

THE IMPACT OF CLIMATE RISK ON FINANCIAL INSTITUTIONS

a risk leader's briefing note



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Professional Risk Managers' International Association

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We help your risk organization navigate complexity and aim to:

- Advance thought leadership in risk management and develop standards of practice for risk management.
- Promote understanding of the field, both from a practice and policy perspective.
- Work with private and public entities on applied risk management related research.

Our work is centered on applied research.

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- The PRMIA Institute is a registered party for the EU's Horizon 2020 funding initiative.
- We have experience in design and management of work packages of larger funding initiatives.
- Our PRMIA expert network and the PRMIA Institute senior advisors are industry leaders with vast experience.

All this allows the Institute to be a research partner with the knowledge and network to bring success to your analysis.

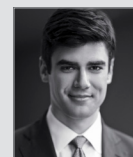
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1. Introduction

Climate is changing. Empirical evidence abounds in all continents, with rising temperatures and an increased frequency of severe weather events. Left unchecked, these changes will generate significant harm for society at large. The political response to this threat was the 2015 Paris agreement on Climate Change, which aims to restrict global temperatures to no more than 2°C above pre-industrial levels. Given the resulting objective of reducing carbon emissions by half by the year 2030, public policy increasingly seeks to incentivise the generation and use of Green Energy, as well as to dis-incentivise carbon-based energy sources.

The transition to a new Green Economy represents a valuable opportunity for many Financial Institutions. It also brings about new risks, some of which have been highlighted in recent central bank studies and will feature in selected supervisory programmes. Consequently, many firms have already started to develop climate-related strategies to ensure an orderly business transition to the new normal.

In this paper, we aim to provide Risk Leaders with an overview of the critical industry changes associated with different climate change scenarios. This provides insight into the key risks and leads naturally to a discussion of how these risks can be managed. From this, we set out a proposed roadmap for the development of Standards of Practice for Professional Risk Management in Climate Change.

PRMIA acknowledges and thanks the contribution of the members of the PRMIA Institute Climate Change Advisory Panel for their time and contribution to this piece of work.



“If we don’t have a planet, we’re not going to have a very good financial system.”

James Gorman, CEO Morgan Stanley

James Gorman's quote from The Financial Times article: <https://www.ft.com/content/5f1d9fd8-d96e-11e9-9c26-419d783e10e8>

key messages

- Climate is changing, and this changes the risk profile of a Financial Institution (FI):
 - Physical risks are increasing, impacting the value of physical assets such as real estate.
 - Transition risks are appearing and will negatively impact the value of 'brown' assets.
 - Green finance is growing, and Risk Managers will need to be able to assess proposals.
 - Every firm will require a climate strategy, which should be approved by the Board of Directors.
- Risk management needs to evolve:
 - Climate is fundamentally a credit/investment concern. A sector-by-sector, client-by-client approach is required to assess all exposures.
 - Scenario Analysis needs to evolve: climate-based scenario analysis is much harder than anything currently done and will need new computational approaches, data and methodologies.
 - Every firm will require a climate risk management strategy
- The Profession will need to evolve: PRMIA is committed to supporting this evolution.

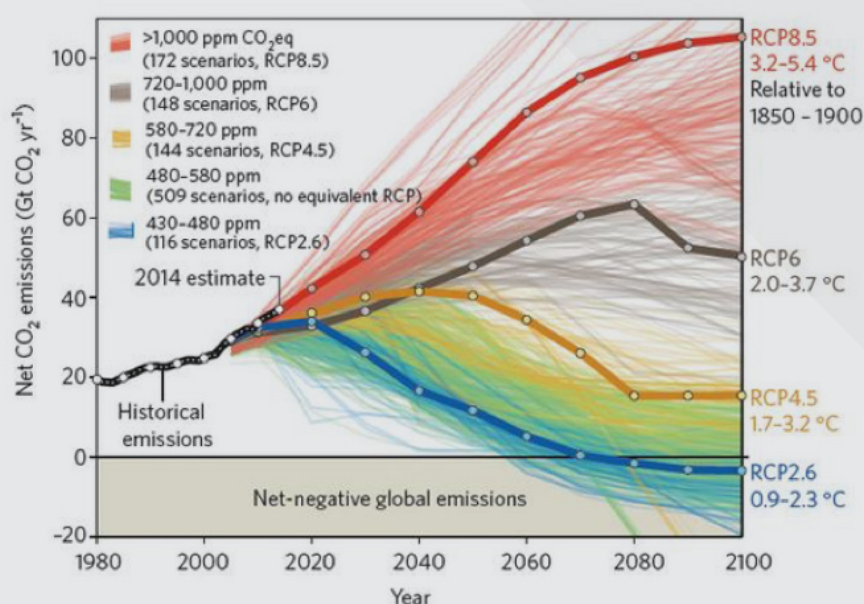
2. What are the risks?

In this section, we provide an overview of the different climate scenarios for the future. These different scenarios give an insight into the key risks faced by financial institutions.

2.1 climate scenarios

Detailed climate-based scenarios have been developed by the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change. IPCC analysis¹ considers over 300 different scenarios for future emissions of greenhouse gases, based on various assumptions regarding population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy. The core scenarios are summarised in the figure below, together with the implied temperature increases.

Figure 2.1 - Representative Concentration Pathway Scenarios based on CO₂ emissions



Source: The Intergovernmental Panel on Climate Change (IPCC)

- The top scenario (RCP 8.5) extrapolates recent emissions trends and assumes little or no effective climate mitigation, doubling carbon emissions by century end. Under such a scenario, the global climate is expected to increase by approximately 4.3°C (mid-point) by the year 2100: such a scenario is often referred to as a '+4-degree world' and represents an increased likelihood of extreme weather events, flooding and desertification.
- Next two scenarios (RCP6, 4.5) are intermediate scenarios with partial mitigation, albeit with different timing trajectories. Broadly speaking, the first (RCP 6) reflects current policies and the second (RCP 4.5) current pledges and targets. In both scenarios, the mitigation is assumed to be achieved by increased adaptation of alternative energy sources, with significant timing

¹ / IPCC (2014): Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, available at: https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

differences. Note that these scenarios diverge materially from the year 2040, with emissions decreasing under the latter scenario (pledges & targets).

- The last scenario (RCP 2.6) is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures. It thus features stringent mitigation, under which emissions are halved in the next decade, ultimately becoming negative in the latter half of the century.

Remark that none of these scenarios are tail scenarios in the strict probabilistic sense: all are comfortably within the 10-90 percentile.

Given the complexity associated with long-term climate forecasts, the following key observations should be made:

- The science still needs a lot more work to take us in a position of relative certainty. The historical data is sparse, the timelines are long, but we must find ways to mitigate the unhedgeable risk of Climate Change.
- Risk managers should consider, as with any distribution, the extremities, based on (not unreasonable) assumptions such as an increasing rate of emissions growth (upward convexity), or radical, accelerated shifts in public policy.

In short, risk managers should seek to understand the reliability and sensitivity of the available forecast data, and not be afraid to develop parallel scenarios outside of the established ones.

2.2 risks associated with these scenarios

Each of the above scenarios makes certain assumptions regarding the speed with which humanity can successfully transition from current, greenhouse emitting practices to cleaner alternatives.

“All aspects of food security are potentially affected by climate change, including food access, utilization, and price stability (high confidence scenario).”

IPCC Report

- At one extreme, there is little or no effective transition from carbon emitting energy to renewables, with the implied increases in global temperature and sea levels. This scenario thus represents a real risk to many physical assets (e.g. real estate) globally.

- This represents a significant increase in the financial risk to Institutions with exposures to these assets, for example, through asset financing, direct investment, or insurance underwriting.
- At the other extreme, an accelerated move to renewable energies would require substantial amounts of directed capital investment. Under this scenario, one would see a significant re-allocation of global capital from current, ‘brown’ energies to renewable, ‘green’ energies. Public policy measures to discourage and ultimately abolish brown energies would have a strongly negative impact on associated asset valuations, with many firms going out of business. Central banks² have thus spoken of a possible future ‘Minsky Moment’ under which impacted assets exhibit jump-to-distress pricing.
- In between, one has an element of both increased physical risk (due to rising global temperatures) and increased investment in renewables, intended to mitigate the physical risk, but ultimately increasing the risks of disorderly transitions in the near future.

“Climate-change impacts are expected to exacerbate poverty in most developing countries and create new poverty pockets in countries with increasing inequality, in both developed and developing countries.”

IPCC Report

In the next section, we will consider the following topics in greater detail:

- Physical risks to financial institutions, due to exposures to physical assets under threat from climate change.
- Transition risks, due to exposures to brown energy sources and possible market disruptions.
- Green finance, which will become a rapidly growing asset class for many firms in the next decade.

² / Cf. e.g. Speech by Mark Carney (2015) Breaking the tragedy of the horizon - climate change and financial stability, available at: <https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability>

3. Physical risks

In this section, we will address the various natures and impacts of physical risk, and set out some examples and case studies on how to address it. High-risk geographies may become uninsurable, and the risk profile may change significantly. Corporate lending suffers from more complex physical risk, for example agricultural crop yields and prices may be affected.

Ample empirical evidence (heat waves, floods, hurricanes) shows that the climate has changed significantly over the last few decades. We don't know what the future will bring, but we can and should analyse the potential impacts of future changes. If global temperatures continue to rise unchecked, how will this impact Financial Institutions?

Climate Change Risk is a long-term risk, which can evolve under multiple scenarios and could take a long time to materialise. Some risks can materialise now, and others may have deferred impacts. For example, London could flood because of the high correlations between high tides and rain. There are also scenarios with systemic implications which could encompass climate disasters simultaneously happening in London, NY and Tokyo, and the future projections are not very clear. Other systemic scenarios include sea-level rise, a shortage of drinking water, the tourism industry being hit by water crises and crop yields deteriorating because of climate change, which will raise sovereign risk issues.



