NUANCES AND PITFALLS FOR BANKS DEVELOPING CLIMATE CHANGE SCENARIOS

RISK MANAGEMENT GROUPS MUST INTERPRET A RANGE OF SCIENTIFIC TAXONOMIES TO NAVIGATE THE MAZE OF DEFINITIONS AND POSSIBILITIES IS THE FIRST STEP IN THIS MISSION-CRITICAL JOURNEY

Climate Risk Perspectives

EMERALD PATHWAYS

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INTRODUCTION

Welcome to Emerald Pathways, the second e-book in the GreenPoint Financial series on financing sustainability.

The first e-book, Code Red, focused on explaining the higher aims of the world of green finance. This included circular economies, COP ambitions, and concerns around built-in challenges such as supply chains and UN definitions of 'Responsible Banking'.

This series, Emerald Pathways, is more orientated towards the exploration of the nuances of climate change as an emergent risk type. CO2 is often used as a catch-all term for Greenhouse Gases (GHG), but some questions need to be considered, such as:

- How is carbon priced, and what does CO2e mean?
- What is the 'Carbon Budget' and how does it influence policy and policy prioritization?
- What do 'Carbon Intensity' numbers refer to, and how can banks navigate them for their own reporting requirements?
- How do 'Border Carbon Adjustments' mitigate regulatory arbitrage and prevent carbon leakage?

Complexity is unavoidable when merging rapidly evolving science with established banking reporting standards and differential regional climate plans. But that complexity must become part of every bank's risk management framework.

System thinking must replace well-worn historical analysis as impacts on the real economy, and therefore on the risk profiles of bank customers, are forecast and costed. This has to include:

- The role of stranded assets in the credit profiling process
- Taxonomies that govern official definitions of sustainability
- The intersection of public and private finance
- The role of innovation funds in the fight against climate change

The following articles look into these issues, from the perspective of financial risk management. Banks are crucial to the process of mobilizing trillions of dollars of private money towards the adaptation of businesses and infrastructures in the face of and mitigation of, climate change. Working in the context of current regulations around risk reporting and capitalization, bankers must understand the nuances and complexities, and use them to create viable scenarios that are capable of supplying the detailed analysis needed to price green loans and incentive sustainable businesses.

This e-book is intended as a start point in the sustainability journey for banking professionals - an introduction to green finance and its many embedded and interrelated topics.

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Chapter 1

GREEN FINANCING COMES IN MANY SHADES, EACH CARRYING DIFFERING RISK PROFILES - BANKS BE WARNED!

UNDERSTANDING TAXONOMIES, AS WELL AS DIFFERENCES BETWEEN ESG AND GREEN BONDS, IS VITAL FOR BANKS TO BUILD SUSTAINABLE BALANCE SHEETS.

Originally published on December 3, 2021

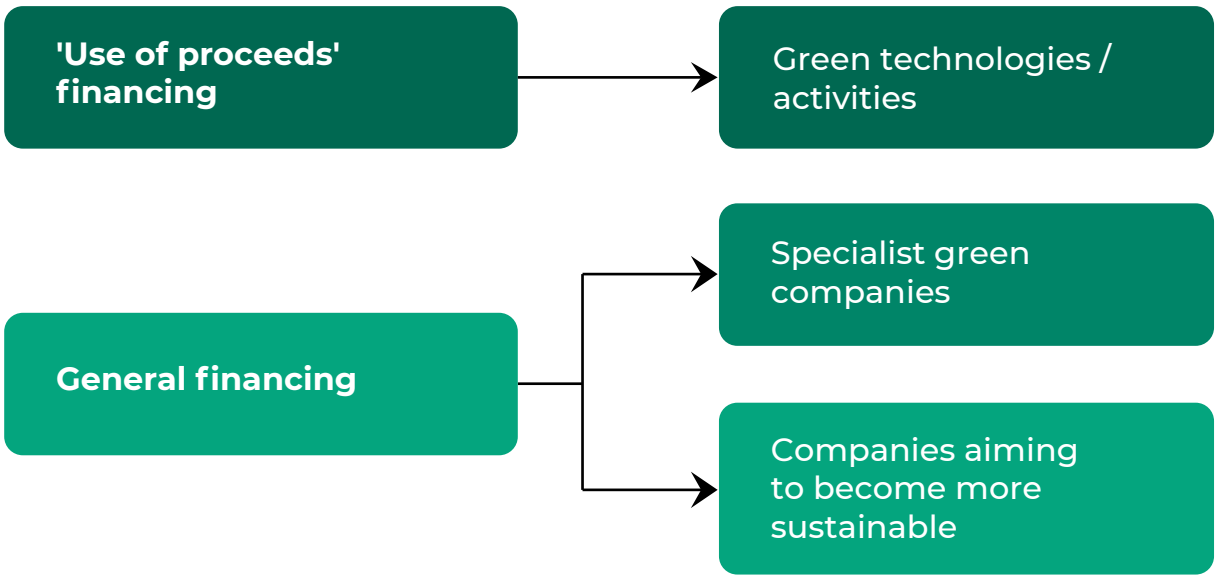
Green funding must meet specific criteria...

Along with the rise in awareness about climate change, comes an increasing desire from private finance to fund solutions to the adaptation and mitigation problems. There is no exact definition of what constitutes 'green' in terms of finance, but providers typically divide their funding recipients into distinct areas of interest:

- Technology/specific projects that target climate change mitigation or adaptation.
- Organizations that specialize in climate change prevention.
- Non-specialist organizations that are seeking to make their operations more sustainable.

These result in the need for credit facilities that are either:

- Targeted and defined with strict parameters about the precise use of funds.
- General financing with less stringent requirements on the use of funds.



In the context of a global economy that is shifting towards a greener future, the definition of green and how it fits into that envisioned future state becomes important for risk management purposes. Sustainable projects within organizations that strengthen their business model in the upcoming normal ought to be incentivized as they directly lower the credit risk profile of the borrower. One way to establish such a definition is to first explore various definitions of green bonds.

There are existing principles around green bonds...

The International Capital Markets Association (ICMA) publishes its Green Bond Principles (GBP). These establish four core alignment requirements as follows:

- Use of Proceeds
- Process for Project Evaluation and Selection
- Management of Proceeds
- Reporting

Use of proceeds refers to the inclusion of legal language into the framework to ensure that funds provided are used for sustainable projects. The association provides examples of such projects within the GBP.

- Renewable energy, including production, transmission, appliances, and products.
- Energy efficiency, new and refurbished buildings, energy storage, district heating, smart grids, appliances, and products.
- Pollution prevention and control, including reduction of air emissions, greenhouse gas control, soil remediation, waste prevention, waste reduction, waste recycling, and emission-efficient waste to energy.
- Environmentally sustainable management of living natural resources and land use, including environmentally sustainable agriculture, environmentally sustainable animal husbandry, climate-smart farm inputs such as biological crop protection or drip-irrigation, environmentally sustainable fishery and aquaculture, environmentally sustainable forestry, including afforestation or reforestation, and preservation or restoration of natural landscapes.
- Terrestrial and aquatic biodiversity conservation, including the protection of coastal, marine, and watershed environments.
- Clean transportation, such as electric, hybrid, public, rail, non-motorized, multi-modal transportation, infrastructure for clean energy vehicles, and reduction of harmful emissions.
- Sustainable water and wastewater management, including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training, and other forms of flooding mitigation.
- Climate change adaptation, including efforts to make infrastructure more resilient to impacts of climate change, as well as information support systems, such as climate observation, and early warning systems.
- Circular economy adapted products, production technologies and processes, such as the design of an introduction of reusable, recyclable, and refurbished materials, components and products, circular tools and services, and/or certified eco-efficient products.
- Green buildings that meet regional, national, or internationally recognized standards, or certifications for environmental performance.

