.

Step 7: Extrapolation of bottom-up analysis results to the wider portfolio
Due to its data-intensive nature, the bottom-up analysis is not expected to cover the entire portfolio. Instead, it is used to generate results for select samples in each sector. Insights from the bottom-up stress-testing analysis are used to identify the sector-specific risk drivers, which are then used to extrapolate the stress-testing analysis to the remaining companies in the portfolio.

Methodology limitations

While the methodology for climate scenario analysis has progressed rapidly in the last few years, it is still at a relatively nascent stage of development and the scarcity of data and modelling limitations remain key challenges. In particular:

- **Scenario design:** Our analysis was conducted based on the second phase of climate scenarios and parameters developed by NGFS, which had yet to incorporate the latest data and physical impacts. In addition, as the parameters were insufficiently granular, further assumptions were needed to better reflect localised conditions and sub-sector differentiation. In recognition of the limitations, NGFS has been proactively improving and updating its scenarios since launch and, in September 2022, published the third edition of its climate scenarios. The latest NGFS scenarios will be able to provide greater sector granularity and cover projected GDP losses from certain extreme weather events, with focus on cyclones and river floods, in addition to chronic physical risk.

Climate Scenario Analysis Methodology

- **Long-term assessment horizon:** To account for the long-term build-up of climate impacts, climate scenario analysis extends to a time horizon of 30 years, which is much longer than in traditional stress tests, as well as a typical business planning horizon. This introduces a higher degree of complexity and uncertainty from potential changes in the pace of technology advancement, geopolitical and demographic shifts and occurrence of climate tipping points. In addition, credit rating and natural catastrophe models are calibrated to forecast over the short term and not over the decades-long time horizon required for climate scenario analysis.

- **Incorporation of second-round effects:** Scenario analysis does not capture potential non-linearities and second-round effects, such as losses borne by insurance companies and costs of adaptation measures introduced to limit losses. This may therefore understate the climate exposure and vulnerabilities.

- **Data availability and quality:** Data limitations, especially for small- and medium-sized enterprises, restrict the ability to scale up the analysis to cover more customers. The resulting bias towards larger borrowers may have implications on the portfolio extrapolation. Even for some large corporates, emissions, energy and land use data required for climate stress-testing are scarce.

We expect continued focus in this area with the Financial Stability Board calling for greater cross-border cooperation on scenario design, modelling approaches, data and developing guidelines for scenario analysis. We will continue to collaborate closely with the industry and regulators to address these limitations and progressively strengthen our climate risk scenario analysis approach.