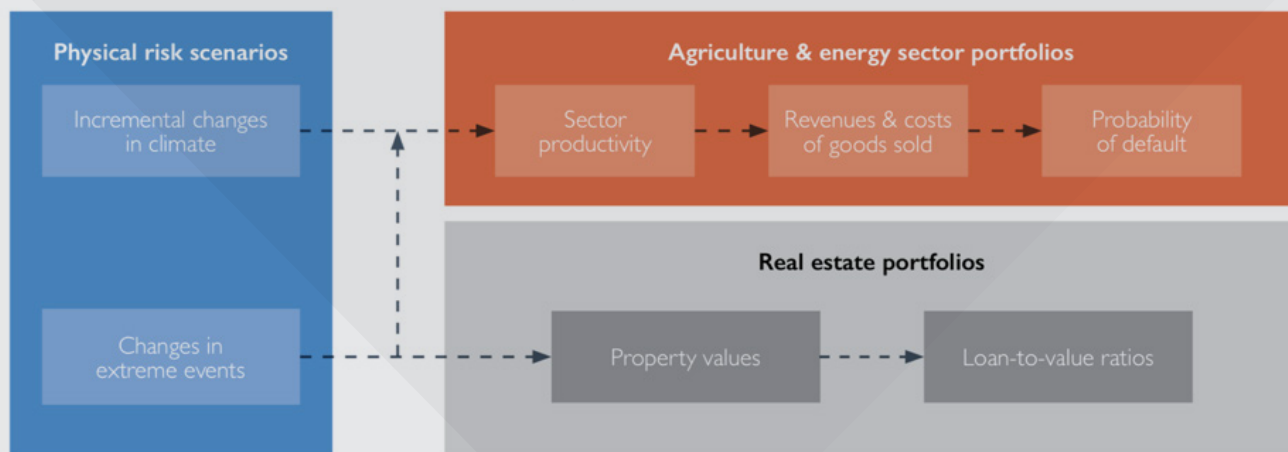
“Mother Nature is not waiting on our political calendar, and neither can we.”

Michael Bloomberg

The results can be scary as we unpeel the onion. Banks generally model the next five years in terms of future scenarios. And this is where most banks have focused their efforts. This makes Climate Risk management a little more complicated, as most of the impacts may be felt further into the future. Some banks have started working on 20-50 years scenarios, but the complexity means that the longer-term implications of climate change are difficult to predict.

Michael Bloomberg's quote from the New York Times article: <https://www.nytimes.com/2019/06/06/climate/bloomberg-climate-pledge-coal.html>.

Figure 3.1 - Overview of the physical risk methodologies



Source: Citigroup TCFD Report

Figure 3.1 outlines the approach used to assess physical risk in the Agriculture, Energy and Real Estate portfolios.

3.1 impacted portfolios

The entire economy is exposed to physical risks. In this section, we consider those FI portfolios which are the most impacted by Physical Risk: for example, those relating to the financing, investing or insuring of selected assets, sectors and regions. The most obvious ones to look at include Oil & Gas, Transportation, Real Estate, Manufacturers, Retail and Agriculture. To assess these risks, we need to understand both what the industry looks like in a +4-degree world, and what impact will this have, both on FIs and on society at large.

Mortgages

Many real estate assets (e.g. those located in or close to a floodplain) are exposed to physical risk. For many firms, the mortgage book is one of the largest portfolios, meaning the exposure is material. Climate risk is not foremost in the risk assessment of a mortgage portfolio: the principal driver of default is usually economic, relating for example, to unemployment. However, a severe flooding event which destroys both the property and the ground on which it is built may lead a borrower to default, especially in the North American market, where this could be the norm due to recourse lending. Thus, property insurance risk also becomes a default risk. Where mortgage securitisation is commonplace – for example, the UK, US and the Netherlands – this also becomes an investor risk, with potential downstream litigation. Where the taxpayer provides direct or indirect mortgage insurance or guarantees (e.g. Fannie/Freddie in the US, or NHG in the Netherlands), this will ultimately become a taxpayer issue as well.

Example: Flood risk in the UK

The UK Met Office estimates that under a medium emissions scenario the frequency of heavy rain days (defined as days with over 25 mm rainfall) will increase over most of lowland UK by a factor of 2-3.5 in winter and 1-2 in summer by the 2080s compared to 1990 levels. Coastal properties will also be impacted by sea-level rise and the subsequent increase in storm surge risk. Under a 2°C scenario, sea level in England and Wales is projected to rise a further 21-28cm by 2080.

In the UK, flood insurance usually is part of an annual home insurance policy, which is a requirement at the point of mortgage origination. However, during the lifetime of a mortgage, homeowners might fail to renew their policy, leaving them, and eventually, the bank, exposed to the financial risk of flooding.

The Financial Stability Report of 2019 by the Bank of England found that almost 10% of current mortgage exposure in England is in a flood risk zone³. Most of these properties fall within the low-risk category (probability of flooding of 0.1-1% in any one year). However, both the proportion of mortgages located in a flood risk zone and risk category would be expected to increase significantly based on the climate estimates discussed above. The analytical challenge for a mortgage bank is thus to develop forecasts of this exposure 20-30 years from now: a non-trivial task.

Example: Property & Casualty Insurance in the US

The US already presents some challenges: there are increasingly parts of (for example) Florida where it is hard to insure properties. Governments are starting to say that if citizens choose to live in a high-risk area, they will do so on their own account.

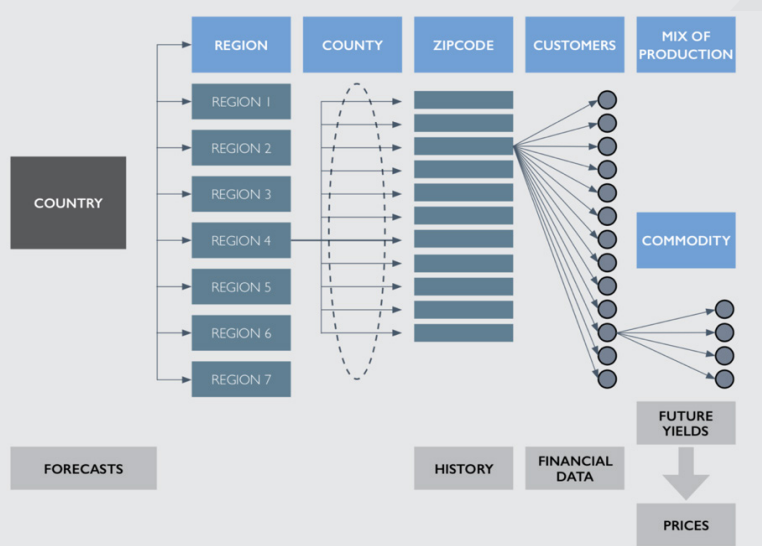
The demand for insurance in risk-prone areas will increase as they are exposed to an increase in the frequency and severity of extreme weather events. However, insurance companies may struggle to obtain sufficient rate increases to offer the required coverage profitably.

Example: Corporate lending

Next, we will summarise some key case studies from the UNEP/Fi report “Navigating a New Climate”⁴.

Stress testing an agriculture portfolio

Figure 3.2 - Stress testing methodology used for an portfolio of agriculture



Source: UNEP/Fi “Navigating a New Climate Report”

The key objective of the cited stress test was to determine the change in probabilities of default (PD) for the agricultural portfolio of a bank resulting from incremental climate change and increasing extreme weather events. Agricultural markets are global and weather is the key determinant for production yields, so there has always been an element of weather and climate risk.

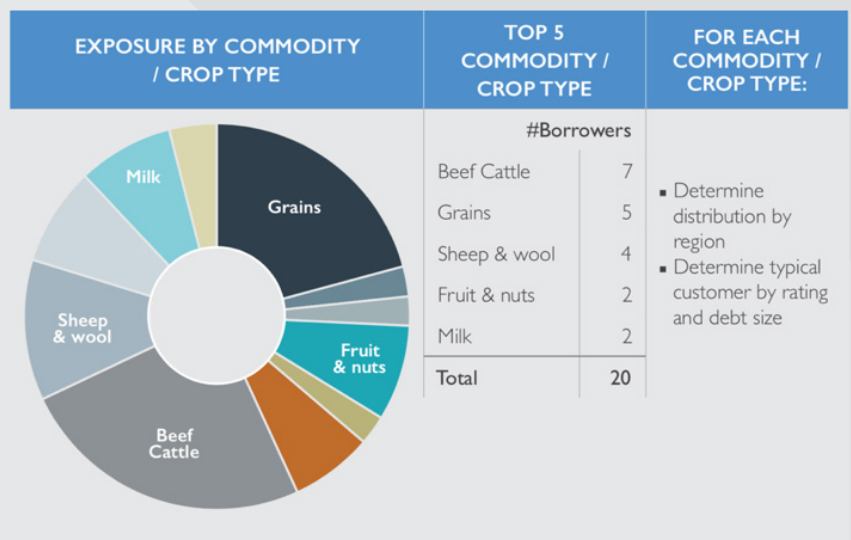
The following data sources were collected to cover the broad geography and production of the portfolio, with a specialist review at all steps to determine which are the key drivers.

3 / See more at: <https://www.bankofengland.co.uk/financial-stability-report/2019/july-2019>

4 / See more at: <https://www.unepfi.org/publications/banking-publications/navigating-a-new-climate-assessing-credit-risk-and-opportunity-in-a-changing-climate/>

The portfolio was split by commodity to determine a representative sample size and the focus was on commodities that represented over 10% of the portfolio. Then, the geographical distribution per commodity was derived and for each commodity the typical debt of a client.