Process for Project Evaluation and Selection means that an issuer of a Green Bond should clearly communicate:

- The environmental sustainability objectives of eligible Green Projects.
- The process by which the issuer determines how projects fit within eligible Green Projects categories (examples are identified above).
- Complementary information on processes by which the issuer identifies and manages perceived social and environmental risks associated with relevant project(s).

Management of Proceeds refers to the accounting of the project and usage of funds provided. Projects should be accounted for in a specific sub-portfolio and tracked by a formal internal process.

Reporting on the projects should be provided by the funding issuer, kept up to date, and be readily available to management. Annually, projects where funds have been used should be reported on, and where facility rollover is required, held to scrutiny against the original covenant.

The GBP is an excellent place to start when thinking about the exact definition of a green bond, but it does not always follow that the changing economic environment will mirror the sustainable ambitions of the bond issuers. From a credit risk perspective, green bonds defined against these principles may, but are not guaranteed to, achieve a lower credit risk profile as climate-related policies are announced and brought into law.

For bond definitions that are explicitly aligned to government objectives, we can explore the following taxonomies:

- Green Bond Endorsed Catalogue (People's Bank of China)
- Sustainable Finance Taxonomy (European Union)

Both are intended to provide working definitions of green bonds that are in line with the climate policy objectives of the publishing governments. Given that these same governments are signatories at the annual Conference of the Parties (COPs), there should be alignment between scientifically endorsed mitigation projects, policies, and green bond definitions. It is this alignment that makes these beneficial when linking green loan pricing, risk management and use of loan proceeds.

Before looking at that explicit link, though, it is important to recognize that there are some differences between these taxonomies.

	EU Sustainable Finance Taxonomy	NDRC Green Industry Guiding Catalogue	PBC Green Bond Endorsed Project Catalogue
Guiding Principles	• Climate and environment policies and the Paris Agreement • 6 environmental objectives and the principles of 'Substantial Contribution' and 'Do No Significant Harm'	• Pollution prevention and control • Promoting green industry development	• Ensure the robustness of the green bond market • 6 environmental objectives without specifying the relationship in between
Screening Criteria	• Principles to define economic activities with substantial contribution to environmental objectives, in particular climate change • Specific and quantitative carbon emission thresholds • Excludes fossil fuel activities without carbon capture	• No principle to define eligibility of the industries • No carbon emission threshold • Does not exclude fossil fuels	• No principle to define projects aligned with environmental objectives • No carbon emission threshold • Does not exclude fossil fuels

The six environmental objectives of the EU taxonomy are defined as:

- Climate change mitigation
- Climate change adaptation
- Sustainable use and protection of water and marine resources
- Transition to a circular economy
- Waste prevention and recycling
- Pollution prevention and control
- Protection of healthy ecosystems

These are completely aligned with that bloc's 'Green Deal' high level aims.

To compare the Chinese and European classification schemes, the following list of environmental screening criteria is used.

Sector	Screening Principles under the Taxonomy for Climate Change Mitigation
Agriculture	• Reduced emissions from ongoing land and animal management • Increased removals of carbon from the atmosphere and storage in above- and below-ground biomass through ongoing land and animal management, up to the limit of saturation levels • The agricultural activity is not being carried out on land that was previously deemed to be 'of high carbon stock'
Forestry	• Compliance with Sustainable Forest Management (SFM) requirements; the establishment of a GHG balance baseline for above-ground carbon pools, based on growth-yield curves
Manufacturing	• Activities that contribute to a transition to a net-zero emissions economy in 2050: no metric • Activities that enable low carbon performance or enable substantial emissions reductions: carbon emission performance that reduces carbon emissions to best practice standards
Electricity, gas, steam and air conditioning supply	• The threshold for life cycle of emissions (LCEs) is 100gCO_2e/kWh, which will be reduced every 5 years till net-zero CO_2e by 2050 • New energies such as solar, wind and existing hydropower in the EU currently meet the threshold, thus are exempt from LCEs analysis • **Coal-fired power:** projects without carbon capture will not meet the required threshold. Coal-fired power with carbon capture and sequestration may qualify in the short-term, but new coal plants generally have lifetime of 40 years or longer and they need to demonstrate that it will be able to reach net-zero emissions in 2050 • **Natural gas-fired power:** projects without carbon capture will not meet the required threshold. Gas-fired power with carbon capture and sequestration may qualify. However, this will be subject to the requirement that fugitive emissions across the gas supply chain need to be measured • Electricity generation from other gaseous fuels (such as hydrogen or renewable gases): would be eligible subject to meeting the emissions threshold
Water, sewerage, waste and remediation	• Water collection, treatment and supply: quantitative energy efficiency (such as water supply of an average energy consumption lower than 0.5kWh/m^3) or reduce energy consumption by 20% or more • Other activities, such as the energetic utilisation of bio-gas gained through the anaerobic digestion of sewage sludge and bio-waste, or the recovery from waste: qualitative emission reduction metrics should be met
Transportation	• Efficient, low- or zero emissions fleets; emission metrics need to be followed in terms of per vehicle km, per passenger km or per tonne km • Fuel substitution to net-zero carbon fuels: net-zero carbon fuels such as advanced bio- and synthetic fuels should be used for a dedicated purpose without being mixed with other fuels

Sector	Screening Principles under the Taxonomy for Climate Change Mitigation
ICT	• Data centres: follow the Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency[11] • Data-driven solutions for GHG reductions. no metric need to be followed

With these definitions in mind, the following table shows how the two schemas differ.

Sector	Scope	Environmental Objectives	
	Project Catalogue vs Taxonomy	Taxonomy	Project Catalogue
Agriculture and forestry	The Taxonomy has a broader scope and is more detailed	All six environmental objectives	Resource conservation and recycling, ecological protection and climate change adaption
Manufacturing	The Project Catalogue has a broader scope and is more detailed. The Project Catalogue includes "clean coal" while the Taxonomy excludes fossil fuels	All six environmental objectives	Energy saving, pollution prevention and control, resource conservation and recycling, clean transportation
Electricity, gas, steam and air conditioning supply	The Taxonomy excludes co-fired power without carbon capture, natural gas-fired power without carbon capture, and nuclear energy; while the Project Catalogue includes these projects	All six environmental objectives	Pollution prevention and control, resource conservation and recycling, clean energy
Water, sewerage, waste and remediation	Mostly the same	All six environmental objectives	Pollution prevention and control, resource conservation and recycling, ecological protection and climate change adaption
Transportation	Mostly the same	All six environmental objectives	Clean transportation
ICT	The Project Catalogue is specifically about energy and transportation while the Taxonomy is more general	Climate change mitigation	Energy saving, clean transportation, clean energy, ecological protection and climate change adaption
Construction and real estate activities	Mostly the same but the Taxonomy excludes buildings related to fossil fuels	All six environmental objectives	Energy saving, resource conservation and recycling

Although there are substantial differences, the point remains that projects that meet these definitions, within the regions they are applicable, will correspond to policies created to meet the ambitions of that government. Therefore, they will benefit from an increasingly benign economic climate.

ESG bonds may be green, but they are not green bonds...

It should be noted that there is a wider world of ESG bonds in the modern market. To align with climate-change mitigation policy, it is only specifically 'green' loans and bonds that are considered in this article.

Greenness of the bond is definitively linked to its forward credit profile...

As mentioned in the previous sections, aligning credit facilities with policies, aimed at mitigating climate change, will have a knock-on effect of reducing the credit risk profile of the borrower.

The reverse is also true. Financing projects and firms that will find themselves targeted by expensive regulation, or their business models made redundant by environmental laws, can only see credit risk across the balance sheet rise exponentially.

Green principles must be adopted for general loan governance...

Banks are faced with risks and opportunities in the emerging green economy.

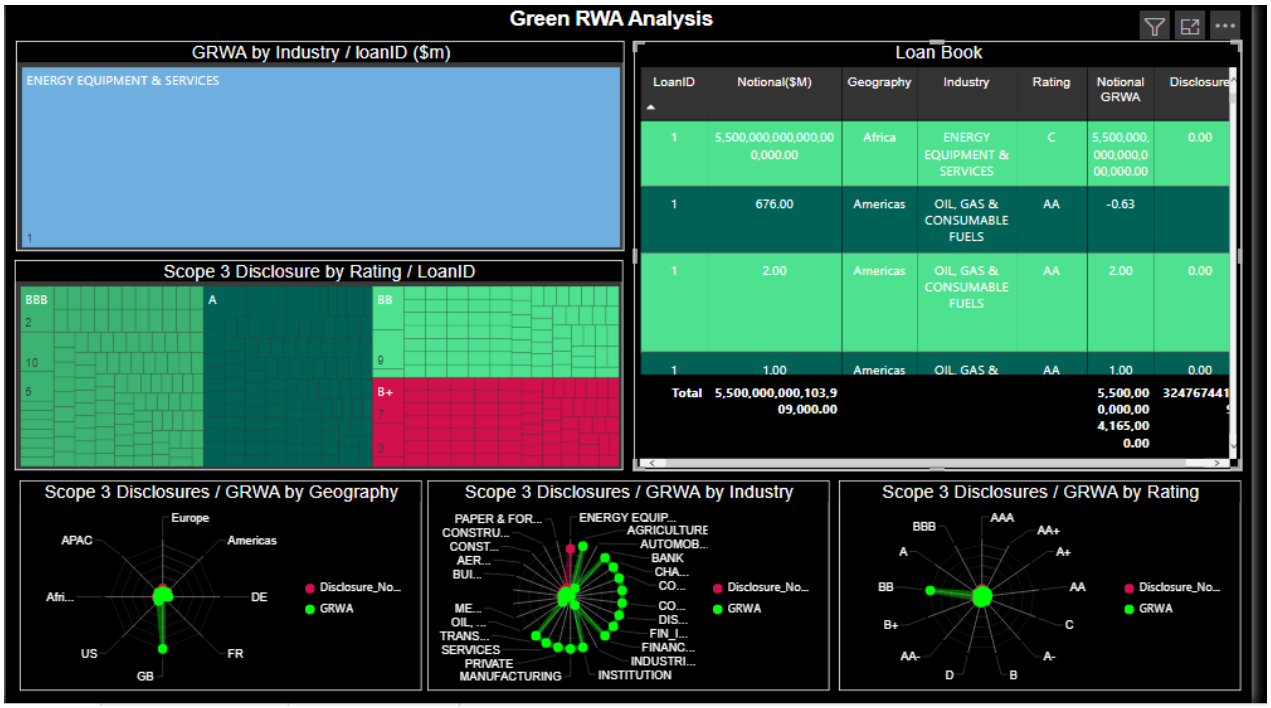
The main risk is that their loan books incur increasing credit risk charges due to the Risk Weighted Asset (RWA) calculation causing more capital to be held in low return, safe assets, or High Quality Liquid Assets (HQLA). Holding a higher percentage of capital in these assets directly decreases profitability, as less capital is 'working' in the market.

Related to the RWA increase is the pricing of loans. Higher credit risk is typically accompanied by a higher spread on the loan itself. The problem with climate change risk is that loans and credit facilities are often long-term, with the rate set in the current 'brown' economic environment. Offsetting spreads need to be set for the future, against the most predictable climate-impacted economic environment.

Banks have to create frameworks and protocols now, to ensure that they remain liquid as the coming decade of climate policy initiatives unfolds.

GreenCap can help...

GreenCap is a 'Risk As A Service' system that empowers banks with the capacity to include climate change into their loan pricing and credit risk analytics.



GreenCap:

- Builds specific Intergovernmental Panel on Climate Change (IPCC) climate pathways into pricing and risk analytics.
- Allows banks to price adaptation and mitigation into current and future credit pricing.
- Enables climate-related strategies to be developed by the bank.
- Deals with transition (policy-based) and physical climate risks.
- Provides sustainability reporting at the CFO level.

Visit GreenCap.live for more details.

Chapter 2

EXPECTATIONS OF CLIMATE RISK MANAGEMENT ARE GROWING AND BANKS MUST CREATE THEIR FRAMEWORKS NOW

GOVERNMENTS AND REGULATORS ARE RATCHETING UP SCRUTINY AND EXPECTATIONS OF CLIMATE RISK. BANKS CAN PREPARE BY LOOKING AT EARLY MODELS.

Originally published on December 10, 2021

Since the Paris COP of 2015, governments around the world have been looking at their economic infrastructure with a view to meeting their pledges and commitments made at that summit.

Planning for climate change inevitably starts with identification of greenhouse gas (GHG) emissions across the range of industrial sectors, and the creation of possible policies and plans that could prepare the 'real' economy for a low carbon future. Projections along various climate pathways are then priced in terms of required investments from both, public and private sources.

Lawmakers recognize that banking will not only have to act as the main conduit for green private finance but that banks will be faced with new risks to evaluate and manage as the transition towards sustainability occurs.

Guidance, from financial regulators across the world, as to how these new risks should be measured, managed, and reported is developing.

There are early movers in the regulatory space...

The UK's Prudential Regulatory Authority (PRA) worked with the Financial Conduct Authority (FCA) to create the Climate Financial Risk Forum in 2019. The result was a set of guidelines from the PRA covering how climate-related risks should be integrated within existing risk management.

Banks can use this guidance summarized below, within and outside the UK as a best practice model. The following sections are explicitly noted (taken from *PRA Supervisory Statement SS3/19*).

Governance

The PRA expects a firm's board to understand and assess financial risks from climate change that affect the firm, and be able to address and oversee these risks within the firm's overall business strategy and risk appetite. The approach should demonstrate an understanding of distinctive elements of financial risks from climate change and a sufficiently long-term view of the financial risks that can arise beyond standard business planning horizons.

Risk Management

The PRA expects firms to address financial risks from climate change through their existing risk management frameworks, in line with their board-approved risk appetite, while recognizing that the nature of the risks requires a strategic approach. In a manner proportionate to their business, firms should identify, measure, monitor, manage, and report on their exposure to these risks. Firms should be able to evidence this in their written risk management policies, management information, and board risk reports. This includes where appropriate, updating existing risk management policies.

Risk Identification and Measurement

The PRA expects firms to understand the financial risks from climate change and how they will affect their business model. Firms should use scenario analysis and stress testing to inform the risk identification process and understand the short- and long-term financial risks to their business model, from climate change. Firms are also expected to go beyond using only historical data to

inform their risk assessment, for example by considering future trends in catastrophe modeling. The PRA expects that such scenarios will develop and mature over time as firms learn from experience and each other.

Risk Monitoring

Where appropriate, the PRA expects firms to consider a range of quantitative and qualitative tools and metrics to monitor their exposure to financial risks from climate change. For example, these could be used to monitor exposures to climate-related risk factors, which could result from changes in the concentration of firms' investment or lending portfolios, or the potential impact of physical risk factors on outsourcing arrangements and supply chains. The PRA expects that these metrics and tools will evolve and mature over time as firms gain experience.

Risk Management and Mitigation

Where the potential impacts of the financial risks from climate change are assessed to be material (for example, as a result of scenario analysis), the PRA expects firms to evidence how they will mitigate these financial risks, and to have a credible plan or policies in place for managing exposures. This could include actions the firm is taking to reduce concentrations of these risks. Plans should be reflective of the distinctive elements of the financial risks from climate change, so may differ from other risks.