Figure 3.3 - Determining the key price drivers of the portfolio



Source: UNEP/Fi “Navigating a New Climate Report”

The methodology assumes climate change impacts changes in production and price for a local market, and also in the global supply and demand curves. Extreme events are counted as one-off impacts on revenue. Each client exposure is measured based on historical data and projected changes at all of their geolocations, using the following data sources:

- Storm, cyclone, flooding and fire – UNEP Global Risk Data Platform⁵
- Extreme heat – GFDRR Think Hazard⁶
- Drought – Princeton Climate Analytics
- SwissRe - CatNet⁷
- MunichRe - NatCat Service⁸

After determining the impact on revenue for each client, the bank then looked at how revenue would affect other factors that translate into PD from the bank’s rating model. All cost factors were held constant, despite cost-cutting measures during bad seasons from farmers as the physical risk methodology excludes adaptation. Other factors included funding increases and loan amortization rescheduling. Extreme stress sensitivities included loss of crops and livestock, but did not include loss of equipment, which are covered by insurance.

⁵ / See more at: <https://preview.grid.unep.ch/>

⁶ / See more at: <http://thinkhazard.org/en/>

⁷ / See more at: <https://www.swissre.com/reinsurance/property-and-casualty/solutions/property-specialty-solutions/catnet.html>

⁸ / See more at: <https://www.munichre.com/en/reinsurance/business/non-life/natcatservice/index.html>

Findings

Incremental change impacted the representative client revenue by -6% to -12% under the 2020 2°C and 4°C scenarios and reached a range of -12% to -22% under the 2040 4°C scenario. The revenue downside of an increase in frequency of extreme events caused an estimated loss of about 1% based on events on a 12-month period.

The table below shows the result of applying the above revenue impact on client ratings. Under the 2040 4°C scenario, the PD increased between 1.1x and 1.5x, and the average portfolio rating deteriorates by a one notch downgrade.

Figure 3.4 - Credit rating results following the stress testing

INDUSTRY	2020s SCENARIO	2040s SCENARIO	
	2°C & 4°C	2°C	4°C
Mixed farming	1 notch	1 notch	2 notches
Grain	<1 notch	<1 notch	1 notch
Cotton	1 notch	1 notch	2 notches
Horticulture	1 notch	1 notch	1 notch
Beef farming	<1 notch	<1 notch	<1 notch
Dairy farming	1 notch	1 notch	1 notch
Others	1 notch	1 notch	2 notches
Total portfolio	<1 notch	<1 notch	1 notch

Source: UNEP/Fi “Navigating a New Climate Report”

Empirical data shows us that isolated one-off extreme weather events have been easily absorbed by the agricultural industry, but the unknown lies in repeated extreme events which are expected to rise in frequency. Research suggests that repeated storms, floods and droughts could impact revenues by over 50%.

This was a great first exercise connecting bankers, agricultural experts and scientists to determine climate change risk and opportunities. Adaptation was not taken into account, and that is a key feature of agriculture. A geographically diverse portfolio also disguises the impact of extreme events in one location, so heavy concentration portfolios may be more impacted than our test portfolio. Data should become more granular and sensitives better known for more robust results. For example, current modelling of long-term droughts and flash droughts is considered to underestimate impact, whilst flood history is known at the farm level, but production impact is at the national level.

UBS Case Study: Assessing physical climate risk to electric utility companies

UBS performed a bottom-up sensitivity analysis for financial vulnerability to physical risk to their electrical utilities lending book, which required translating climate risk data into change in probability of default (PD). The regions were the European Union and the United States, covering owned and operated plants by borrowers and subsidiary assets.

UBS used Bloomberg MAPS to identify and understand the climate risk factors for each asset. The large number of data points per asset makes aggregation almost impossible at the portfolio level, as there are over 1 million data points for a portfolio of 20 borrowers on 2 scenarios. Hence, a focused approach on one borrower with concentrated exposure in the southern part of the United States was performed, resulting in a 14.5% production capacity impact from incremental climate change in a 2020 2°C and 4°C scenario. A further 0.24% production capacity impact was forecast under the same 2°C and 4°C 2020 scenario, driven primarily by heat waves and flooding.

The methodology translates the production capacity decrease into decreased revenue and suggests analysing the PD based on this number. There were challenges to the lack of broader market dynamics being taken into consideration, like insurance, emergency funding from local authorities, spare capacity, price dynamics based on regional loss of capacity, and many more.

Walking through this scenario helped experts understand the data and methodological challenges for assessing physical risk. The assumptions that have to be made at various decision points and need improvement include downtime of utilities from extreme weather events and the simplification of climate risk data to understand the impact on downtime. If all utilities would align to the Task Force on Climate-Related Financial Disclosures (TCFD) reporting recommendations, this would allow the creation of a relevant dataset for such events.

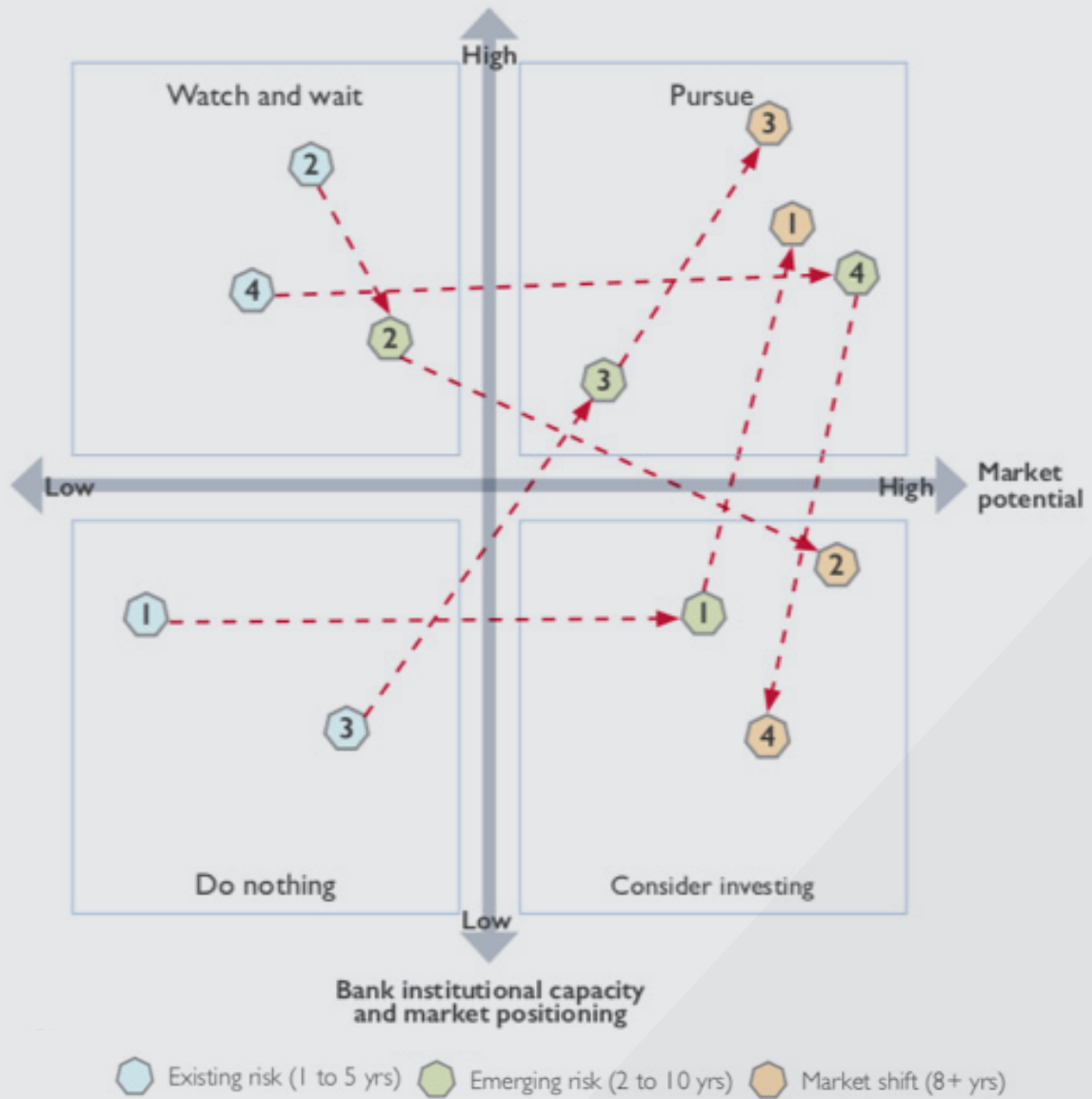
Considering data consortium partnerships with the insurance industry would be great for banking, and there needs to be a systemic examination of the industry to fully comprehend the implications on the credit worthiness of obligors in the space. For example, In Texas, about 1/3 of oil production was severely impaired due to flooding post-Hurricane Harvey.

Closing remarks

Physical risk is a daunting challenge for credit originators, but the insurance industry has shown that their Natural Catastrophe modelling capabilities can be adopted to provide valuable insights. Scenario analysis is certainly the best tool in practice for uncertain outcomes, with bankruptcy point modelling emerging as a fundamental practice.

Banks should strengthen their front and second lines of defence to better understand the industries and geographies where they originate loans. According to their institutional capacity and market potential, they may choose to underwrite some risks and avoid others. If risks are increasing in an industry, but the firm has great capacity to analyse and underwrite, there could be new margin opportunities arising in niche markets. These dynamics may start a specialisation trend within the next 10 years.

Figure 3.5 - A risk-based approach for institutional positioning



Source: UNEP/Fi “Navigating a New Climate Report”

3.2 policy risks

There are plenty of examples of good regulatory intentions with a negative societal outcome. Take for example the shift away from coal mining and use in East Germany and Poland. These did not have a job transitional plan and had devastating short and medium-term implications for the local community.

The optimal transition time from brown to green assets is expected to be between 10 and 20 years, and public perception translated into political and customer preferences will be a key driver for this evolution. The younger demographic is overwhelmingly supportive of climate conscious policies, and their political influence and spending power will increase as time passes.

Policy errors are not without precedent, as the renewable industry was penalized before in the EU with subsidies that have been abruptly withdrawn, in what has been termed subsidy-risk. The price in large power markets is largely driven by the price of coal and natural gas, and a subsidy free green energy operator may find it hard to survive when energy prices are on the lower bound. Introducing output price risk for operators at this point in time will complicate the lenders decision-making process.