Risk Reporting and Management Information

The PRA expects firms to provide the board and relevant sub-committees with management information on their exposure to the financial risks from climate change, for example, based on scenario analysis and the mitigating actions and associated timeframe the firm proposes to take. The management information should enable the board to discuss, challenge, and take decisions relating to the firm's management of the financial risks from climate change.

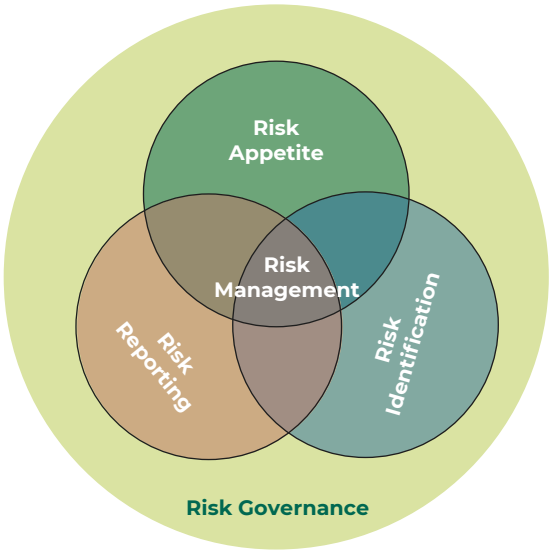
Scenario Analysis

Where proportionate, the PRA expects firms to conduct scenario analysis to inform their strategic planning and determine the impact of the financial risks from climate change on their overall risk profile and business strategy. Scenario analysis should also be used to explore the resilience and vulnerabilities of a firm's business model to a range of outcomes. The PRA expects approaches to scenario analysis to evolve and mature over time.

Disclosure

Banks and insurers have existing requirements to disclose information on material risks within their Pillar 3 disclosures (as required under Capital Requirements Regulation (575/2013) (CRR) and Solvency II), and on principal risks and uncertainties in their Strategic Report (as required under the UK Companies Act).

The strong underlying message is that, even though climate change exhibits highly specific characteristics, the financial impacts and risks to the banks need to be measured, monitored, and controlled within the standard risk framework currently in place.



Climate scenarios have unique parameters...

The PRA guidance notes that climate change analysis requires a subtly different approach, including appreciation of the specific risk types and the timeframes.

Risk Taxonomy

Financial climate risk can be split between:

- **Transition -** Risk associated with policies created by governments to meet pledges made to cut emissions. These policies become regulations and costs to impacted industries, which translate into increased credit risk to any bank financing them.
- **Physical -** Risk created by actual climate change, from rising sea levels, heatwaves, violent weather, or any other known effects from rising global temperatures. This impacts physical assets of banks' customers, as well as those of their supply chains. Such disruption has the capability of deteriorating the business model of these firms, drastically changing their credit risk profile.

Scenario Definition

Typical risk scenarios span from one to five years and are designed to test short- and mid-term liquidity. Climate scenarios, by contrast:

- Have time horizons set by the short-, mid- and long-term goals. Long-term is defined as the 2100 global warming limits (relative to 1990 temperature levels). Mid-term refers to 2035 to 2050, and GHG emission levels that would be required by these dates to meet the 2100 targets. Short-term refers to 2030 or earlier, and the policy environments required to reach the mid-term levels.
- Are defined using multiple possible pathways to reach various final heating goals.
- Require banks to interpret data as it develops and becomes available, to create working scenarios that are refined through the coming decade.

Data is incomplete, but available...

Risk management needs data, and in the case of climate change, that data is sourced from a fast-developing scientific base. It is clear that the climate models are improving, with predictions from the 1990s proving accurate. However, the fact that they deal with potential futures means that they are still predictive models, and therefore, are quite different from the vast data sets of past market data normally used by banks for stress testing and scenario building.

Even so, data from various bodies does provide a solid starting point for how businesses will be affected under various climate pathways.

- **The Intergovernmental Panel on Climate Change (IPCC)** provides a large number of research pathways that would lead to specified, end of century, temperature levels. These are created by experts across multiple sciences and detail how the GHGs would reduce over time to reach these numbers.
- **The Net Greening of the Financial System (NGFS)** works through the IPCC scenarios and provides costs in terms of local and global GDP impacts. The NGFS is a collective of central bankers and economists and includes almost all of the world's main economies.
- **The International Energy Agency (IEA)** tracks precisely which industries will be targeted by the pathways and how specified adaptations and transitions are moving along. This indicates whether the pathways are being followed in an orderly manner, implying a managed route, or, in a disorderly manner implying a higher likelihood of sudden, stringent measures being put in place.

Pathways and financial scenarios evolve over time. It is important for banks to have frameworks in place that can take in changing data sets reflecting this dynamic environment.

Bank strategy has to react to evolving pathways...

A key message in the guidance is the need for banks to manage their own climate strategies in the context of this emerging area of risk.

This implies:

- Short-term analysis of current financial risks faced by banks if no changes are made to their loan books and specific pathways are followed by world governments.
- A mid-term analysis of various scenarios, both orderly and disorderly, regarding the impact on the balance sheet and its credit profile/capital requirements.
- Longer-term green targets that the bank believes fit its climate strategy and wider risk appetite.
- Monitoring these targets and the capacity to report to stakeholders about their progress.
- Front line tools that are designed to recognize the changing credit risk profile, and reflect it in new credit facility pricing.

It has to be emphasized that this is a new risk category, and it does have unique properties, but it has to fit into a bank's core view of risk management and governance.

GreenCap can help...

GreenCap is a ready-to-use risk system, designed to specifically answer these questions:

- What is the bank's financial exposure to transitional and physical climate change along various pathways?
- What would be the change in that impact scenario, given a bank's green strategy for its balance sheet?
- Is the bank moving towards, or away from its target sustainability levels?

GreenCap was designed to work with existing bank measures and to augment the risk appetite, and fit in with current risk governance practices.

Visit GreenCap.live for more details.

Chapter 3

CLIMATE-RELATED STRANDED ASSETS REPRESENT SIGNIFICANT CREDIT RISK TO BANKS

BOTH TRANSITIONAL AND PHYSICAL CLIMATE CHANGE WILL DEPLETE COLLATERAL VALUE ON THE BALANCE SHEET. BANKS MUST FACTOR THIS INTO CREDIT RISK MANAGEMENT.

Originally published on December 17, 2021

In the context of climate change, stranded assets are defined as the ones that will be rendered economically inert, by either environmental changes or policies designed to curtail such changes. A widely used example of a stranded asset is oil that is notionally owned by a firm but ultimately loses its value, once the decision to leave it permanently in the ground has been made. The concept becomes especially important when asset valuations are made for the purpose of market value analysis or as collateral valuation for credit evaluation.

Compliance costs are related to, but different to stranded asset losses...

Policies put in place by governments in order that their economies can be restructured will create significant costs to businesses. Compliance with new regulations, from green building codes to sustainable agricultural practices will require initial investment and cause increased running costs. Certain assets, though, will become useless, which means that their valuation becomes zero for collateral valuation and resultant credit pricing.

Lowering collateral values and simultaneously increasing running costs, and the need for credit facilities creates a double bind for firms relying on banks for day-to-day liquidity. Greater borrowing with less collateral essentially equals a higher credit risk to the lending bank, which then needs more capital held against that risk. Stranded assets should be viewed as extreme examples of transitional risk.

Assets are also stranded by physical climate change. From rising sea levels to extreme weather such as heat and wind events, climate change will cause significant disruption to business activity in impacted areas. This element of asset stranding sets it apart from compliance, making it more difficult for policymakers to reduce or manage through orderly planning

Losses from stranded assets are already expected to be substantial...

The Carbon Disclosure Project (CDP) is a 'not for profit' charity that runs the global disclosure system for investors, companies, cities, states, and regions to manage their environmental impacts.

A 2019 report published by CDP detailed what 215 of the largest global companies were expecting over five years.