Policymakers need to bring long term commitments for industry operators and capital efficiency measures for green lenders and investors. These could take the form of capital efficiency measures for green projects, or reduced capital gains taxes on green investments.

This is no easy feat to regulate right because we are facing various regulatory, geographical and industry jurisdictions, and there is no single regulatory body that can get traction. We also must be mindful of regulatory synchronization for the financial and non-financial corporates (NFC) to move at the same pace. It is generally easier for finance to synchronize with NFCs, and it is finance that has been lagging, but we are getting closer to a point of equilibrium.

In conclusion, governments want to be perceived as green and may make many statements to this effect, but there's not enough spending power behind the rhetoric, and there are too few real long-term incentives to drive this transition. Short term reactions are very common, and this kind of policy will not be enough, and may introduce transition risk for green assets.

4. Transition risks are substantial

There are well-documented fears that certain (stranded) asset classes will experience a 'Minsky moment' and collapse in value. For example, if the internal combustion engine is banned – not unrealistic, given a 20yr view - what happens to asset prices? We will consider the risks associated with climate transition, how will regulations drive this transition and the impact on FIs and society at large.

Lenders and investors in carbon-heavy corporations must understand the transition strategy of their debtors to maintain their Probabilities of Default (PD) and Loss Given Default (LGD) stable. Some lenders will not want to underwrite the risk of research and development related to the energy transition, so expect the capital structure of these companies to suffer changes as well.



“There will be industries, sectors and firms that do very well during this process because they will be part of the solution...but there will also be ones that lag behind and they will be punished. The longer the adjustment is delayed in the real economy, the greater the risk that there is a sharp adjustment.”

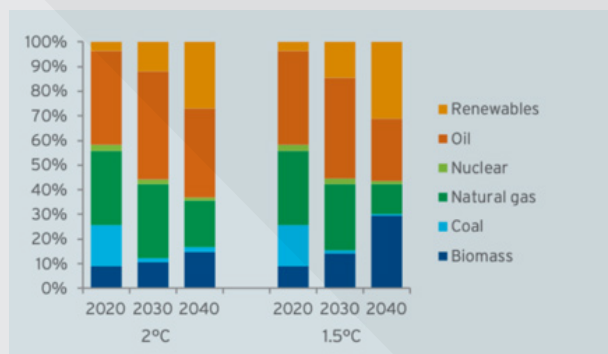
Mark Carney, Governor, The Bank of England

This doesn't mean that companies that won't transition will not find sources of financing any more. They will just exist with a higher PD and will find more expensive sources of finance, like private equity and debt. It is generally expected that larger capitalization companies will have larger budgets to reinvent themselves. On the other hand, they are also the largest tankers to steer and must cannibalize more existing assets than new entrants.

If we look at the US energy mix forecasts under the 1.5°C scenario from the Potsdam Institute for Climate Impact Research, there will be a large transition in the next two decades towards renewables and biomass. Moreover, the fuel sources for US electricity may migrate almost in entirety to renewables, away from the dominant coal and natural gas plants that generate output for the system today.

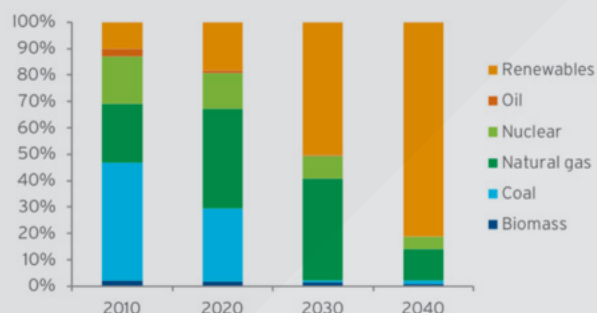
Mark Carney's quote from The Guardian article: <https://www.theguardian.com/environment/2019/oct/13/firms-ignoring-climate-crisis-bankrupt-mark-carney-bank-england-governor>

Figure 4.1 - US Primary Energy Mix



Source: Potsdam Institute for Climate Impact Research

Figure 4.2 - US Electricity – Fuel Sources



Source: Potsdam Institute for Climate Impact Research

Divestments are already in place, with the Norwegian Sovereign Wealth Fund divesting from fossil fuels and insurers are avoiding the coal sector. The key question is what happens if investor preferences change immediately? It would be a similar duplicate of the financial crisis. Investors need to look no further than Peabody Energy’s chapter 11 filing to understand some of the risks they are facing. The list of defaults according to S&P since the start of 2017 includes:

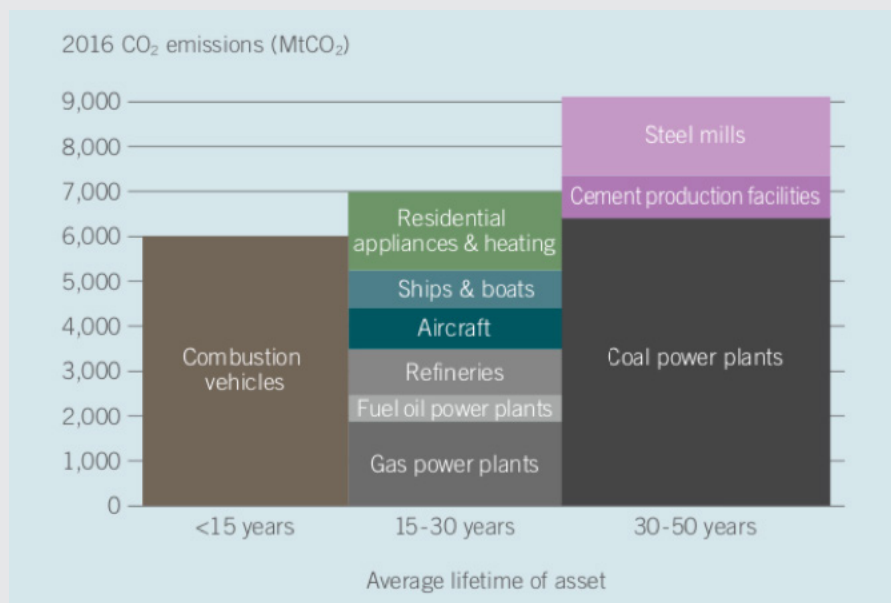
- Murray Energy, Oct 29, 2019;
- Blackjewel, July 1, 2019;
- Cambrian Holding, June 16, 2019;
- Cloud Peak Energy, May 10, 2019;
- Trinity Coal, March 4, 2019;
- Mission Coal, Oct. 14, 2018;
- Westmoreland Coal, Oct. 9, 2018;
- Armstrong Energy, Nov. 1, 2017

Policy shocks will occur during this transition, as there is no clear roadmap with a global buy-in. As some countries are catching up to economic growth and have high energy needs, they sometimes feel constrained to build cheaper and browner options. For example, there are 36,000 MW of coal power plants being built in India.

Between Infrastructure, Agriculture, Mobility and Energy generation and transmission, some will move faster because there are fewer inherent barriers. For example, only 3% of the entire car fleet will be needed in high-density areas if autonomous driving is fully implemented. This has wide-ranging implications on many industries aside from automotive. The car industrial complex needs serious pondering, and the winning cities will get the road infrastructure right for this change.

The average life-time of CO₂ heavy emitting assets is listed in the chart below, including 2016 levels of emissions. Combustion vehicles will have amortised for full replacement in lesser years, but there are many assets that have average lifetimes over 30 years. That means we should stop underwriting these assets today if we want to achieve parameters set in the Paris accord.

Figure 4.3 - CO₂ emissions and typical lifetime of different assets



Source: Rocky Mountain Institute & Financing the Low Carbon Future, CFLI

Other innovations include vertical farms, which use 90% less water and can run 26 crops every year, and when combined with alternative energy sources, they reduce the carbon footprint by over 99%. These will become local businesses with small CO₂ footprints.

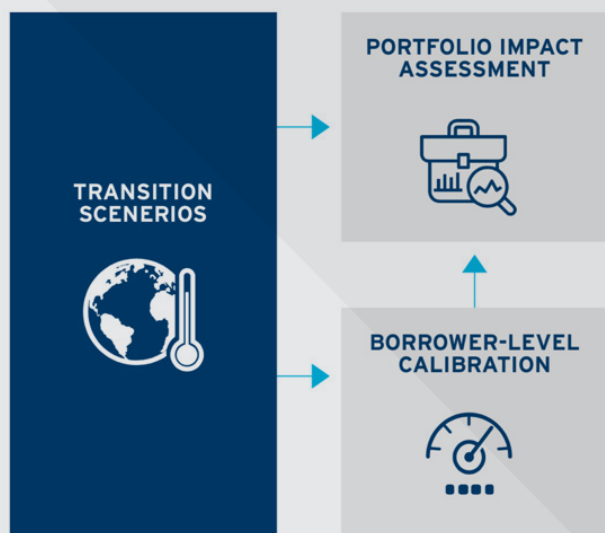
The end-game question for every company is: can you run the company at a carbon-neutral rate for the next 10 years, and how much would that cost?

Many large corporates that have very complex supply chains are starting to announce initiatives to align to the Paris accord. Since the majority of greenhouse gas emissions come from the top 100 companies worldwide, this alignment of the real economy is essential to achieve these goals. For example, Amazon has announced global efforts in lowering the carbon footprint by transitioning to a full fleet of electric vehicles by 2035 and hoping to achieve net zero emissions by 2040. DHL has made a similar announcement, working to reduce 70% of emissions by 2025, and trying to operate at net zero emissions by 2050.

As energy generators decarbonize, there will be a need to change how they deliver those services, and it would be disruptive to divest completely. Germany is burning more coal than ever to manage the intermittency for its green grid because it completely shut down its nuclear capacity. Asset owners need to have well-crafted long-term strategies in place. What is evident in climate science is that we need to get into net negative greenhouse gas emission territory soon, and our technologies and infrastructure are underprepared.

Public perception will be a crucial driver in the speed of implementation for the transition. There are fringe groups who started boycotting various brown lenders, but these don't seem to be a key disruptor of activity yet.

Figure 4.1 - Overview of the transition risk modules



Source: UNEP/FI Report – Extending Our Horizons

There are various demands on data granularity which are not well defined in the professional and regulatory community.

In conclusion, modelling transition risk is very technical and challenging. It differs from industry to industry and country to country, and there will be winners and losers in the transition. Financial Institutions will have to upskill in order to understand transition roadmaps in various technologies and industries.

Policy risks may cause the most significant spikes in asset prices as we move to a greener economy. There is a strong need for policy coordination amongst regulatory bodies which cover different industries and geographical countries, which is a key risk during this transition.

Multilateral institutions may have an essential role within this asset repricing roller-coaster that we may see going forward. There may be reputational hits for financiers and operators. The only certainty is the cost of compliance will go up for lenders as new data lakes need to be put in place. Reconciling internal datasets is an onerous task that is currently being addressed.

5. Green finance

The Green Finance market is still small, but developing fast, and is an important pillar to sustain the transition from brown to green assets. We will address policies that encourage climate resilience, various risk implications which should concern FIs, including environmental ratings.



Climate change is the result of the greatest market failure that the world has seen.

Knut N. Kjær, Executive Chairman, Sector Asset Management and first manager of the Government Pension Fund of Norway

The Paris accord targets a 2°C maximum increase in global temperature. Implied reduction in carbon emissions (45% in the next decade) will require significant re-working of global energy structures, with multiple ‘carrot and stick’ initiatives to modify incentives.

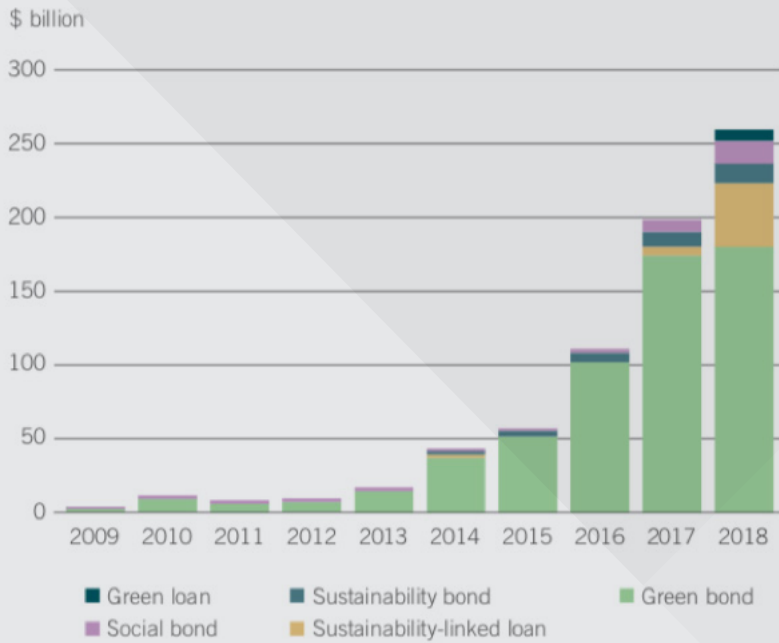
- Green finance is, therefore, a critical public policy tool to achieve this goal. A mass-market movement to government-sponsored initiatives is not without precedent. Success will depend on many factors.
- Carbon Trading is essential in diminishing “free-riders”, and concentrated loan exposures to high carbon-emitting sectors might be significantly impacted.
- Issuance is increasing, with \$130bn green finance in 2018. The total market is currently approximately \$750bn, expected to surpass \$1tn by 2020. Demand from investors is substantially higher.
- The Green Bond market included in the CBI⁹ database rose 48% year-on-year in the first half of 2019, reaching \$117.8bn. Fannie Mae issued over \$56bn of Green Mortgage-Backed Securities (MBS)¹⁰ since 2012, making Fannie Mae the largest issuer worldwide.

Knut N. Kjær's quote from the Climate Bonds article: <https://www.climatebonds.net/2019/03/quotes-climate-bonds-2019-conference-report-mobilising-green-trillions-taxonomies-new>

⁹ / See the methodology at: <https://www.climatebonds.net/cbi/pub/data/bonds>

¹⁰ / See the press release at <https://www.prnewswire.com/news-releases/fannie-mae-prices-805-million-green-multifamily-dus-remic-fna-2019-m9-under-its-gems-program-300865697.html>

Figure 5.1 - Global issuance of sustainable debt finance

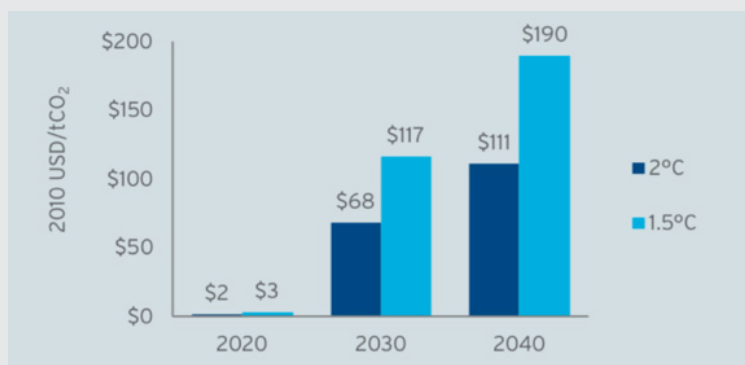


Source: BNEF, CFLI

5.1 climate resilience

The easiest way to incentivise the energy transition is through subsidies: creating subsidies for new providers (e.g. through tax breaks), and by eliminating the existing, indirect subsidies of the high emitters, also known as carbon taxes. So far, carbon taxes are too small to drive economic behaviour, and the political establishment doesn't seem to have a strong enough mandate to change that for the better in the next few years. According to the Potsdam Institute for Climate Impact Research, a leading scientific body in GHG research, the price of carbon will suffer significant hikes over the next decades. Under a 2°C the price should be \$68/tCO₂ in 2030 and \$111/tCO₂ in 2040, compared to just \$2/tCO₂ forecasted in 2020.

Figure 5.2 - Global carbon price



Source: Potsdam Institute for Climate Impact Research

The UN has done incredible work to drive change here by setting up The United Nations Environment Programme – Finance Initiative (UNEPFI)¹¹ and the UN Climate Summit in September 2019 in New York. The Kyoto agreement generally failed due to a lack of political continuity and inconsistency.

¹¹ / See more at: <https://www.unepfi.org/>

On the flip-side, the UN has established the Principles for Responsible Investing¹² in 2006, and now more than 50% of global assets are invested under these principles. The push from investors and asset owners towards better stewardship has happened in a decade since those were enacted. The UN can also be credited with setting up the Principles for Sustainable Insurance¹³, and 25% of the worlds gross written premiums are following their guidelines. We hope similar traction will be achieved from the recently signed Principles for Responsible Banking¹⁴. Another positive result from the UN and Global Canopy in Oxford is Natural Capital Finance Alliance¹⁵, which provides tools and methodologies helpful for the budding scientist.

There is a danger of making the taxonomy and threshold too high in the green finance market, which would mean that it would remain a niche market. This, in turn, would make the transaction costs too high for it to have a significant impact on the real economy. Ideally, Green Finance will become, simply, Finance: ultimately, all finance will need to be green. In order to get there, we must shift the focus from the definition of green deals to the meaning of brown transactions and penalise these more stringently.

Carbon pricing is the most effective way to discourage activities, but it also poses a severe transition risk if done too abruptly. Investing in a company exposed to carbon prices becomes a carbon price bet. Over the years, there were many policy errors that did not incentivise the transition. Cement companies made millions in surplus rights because of a structural over-allocation of green credits, whilst photovoltaic¹⁶ operators were hurt by such a policy shock.

¹² / See more at: <https://www.unpri.org/>

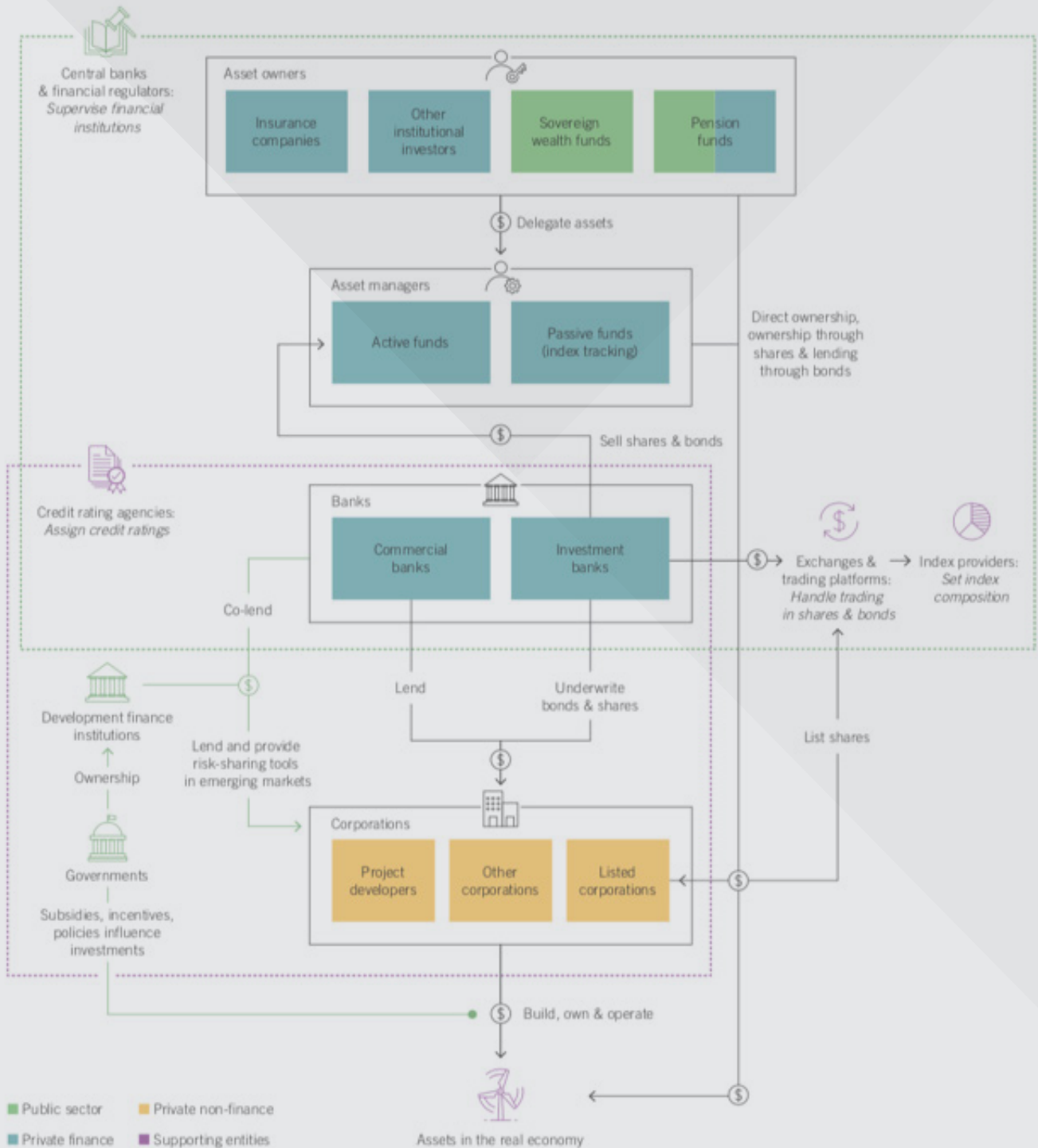
¹³ / See more at: <https://www.unepfi.org/psi/>