- Total losses due to climate change could reach $1 trillion.
- Losses due to stranded assets could reach ¼ of the total, or $250 billion.
- Opportunities in a greener economic future outweighed the predicted losses.

The above illustrates the potential dilemma faced by firms and their bankers. Taking advantage of green opportunities requires investment and credit. This is increasingly made more expensive as more liquidity is needed for day-to-day compliance, while the asset valuation underwriting the credit falls.

Assumptions around government compensation may be misplaced and risky...

The concept of stranded assets is not new, but there is evidence that investors and credit providers assume that compensation will be offered where economic policy itself reduces asset values. This assumption may be leading to this risk being ignored.

The German climate policy involves a climate levy to reduce coal-generated electricity. Suphi Sen and Marie-Theres von Schickfus (University of Munich) studied the attitude of investors to the risk of stranded assets within German utility companies.

Share prices were tracked against three policy stages.

- Levy on carbon emissions
- Compensation mechanism
- Regulatory compliance checks

The most significant negative reaction in the share prices was in the third stage.

The conclusion was that compensation is assumed to the extent that the risk of non-compensated stranding was not considered material. This is a big assumption that is not based on the reality of the policies being explored across industries. The full study can be read here.

Banks are advised to include asset stranding in any analysis of their current or planned balance sheet.

Stranded assets risks exist in every sector...

Energy and transportation garner maximum attention when transition risk is discussed, but there is substantial risk across all commodities. Agriculture, for example, is facing multiple challenges globally.

- Policies aimed at reducing Greenhouse Gases (GHGs), including Nitrogen, Methane, and Carbon Dioxide could cause Beef, Soy, and Palm producers to abandon large areas of operation due to the cost of adaptation.
- Reforestation is widely seen as an urgent requirement to create effective carbon sinks (natural removal of CO2 from the atmosphere). The economics of reforestation result in significant opportunity loss for current owners of targeted land.
- Prevention of deforestation is a corollary of reforestation, but directly prevents planned economic use of land, resulting in significant loss of value to the owner.

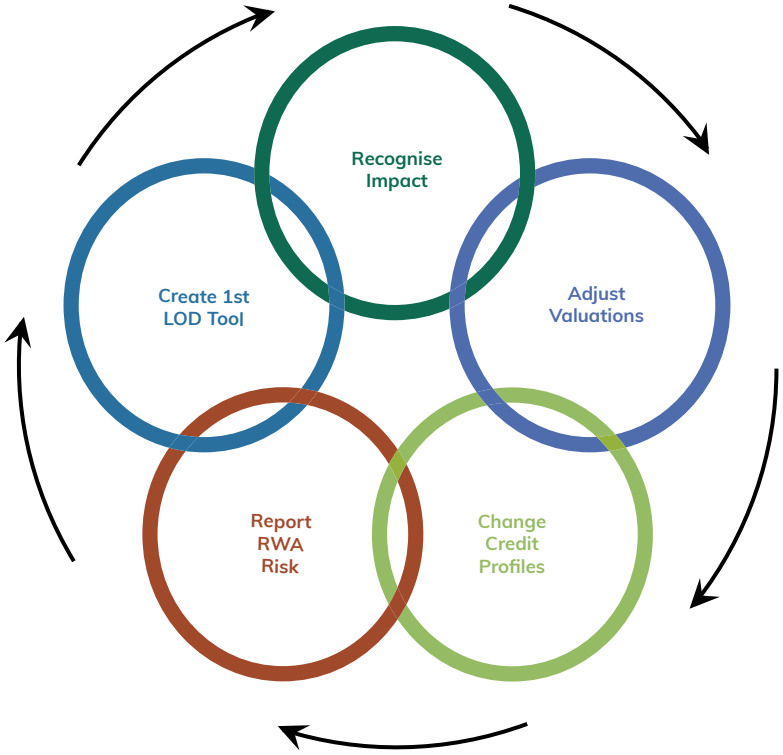
Agriculture is just one example where policies that are discussed at Conference of Parties (COP) level, and adopted by governments, will witness downward changes in currently 'priced-in' collateral values. Similar points can be made across all industrial sectors. While cost of compliance is a 'probability of default' or liquidity issue, stranded assets are a 'loss given default' or a collateral value problem.

Banks need to include collateral value falls in their stress tests...

As banks create risk frameworks that are designed to include climate change as a factor, they must include the potential credit impacts from stranded assets.

Building asset stranding into risk management involves:

- Recognizing the impact of climate change and climate policy on obligors' assets.
- Adjusting the recoverable value of loans and credit facilities to reflect that impact.
- Ensuring that expected credit profiles change accordingly, through climate stress tests.
- Making resultant Risk Weighted Asset (RWA) provisions reportable metrics from the stress tests.
- Creating 'first line of defense' tools that allow the risk to be priced correctly into new and rolling credit facilities.



GreenCap can help...

GreenCap is a 'Risk As A Service' (RAAS) solution that allows banks to assess the climate change risk to their loan books and balance sheets. Explicitly, this system incorporates the ability to repay and the recoverable value of collateral from the borrower, as key drivers of the financial risk faced by banks as lenders.

Banks can set and track risk-based targets against specific climate pathways with GreenCap. The calculation includes:

- Expected global and local losses by climate pathway.
- Sector-based benchmark correlation to expected losses.
- Loan level adjustments from mitigation investments and adaptations.
- Liquidity and asset valuation inputs.

Visit GreenCap.live for more details.

Chapter 4

CONSUMPTION RATE OF THE CARBON BUDGET WILL DICTATE THE GREEN TRANSITION'S SPEED AND RISK

CALIBRATING CLIMATE SCENARIOS WILL REQUIRE BANKS' RISK DEPARTMENTS TO NAVIGATE THE VAGARIES OF GLOBAL CARBON BUDGET MANAGEMENT. THIS REQUIRES AN UNDERSTANDING OF WHAT IT INVOLVES AND WHAT IT REALLY ENTAILS.

Originally published on January 07, 2022

The carbon budget is a consequence of the 2100 global warming target...

In 2015, at the Conference Of Parties (COP) in Paris, the world's governments committed to holding global warming to 2 degrees above 1990 levels, while making best efforts to achieve a 1.5-degree limit.

This target is calibrated by using the heating potency of CO2 and calculating the cumulative amount of the gas in the atmosphere that would create it. The current atmospheric CO2 level can be measured with reasonable accuracy. It is also known that every gigaton (Gt) of carbon burned creates 3.67Gt of CO2.

For a 2100 limit of 2 degrees, the remaining carbon budget is 1150Gts of CO2, but for 1.5 degrees it is just 400Gts. The current global rate of CO2 emission is 42Gts p/a and still trending up.