¹⁴ / See more at: <https://www.unepfi.org/banking/bankingprinciples/>

¹⁵ / See more at: <https://naturalcapital.finance/>

¹⁶ / Photovoltaics are best known as a method for generating electric power by using solar cells to convert energy from the sun into a flow of electrons by the photovoltaic effect. Solar cells produce direct current electricity from sunlight which can be used to power equipment or to recharge a battery.

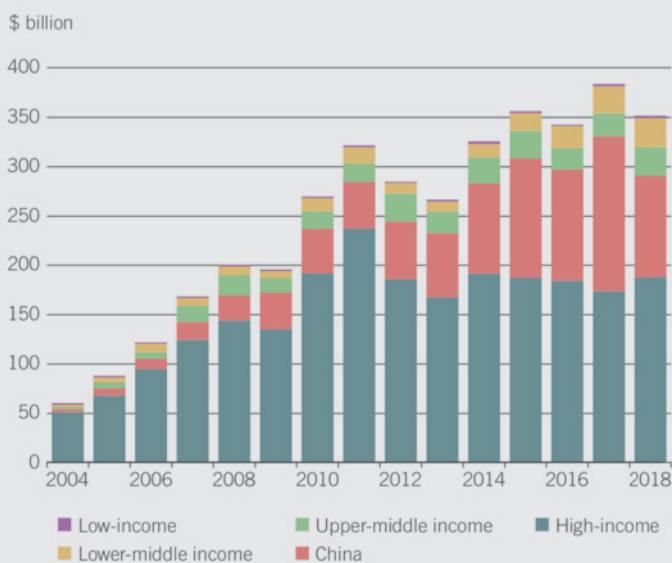
Figure 5.3 - The Investment Chain: The interaction of the private sector, public sector and real economy



Source: CFLI, Financing the Low Carbon Future

Figure 5.4 shows clean energy investment by countries, broken down into income categories as defined by the World Bank. The most critical transition will happen in the real economy. Finance is a cog in the wheel by adjusting financing costs and valuations. The public sector can encourage this transition by incentivising industry and investment, while banks should create opportunities in this space.

Figure 5.4 - Clean energy investment by country income group



Source: CFLI, Financing the Low Carbon Future

The capital markets and banks can prove to be an essential transmission channel by increasing interest rates on brown projects. This can be perceived as a risk pricing mechanism, and as an indirect tax, which could potentially be transferred from the Central Banks to the government budget later.

The problem is not enough green assets are being originated. All the green bonds are being bought very fast and are usually long-term holdings for pension funds and other long-term asset holders. As there's a supply problem in the green finance market, regulators should come up with incentives such as the ones created for the municipal bond markets.

In the US, there are state and federal tax incentives for insurers that cover certain risky areas. Insurers with foresight become long term green investors in the local economy, both for risk & return considerations and to show the community they are an engaged counterparty.

5.2 risk management for green finance

Alongside the benefits of stabilising climate change, there is a significant economic opportunity in Green Finance. As with every new market, several risks emerge, especially when the market is in a developmental stage.

The recently published EU Taxonomy for Sustainable Activities¹⁷ was the fastest report ever issued by the EU. The technical expert group quickly developed a sustainable finance taxonomy, to ensure consistency in classifying transactions as either green or brown. Some gaps, however, remain: Of note is that nuclear is considered brown in Germany and green in France. The Technical Expert Group did not yet reach a conclusion on the supply chain implications of nuclear energy.

Pricing is not very helpful in today's low margin environment, so banks are asking for more comprehensive governmental support of the Green Finance economy, for example, through fiscal policy. Investors, on the other hand, will require disclosures and will start pricing this risk when they realise a climate transitioning company has better growth prospects. They can vote with their capital allocation process in driving this transition faster.

¹⁷ / European Commission (2019): EU taxonomy for sustainable activities, available at: https://ec.europa.eu/info/publications/sustainable-finance-teg-taxonomy_en

Climate-based credit ratings

As banks' core competency rests in financing deals, many find themselves perplexed by climate science and its relevant competencies. There is a global chorus asking for sustainability ratings. And although there are several vendors offering this service, the market maturity is in its infancy when compared to corporate ratings.

Consistency is needed to be able to manage this market properly. Rating agencies have already started consolidating in this space, with Moody's recent acquisition¹⁸ of Four Twenty Seven, a physical climate risk analyst, and MSCI's acquisition¹⁹ of Carbon Delta, a climate scenario analyst.

Rating agencies have moved into assessing climate risk at the sovereign level since it will ultimately be governments who underwrite future systemic events with negative repercussions for society. As the sovereign debt market is one of the largest traded asset classes in existence, the FTSE Climate World Government Bond Index²⁰ measures quantitative risk assessments on transition risk, physical risk and country resilience. Also of interest is the Notre Dame University Index²¹ on country climate risk. CDP Global is an international non-profit that provides important ratings in the equity space, and their newly launched platform for fund ratings, Climetrics²².

Although there is significant work underway, the market is just beginning to settle on taxonomies and to define consistency. Scientists need more alignment as well, and efficiency should be measured by a global independent body that uses consistent methodologies, just like vehicle emission bodies do for the automobile industry, albeit imperfectly.

¹⁸ / Cf. e.g. <https://www.businesswire.com/news/home/20190724005169/en/Moody%E2%80%99s-Acquires-Majority-Stake-Twenty-Leader-Climate>

¹⁹ / Cf. e.g. <https://www.businesswire.com/news/home/20191002005559/en/MSCI-Completes-Acquisition-Carbon-Delta>

²⁰ / Available at: <https://www.ftserussell.com/index/spotlight/climate-wgbi>

²¹ / Available at: <https://gain.nd.edu/>

²² / Available at: <https://www.climetrics-rating.org/>

6. Implications for risk management

So far, this paper has outlined the differing climate scenarios under active consideration, and taken a closer look at the implied physical and transition risks, plus the emerging world of Green finance. In this chapter we look more closely at the implications of climate change for Professional Risk Managers, by considering the regulatory perspective, the practical challenges, and emerging best practices.

6.1 regulatory considerations

Until relatively recently, climate-related risks were viewed as reputational in nature rather than financial. This perception meant that climate was ‘owned’ by the Sustainability department, which would represent the Institution in dealings with environmental activists and non-governmental organisations. The focus would, therefore, be around external communication, rather than matters of policy.

The first crucial change came with the establishment of the Task Force on Climate-Related Financial Disclosures (TCFD), which was established in 2015 by the Financial Stability Board (FSB) to develop voluntary climate-related financial risk disclosures for use by companies, banks, and investors in providing information to stakeholders. TCFD published their key report²³ in June 2017: this recommended that the core elements of climate-related disclosures should include:

- **Governance:** A summary of the governance applicable to both climate-related risks and opportunities.
- **Strategy:** An assessment of the impact of climate-related risks and opportunities on a firm’s business, strategy, and financial planning. Disclosing firms are also expected to assess the resilience of their strategy by taking into account a number of different climate-related scenarios.
- **Risk Management:** The means by which climate-related risks are identified, assessed and managed.
- **Metrics and Targets:** The management information used to assess and manage relevant climate-related risks and opportunities



“The focus generally in the green markets has been on the very brown and very green, but 70 percent of the GHG emissions arise from the 100+ largest companies of the world and we need to work with them to drive the transition.”

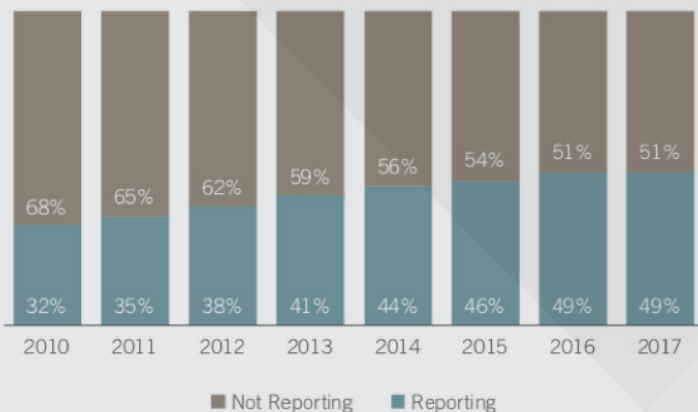
Daniel Klier, Group Head of Strategy and Global Head of Sustainable Finance, HSBC.