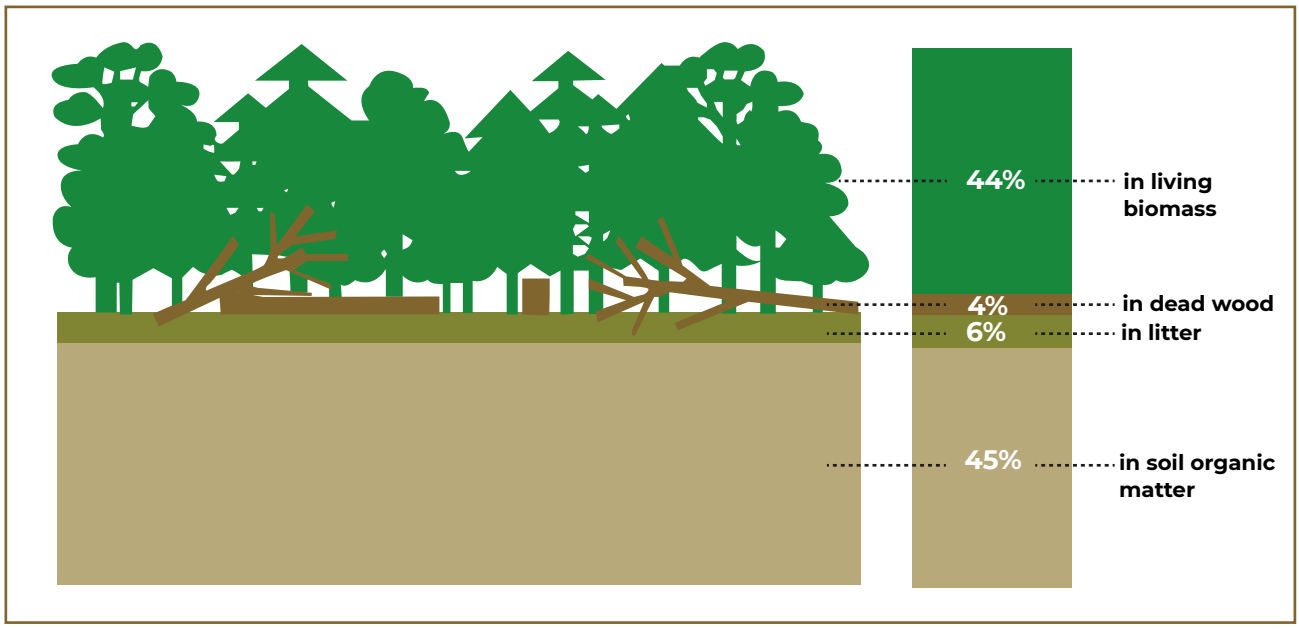
The life of the remaining budget, however, is subject to a number of variables...

The total amount of CO2 that can be allowed to be released each year, is a function of the cumulative target, and how much CO2 will be sequestered.

Oceans and Forests act as vital carbon sinks, actively absorbing CO2. Between 2010 and 2019, 21.7Gt of CO2 was removed from the atmosphere by these ecosystems. In 2020, over half (54%) of the gas emitted was absorbed, but this is viewed as anomalous, due to the overall 7% fall in emissions, as a result of the global COVID pandemic. Also, it is far from clear whether this rate of sequestration can be sustained.

Deforestation is a significant threat to the carbon budget timeframe. Not only does it reduce the capacity to turn CO2 into carbon-storing biomass, but the means by which this happens, specifically fire, creates a net increase in the CO2 that is released. The United Nations 'Food and Agriculture Organization', in its 2020 key findings, estimated that the world's forests currently hold around 662Gts of carbon.

Proportion of carbon stock in forest carbon pools, 2020



Source: Food and Agriculture Organization of the United Nations

Reforestation is a key goal agreed at the recent COP, in Glasgow, but the trend is still towards deforestation for agricultural use, mainly in South America and Africa. There is also the concern that weather extremes, caused by current levels of global warming, will increase the number and severity of forest fires.

Phytoplankton turn the oceans of the world into another main carbon sink. These microscopic algae currently absorb as much carbon as all the plants and trees on land combined. The combination of plankton-eating dumped microplastics, and acidification-driven changes in the oceanic ecosystem mean that the constancy of this source of CO2 removal is under considerable doubt.

Carbon Capture and Sequestration (CCS) is also a big unknown. Much of the climate change mitigation research, currently being conducted, is in this area, and most pathways that lead to either 1.5- or 2-degree limits, involve significant periods in the latter half of the century of net negative emissions, where more CO2 is removed than emitted.

These factors taken together result in a situation where the carbon budget as a destination has many possible routes.

Economics, tipping points, and feedback loops will determine policy...

The global carbon budget is known by governments who make up the UN, and who attend the COPs, but individual limits and policies are determined locally within each country. The shared aim to limit global warming is, therefore, tempered by their specific economic needs. This means that even though the required actions are reasonably well-understood, the timing of policy and implementation is less than certain.

The agreement at COP26 to annual reporting against, and increasing of, self-set targets will undoubtedly focus attention, but other factors may come into play.

The fact that global warming increases the likelihood of extreme weather events is now an accepted one, and there are other positive feedback loops within the ecosystem to consider - from unplanned forest fires, through oceanic biodiversity loss, to melting ice caps. All of these accelerate the impacts of global warming and are likely to force more urgent action from policymakers around the world.

Banks must work with current pathways...

The Intergovernmental Panel for Climate Change (IPCC) researches and publishes pathways that could result in the world achieving its global warming targets. These set out the actions that must be taken across a range of areas including:

- Industry
- Transportation
- Agriculture
- Land Management
- Infrastructure
- Construction

The question is less about what a pathway requires, but rather the speed at which it is put into place. Therefore, there are generally three sub-scenarios applied to each pathway, for comparative purposes. These are:

- **Orderly -** This is defined as a program that is planned and put into place early, to achieve a transition to a sustainable economy that businesses and populations can work with, without sudden, stringent measures. The costs here are significant and must be budgeted in a way that allows the economy to prepare for and absorb them without crisis.

- **Disorderly -** This is defined as taking little or no action until absolutely required, leading to significant business disruption. Regulatory changes, without notice, damage supply chains and

limit firms' capacity to adapt appropriately. This economic damage may hurt the ability to fund the required changes and cause liquidity issues throughout the system.

- **Hothouse World -** This is defined as doing nothing but adapting to the physical effects that global warming creates. This is not viewed as a viable alternative but is used to illustrate the endpoint of simply continuing on the same economic path as currently followed.

Each of these has a different impact on the businesses that make up the economy of each country. All these will have a mixture of positive and negative effects on firms' business models and therefore, their credit profiles as customers of the bank.

An orderly transition is likely to impose adaptation costs on businesses, reducing their liquidity, but these will be signaled ahead of time and are likely to be introduced over a period of time. These are certainly costly, but likely manageable by most firms across various sectors.

A disorderly transition means that firms who look to apply non-regulatory changes may not be able to compete, and when regulations are changed, the timescales for compliance are most likely too short for proper investment. Essentially, an adaptation-led liquidity crisis should be expected.

As banks build climate-based scenarios for risk management purposes, both of these must be considered.

Banks can incentivize sustainability...

The fact that banks can run scenarios and see the future impact on their balance sheets implies that they can also take steps to avoid liquidity issues.

The results of climate scenarios will allow risk departments to see the credit-adjusted impact of this transition. Although this impact will come later, it does not change the overall cost to banks in terms of funding an increasing 'Risk Weighted Asset' capital charge against facilities granted before various climate regulations come into effect.

Impacts in terms of dollar costs can be applied by using the official 'Net Greening of the Financial System' (NGFS) estimates against each pathway option.

Banks can then:

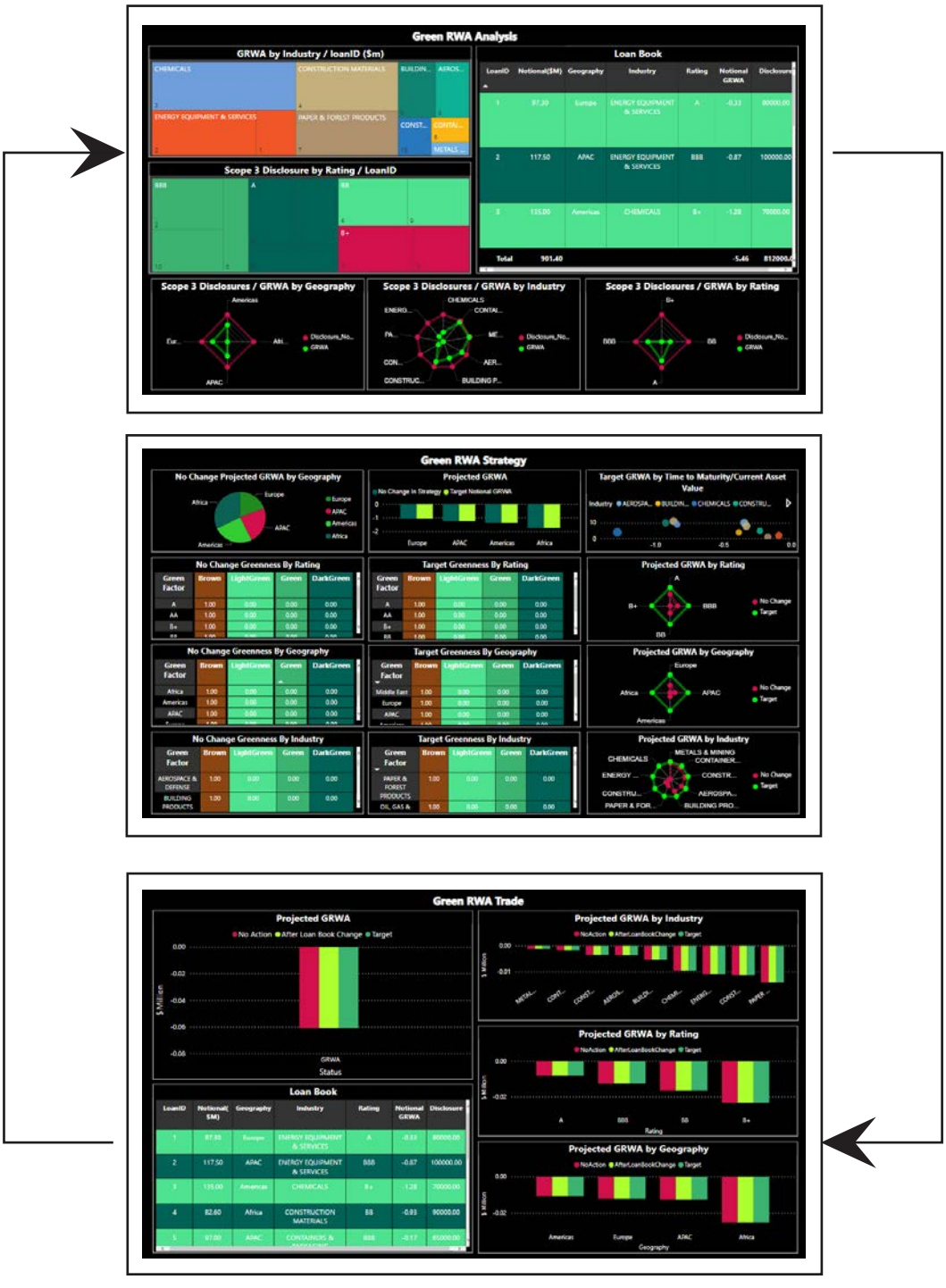
- Estimate the change in regulatory capitalization caused to the loan book by each scenario assuming borrowers only take action when forced to.
- Estimate the difference in the costs if firms took early, pre-emptive action in sustainability - taken using IPCC action recommendations.
- Work the difference, by sector, into a green loan pricing policy.
- Set sustainable business targets using these capital indicators.

- Make monitoring of these targets a part of day-to-day bank governance.

The important fact here is that the required actions and implications of (not) taking them are already known. There is no need to wait for government regulation to measure these impacts, or to take steps to avoid them. Banks can become the catalyst of change, rather than simply its financial conduit.

GreenCap can help...

GreenCap is a stand-alone 'Risk As A Service' (RAAS) solution that provides banks with the tools they need to apply scenarios to their balance sheets over the next 10 critical years. The system supplies reports on the current 'no action' increase in regulatory capital, as well as the means to apply bank-wide targets and loan-level adaptation savings.



Using GreenCap, banks can work with their customers to finance the changes that must happen over the coming decade, as well as pre-empt any liquidity issues by smartly calibrating known scenarios against a decreasing global carbon budget.

Visit GreenCap.live for more details.

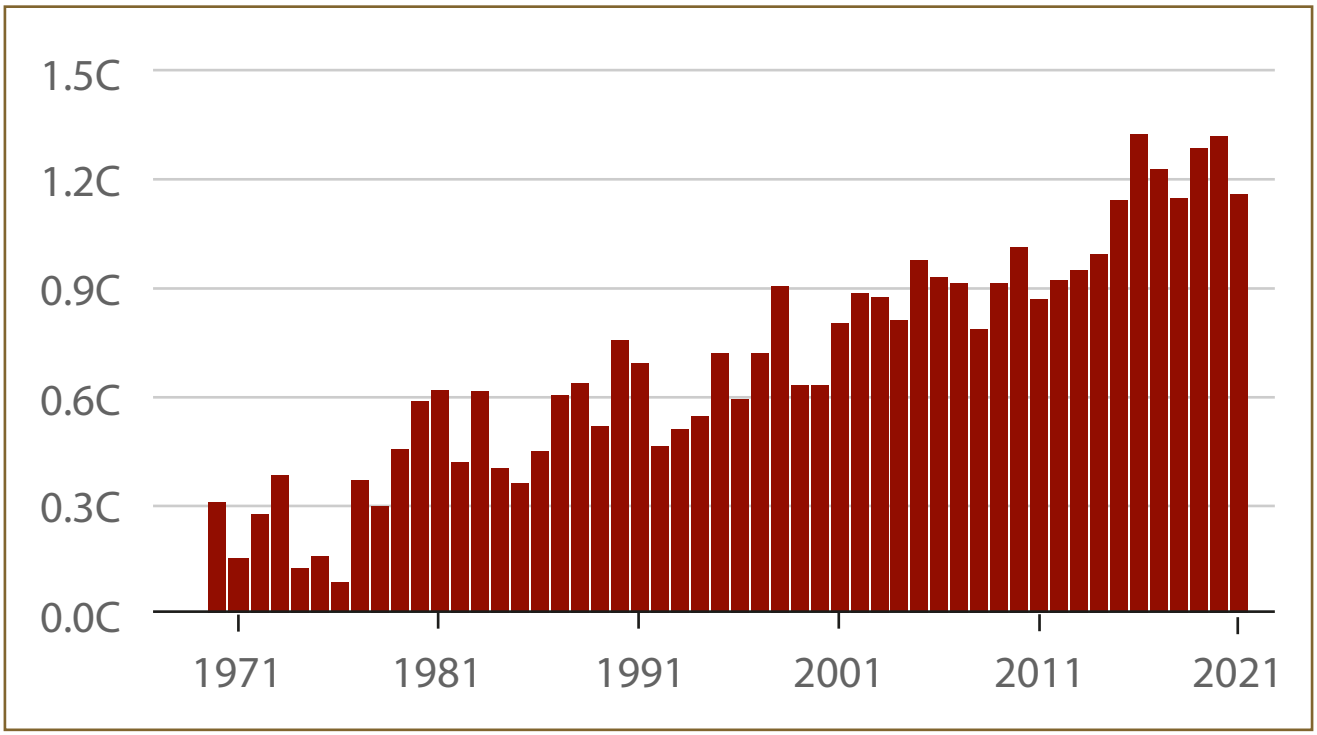
Chapter 5

BANKS THAT BUILD CARBON PRICING INTO THEIR RISK PLANNING WILL HAVE AN ADVANTAGE AS CLIMATE FINANCE MATURES

CARBON PRICING SCHEMES ARE CORE WEAPONS IN THE FIGHT AGAINST CLIMATE CHANGE, AND THEIR IMPACT WILL HAVE SIGNIFICANT CONSEQUENCES FOR BANKS' BALANCE SHEETS

Originally published on January 14, 2022

The year 2021 was officially the 5th warmest year on record and adds to the tally that see the last seven years as the seven warmest since the industrial revolution. 2021's temperature is a particularly stark result given the 'La Nina' effect that would typically dampen the global warming impact.