Knut N. Kjær's quote from the Climate Bonds article: <https://www.climatebonds.net/2019/03/quotes-climate-bonds-2019-conference-report-mobilising-green-trillions-taxonomies-new>

²³ / TCFD (2017): Recommendations of the Task Force on Climate-related Financial Disclosures, available at: <https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf>

Since the TCFD publication, many market authorities (e.g. the FCA in the UK) have drafted rules²⁴ to formalise disclosure rules appropriate to both financial reports and green finance issuance. The TCFD also had a significant impact on greenhouse gas (GHG) emissions reporting as evidenced in the figure below.

Figure 6.1 - MSCI World's constituent companies reporting GHG emissions



Source: Bloomberg.

Central Bank Initiatives

Subsequent to the Financial Stability Board's establishment of the TCFD, a number of central banks formed the Network for Greening the Financial System (NGFS). This has grown to 42 Members and 8 Observers, representing 5 continents. It aims to enhance the role of the financial systems to manage climate-related risks and mobilise the required capital for sustainable infrastructures. The NGFS published in April 2019 its first comprehensive report²⁵ on the subject. The report issued six recommendations, some of which are more relevant for FIs than others. In brief, NGFS recommends that Central Banks take measures to:

- Achieve robust and internationally consistent climate and environment related disclosure.
- Integrate climate-related risks into financial stability monitoring and micro-supervision.
- Bridge the data gaps.
- Build awareness and intellectual capacity and encouraging technical assistance and knowledge sharing.
- Integrate sustainability factors into own-portfolio management.
- Support the development of a taxonomy of economic activities

Taken together, the intended direction of travel becomes clear. A journey that started through the TCFD disclosure initiative builds upon this foundation with more robust requirements for Financial Institutions, effectively placing Climate within the 'Pillar Three' regime of Basel. The planned integration of climate related risks into supervisory activities means that climate will move from Pillar Three into Pillar Two in the coming years. No explicit move into Pillar One is foreseen.

²⁴ / FCA (2019), FCA today announces future work on climate change and green finance, available at: <https://www.fca.org.uk/news/press-releases/fca-today-announces-future-work-climate-change-and-green-finance>

²⁵ / NGFS (2019): A call for action Climate change as a source of financial risk, available at: https://www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf

The move of climate into Pillar Two will significantly increase a Bank's analytical burden, which will bring many practical implementation challenges. These are implicitly acknowledged in the next two bullets, which address the Data challenge (specifically, the need to ensure better sharing of climate between FIs and public bodies), and Knowledge Sharing, to increase professional skills and know-how.

The last two relate to the growth of Green Finance. Central Banks are encouraged to lead by example with their own investment strategies and steer the funds they manage to more sustainable goals. They are also encouraged to facilitate the taxonomies to support green finance initiatives: these naturally complement both sustainable investment and disclosure, enabling better categorisation of investment products, to the benefit of the end investor.

Example: Bank of England

The Bank of England has been very much at the vanguard of climate change in financial services²⁶. This reflects the leadership of its Governor, Mark Carney, who has also served as the chairman of the global Financial Stability Board, under whose auspices the TCFD was established. The Prudential Regulation Authority (PRA) and Financial Conduct Authority (FCA) have established a joint Climate Financial Risk Forum to bring together senior risk practitioners from FIs, regulators and representatives of the profession, and develop guidance in key topics. The recurring themes which one finds in Bank of England publications are familiar: Governance, Risk Management, Scenario Analysis, and Disclosure.

Of particular note are the following initiatives:

- The Bank of England has recently updated the Senior Management Regime, the UK's governance rules for regulated FIs, by stipulating that firms should nominate a Senior Manager responsible for Climate. This demonstrably brings climate into the C-suite.
- The first Climate Risk Stress Test in the UK will take place in 2021 under the guidance of the Bank of England. The methodological details of this endeavour are yet to be published.

Example: European Union

In June 2019, the European Parliament passed into law the so-called CRD5 package²⁷, this being the EU implementation of Basel 4. This legislative package included several non-Basel items relevant for this paper, including:

- Updating of Pillar3 rules to require disclosure of environmental (including climate) risks.
- Risk-weight reductions of up to 25% for investments in sustainable infrastructure that meet specific criteria, for example regarding reliability of cash flows.
- Mandating the European Banking Authority (EBA, the EU's technical standards board) to prepare the following reports:
 - Including assessments of environmental risks into the supervisory process (due 2021).
 - Propose prudential treatment for 'green' assets, i.e. those associated with environmental objectives (due 2025).

²⁵ / See the Bank of England's climate change website and content therein: <https://www.bankofengland.co.uk/climate-change>

²⁶ / European Commission (2019): Adoption of the banking package: revised rules on capital requirements (CRR II/CRD V) and resolution (BRRD/SRM), available at: https://europa.eu/rapid/press-release_MEMO-19-2129_en.htm

The last point in particular is worth noting, since it points to potential future changes in capital treatments, albeit some years in the future, allowing supervisors time to gather data.

Interim Conclusions

Based on the above, one can already see that firms active in Europe will have a significant increase in regulatory work, gathering pace in earnest in 2021. This framework will progress to enable correct capital determinations for green and brown deals, and in turn, make the capital allocation process more efficient. As of now, it's hard for a banker or trader to see pricing information from climate: that should soon change.

6.2 practical challenges

There are great starting initiatives, but unfortunately, there is more uncertainty on the horizon than available modelling and managing techniques. One of the key challenges is that the risk framework looks at one to three-year time horizons rather than decades. Another obstacle is the attribution of events: risk managers and climate scientists alike are unsure if they should attribute an event to climate change or weather volatility. The direction of travel is clear, but the industry doesn't have a clear roadmap to follow.

Governance

The key challenge is that many ESG departments still own this component. There is unanimity that this should be a Credit Risk management issue to get proper attention in the boardroom. ESG experts are essential in the process, but the credit teams have higher profiles internally and are able (in well governed firms) to stop bad deals from happening, a power rarely vested in ESG teams.

Another critical challenge is how well is climate risk understood at the board level and C-Suite, and the fact that it is not trickling down in a practical way in the risk function. Banks are already addressing the challenges and are trying to embed and quantify this in the risk modelling process.

New governance structures are being built in many firms to make the financial institutions resilient and drivers of climate change. Environmental impact is already being assessed for new originations in most progressive institutions. Portfolio scoring is another solution being looked at in monitoring the risk of global exposures. The consequences of these changes are expanded below.

Risk Management

The key step undertaken by progressive institutions is an update to their risk frameworks to embed climate assessments and mitigations within all business-as-usual practices, such as annual reviews of existing client files, credit rating methodologies and portfolio reviews. It is by no means an easy process, and starting early is a good idea as the estimated timeline to the first completion is 12-18 months. It will then become an iterative process as the regulatory guidelines evolve in this direction.

The key aspects are to define climate risk in the strategic plan, translate it into the risk appetite framework, and define the key controls to remain within risk appetite. There are also tactical activities involved, like getting client input on climate change and how it will affect their business.

Risk Pricing

When it comes to risk pricing, there are various exercises taking place throughout the industry, such as stress testing the banking book, and applying climate-based adjustments. Different pricing grids will start having penalty adjustments for brown deals and pricing incentives for sustainable deals. For new origination, there will be modified credit scoring, which will translate into updated probabilities of default (PD) and loss-given default (LGD), and various portfolio stresses under different scenarios.

Scenario analysis is currently being done on different time windows, the short term being preferred at present for better certainty. There are interesting climate pathways scenarios, which translate into macro views for a 2-3-year time horizon. Market participants are asking for standardization on regional scenarios. The critical variable is trying to find out the climate impact on future property valuations and re-think the portfolio structuring approach.

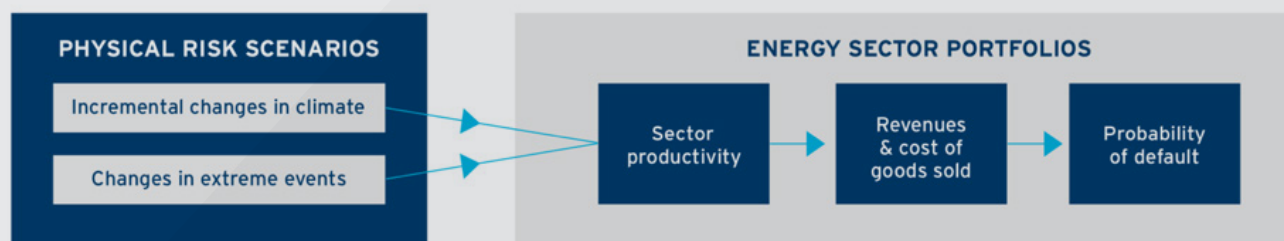


A framework for firms to publish information about their climate change footprint, and how they manage their risks and prepare (or not) for a 2 degree world, could encourage a virtuous circle of analyst demand and greater use by investors in their decision making.

Mark Carney, Governor, the Bank of England, Breaking The Tragedy of Horizons speech

The mortgage book will be the first to go through an environmental analysis in most institutions, to take account of (for example) increased flooding risk to vulnerable regions. There will be a subsegment readjustment of risk parameters, such as PDs and LGDs. The methodologies are not very clear yet for translation, and timeframes are the biggest challenge in defining risk parameters, but we will be back on this topic. At some point, there will likely be supplementary capital requirements for brown assets, with regulators in France and Japan expected to be amongst the first to implement these. Global megabanks will have some of the most significant challenges as they have very complex and geographically diverse portfolios.

Figure 6.2 - Physical Risk Methodology

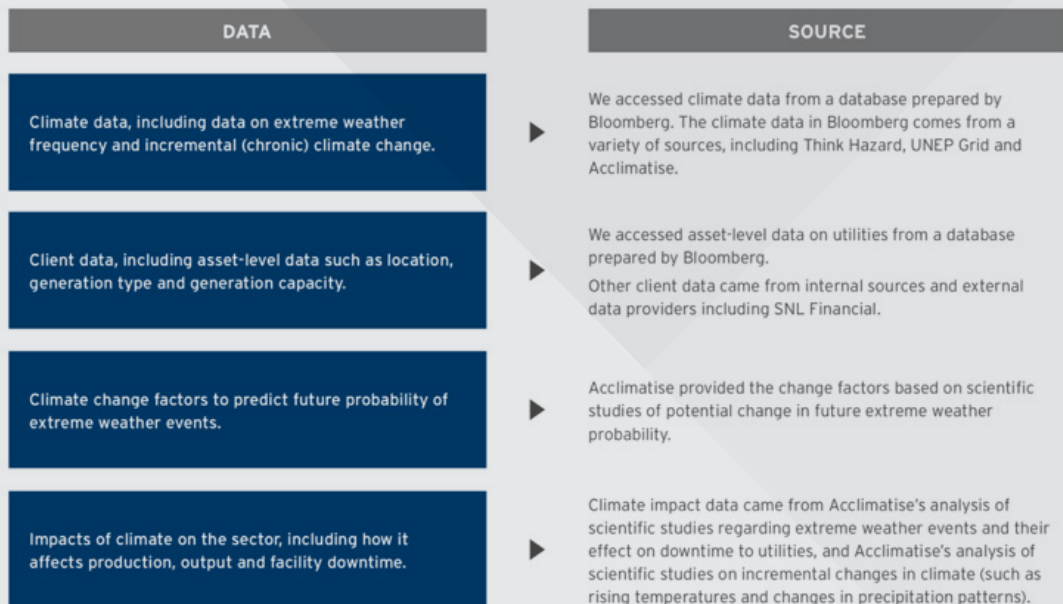


Source: UNEP F1 Report - Navigating a new climate

Mark Carney's quote from his speech here: <https://www.bis.org/review/r151009a.htm>

The corporate lending portfolio is undergoing testing for various climate warming pathways, but in general physical and transition risk is modelled separately due to a limitation on data quality. Unifying the techniques would be ideal but is currently impractical. Most actors are narrowing filters on specific sectors of the portfolios which face the most significant climate or regulatory disruptions, and then there is individual analysis performed on the obligors.

Figure 6.2 - Physical Risk Analysis - Data & sources



Source: UNEP/Fi Report - Navigating a new climate

Accounting metrics also need to be developed, and at some point, these risks need to be translated into dollar exposures. But it is tough to get any organisation to take this disclosure risk. Usually, any climate-related event is already managed by the time it has been disclosed.

Scenario Analysis

Arguably the greatest challenge in climate risk management relates to scenario analysis. This is an area which has evolved substantially in the years since the financial crisis of 2007-08, and for many firms forms part of the annual supervisory gymkhana, as macro-economic scenarios are converted into risk parameters, enabling an assessment of financial health under stress. Climate-related scenario analysis represent a significantly more demanding methodological challenge, whereby climate scenarios must be converted into economic ones, which in turn must be evaluated for their risk management consequences.

For example, if one starts with a severe climate scenario in which emissions continue to increase at the current rate, then one would then need to compute the impact on climate in one's own home market in 10 or 20 years' time, considering (for example) the increase in temperature, sea levels and drought implied by the climate scenario. This then needs to be mapped to the physical geography of the Bank's home market - for example, what percentage of real estate collateral is now in a high flood risk zone? - or, what impact will this have on food prices? These represent a stress testing which is an order of magnitude more complex than anything currently in use.

The most important skill banks can learn short-term from adjacent financial services industries is Natural Catastrophe modelling. The largest challenge is the frequency and intensity of events which are becoming increasingly non-linear, and the diversity of tail events is increasing. Severe weather is generally very regional, so the best thing insurers can do is to diversify geographically.

The main problem with the current approach to Climate Risk is that it is addressing today's weather risk, but we are not yet able to model climate change risk. Climate Risk is a Big Data problem that needs to be solved. We find many similarities to the world of Climate Risk today with the early days of Enterprise Risk Management when banks had no Chief Risk Officer. When banks' systems will become scenario-based, and the data challenges will be overcome, climate risk will be much easier to be calculated. Scenarios are imperative in pricing this correctly.

When a similar process to the Internal Capital Adequacy and Assessment Process will be applicable to Climate Risk, firms will be better prepared for the potential portfolio damage and to drive change. This process is estimated to take between 8 and 10 years to complete. When you can measure risk correctly, you can launch products that mitigate that risk, and green finance will become finance.

The TCFD continues to do excellent work on disclosures, and this is the first step of a long journey. Consider this as the minimum threshold, where scenarios are not well defined yet. We need to find the good and bad side of the tails, instead of focusing on the inner side of the distribution. With the advent of Machine Learning and Artificial Intelligence, we can now concentrate on low-probability high-impact scenarios and have black swans generated algorithmically.

Knowledge

Climate Change Science knowledge is domain expertise that was not required in the finance industry until recently, and the level of depth that bankers need to go to is unknown. Standardization is in high demand at this point. In a similar way, the automobile industry has continental-wide emissions bodies, and financial markets should have a regulatory body to rate deals on a scale from Green to Brown. It is not good to have different levels of consistency because they will be arbitrated.

In time, benchmarks should be created and shared within firms, so that we don't end up comparing apples to oranges. The NGFS and the EBA are the best-positioned bodies to drive consistency within frameworks. One solution would be to generate scenarios at the global level and take them down to micro geographies.

Other difficulties include behavioural changes which are tied by existing commercial relationships which will be hard to change. Front office engagement for a proper climate risk profile is also imperiously necessary. Banks are not yet equipped to have a strategic discussion with clients on how to transition from brown to green, yet every relationship manager needs to be able to do this.

6.3 What actual steps are people taking, and what do they envisage taking?

The good news is that there are already significant initiatives underway.

Firstly, banks with over \$47tn in assets have signed the UNEPFI Principles for Responsible Banking²⁸ at the UN Climate Week in New York on the 23rd of September 2019. This commitment will align institutions to the Paris accord and the UN Sustainable Development Goals (SDGs).

At a more micro level Natixis has launched the Green Weighting Factor²⁹. This is a new methodology to re-allocate capital for financing deals based on their climate impact, which is now live within the bank. It applies to Natixis' financing across all business sectors worldwide apart from the financial industry. Under the methodology, analytical risk-weighted assets (RWA) are reduced by up to 50% for green deals, while facilities that have a negative environmental and climate impact see their analytical RWA increased by up to 24%.

On a governance level, the tone at the top is changing, and the board agenda will allocate more time to the topic. The risk committee will have to oversee the transformation and reporting framework. Remuneration will start having a climate component. The most prevailing question is: What are the critical decision points where you want to embed climate risk within the organization?

There is a decent grasp of transition risk, although the technological transition roadmap has many moving parts. The good news that renewable energy sources are overcoming economic parity with brown solutions. Customer preference is changing as well, with an example being people in developed countries that don't want to fly that much anymore because of the carbon footprint. Clients are asking banks what steps they are taking to address climate change. The youth demographics increasingly view climate change as the most important global issue that needs to be addressed, and this will be foremost in the decision process of many a Board member in the coming years.

Accounting metrics also need to be developed, and at some point, these risks need to be translated into dollar exposures. But it is tough to get any organisation to take this disclosure risk. Usually, any climate-related event is already managed by the time it has been disclosed.

²⁸ / See: <https://www.unepfi.org/banking/bankingprinciples/>

²⁹ / See: <https://pressroom-en.natixis.com/news/natixis-rolls-out-its-green-weighting-factor-and-becomes-the-first-bank-to-actively-manage-its-balance-sheets-climate-impact-2dce-8e037.html>

7. Conclusions

In conclusion, we set out a number of key recommendations:

- **Governance:** Ultimately it is the Board of Directors of a firm that must make the hard decisions about how the business model is to evolve. Are there business sectors currently financed by the bank where some degree of deceleration is required? The Board may wish to establish an ad-hoc climate committee to pre-wash technical discussions around climate, and use this as a forum for debate with external contributions, but ultimately, the Board decides.
- **Aims & Objectives:** Once the Board has made the hard, in-principle decisions regarding future transition, these need to be formulated as precisely worded aims and objectives. Public policy already exhibits the high-level goals: for example, constraining temperature increases at two degrees Celsius, or being carbon neutral by a given year. Bank policy needs to go further: given these public goals, what are the corresponding balance-sheet goals?
- **Scenario analysis:** this is undeniably a highly challenging technical task, and one which will take many years to reach maturity. The immediate challenge is to convert long-term climate forecasts (based on e.g. IPCC scenarios) into a more detailed view of their home market. Which territories will be unsustainable in the high physical risk scenarios? Which industries will be unsustainable in the high transition risk scenarios? What are the priority exit categories? Smart use of these scenarios should enable firms to develop strategies to implement their publicly stated aims & objectives.
- **Measurement:** What gets measured get managed. Developing perfect metrics is unrealistic and so some degree of tolerance is required in initial design and implementation, with simple measures in place to assess the physical risk (High/Medium/Low) and transition risk (high/medium/low) of key transactions and portfolios. Ultimately, banks need to have policies which give strong guidance to the results of these assessments, with High Risk transactions rejected and legacy book assets transferred, Medium risk transactions accepted subject to a maturity cap and increased capital hurdle, and low risk transactions accepted.
- **Incentives:** ultimately, these drive behaviour. Warm, PR-friendly sentiment from the Board will achieve nothing if not translated into updated KPIs. Each firm has its own in-house method for assessing performance (for example, risk-adjusted profitability) and ultimately this method needs to be updated to reflect the above considerations.

Managing the impact of climate change represents one of the greatest challenges in modern times. The industry needs to evolve, and the risk management profession needs to evolve. PRMIA is fully committed to supporting this evolution, in keeping with its mission to Promote, Develop and Share Professional Risk Management practices.

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