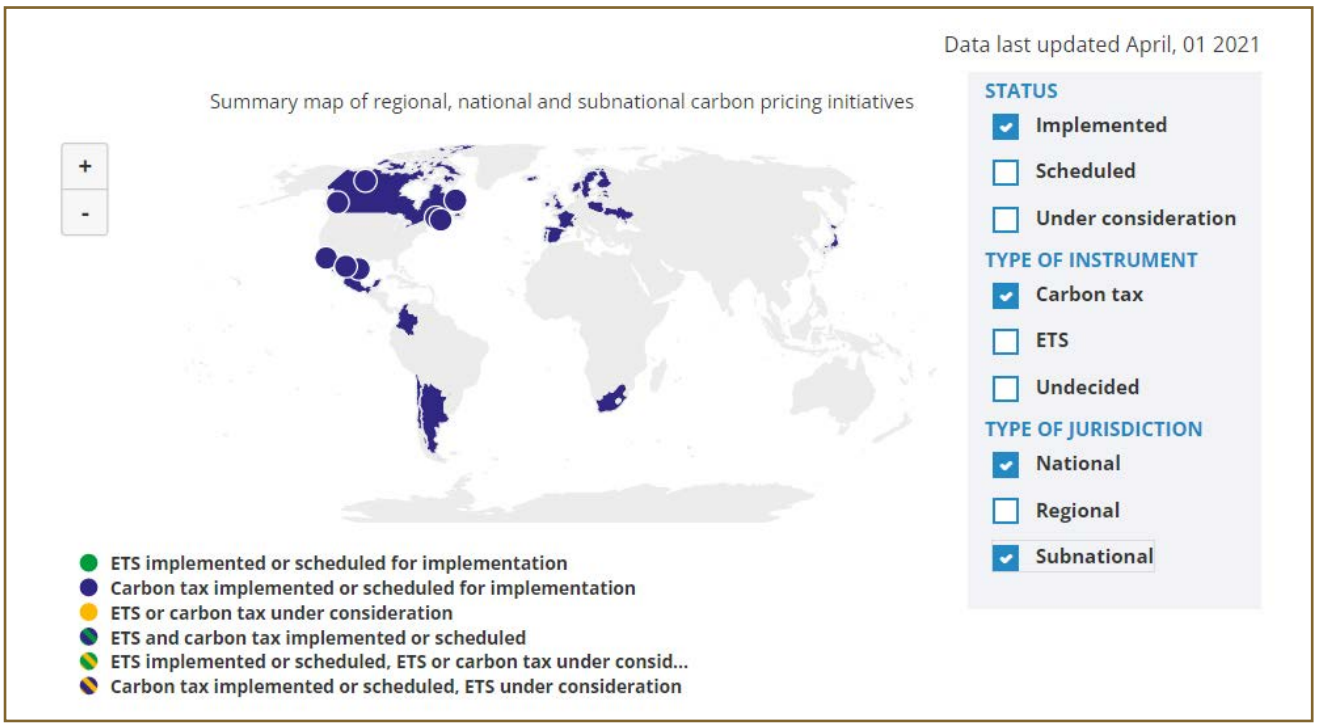
Source: ERA5 - Copernicus Climate Service

This is accompanied by the consistently increasing accumulation of CO2 in the atmosphere, which continues to rise, despite commitments from world leaders to reduce emissions of the gas since the Conference of Parties (COPs), in Kyoto (1998) and Paris (2016).

Carbon pricing schemes are becoming a necessity...

The urgency of curtailing CO2 emissions has led to the creation of carbon pricing schemes around the globe. There are two distinct types of carbon control - direct taxation of CO2 and carbon trading schemes and each has specific characteristics.

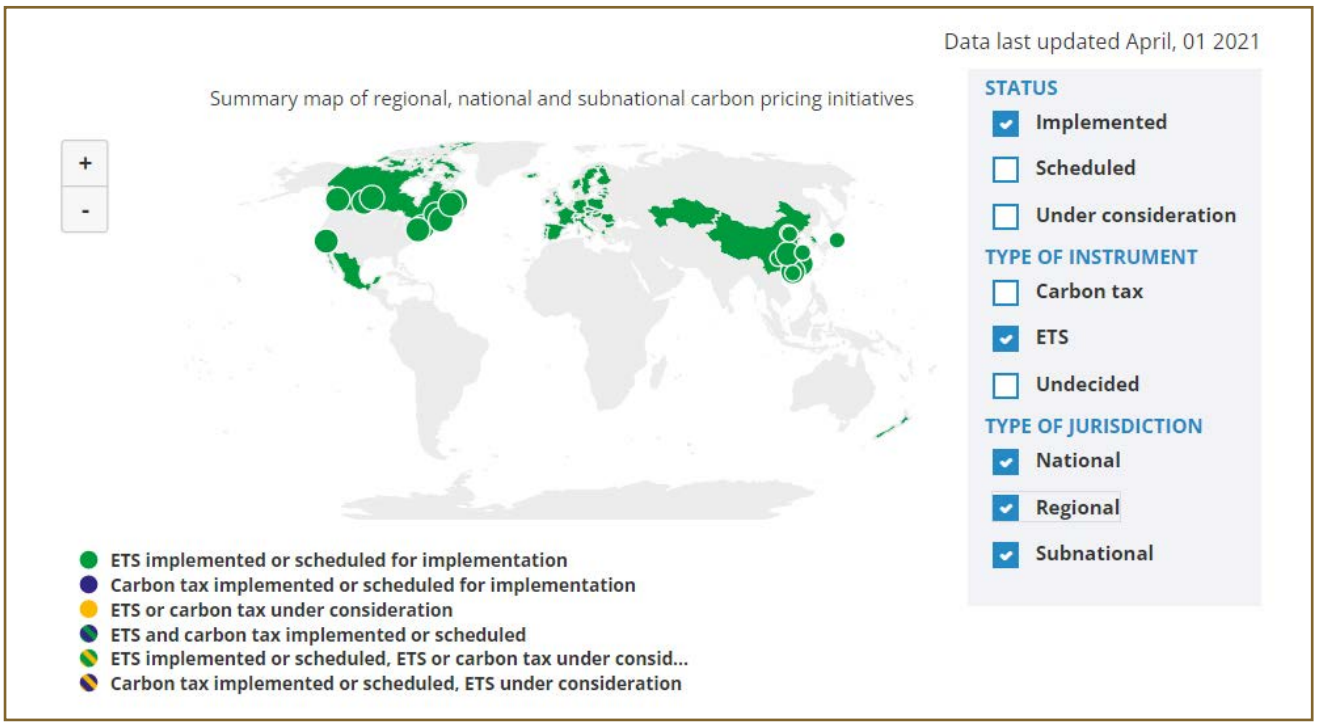
Carbon taxes represent the most direct means of charging for emissions. Currently, 27 national and 8 regional governments have charges in place, which force emitters to pay a set amount per tonne of gas produced.



Source: The World Bank - Carbon Pricing Dashboard

The exact pricing of a tonne of gas varies by jurisdiction, but all are expected to rise as the national CO2 reduction targets become more aggressive through the 2020s. This emission controlling method allows comprehensive pricing to be applied and is transparent, making it useful for business planning purposes. Crucially, though, a carbon tax does not explicitly limit the amount of CO2 being released into the atmosphere.

The alternative to a carbon tax, an Emissions Trading Scheme (ETS), is also popular in several countries and regions. This includes the EU, which has instituted a bloc-wide ETS.



Source: The World Bank - Carbon Pricing Dashboard

It should be noted that while there is no federal ETS or carbon tax in the US, several states have independently implemented a trading system locally. ETSs are sometimes called ‘Cap and Trade’ systems and have the following basic features:

- A total cap is set on the emissions from the covered area, and by the covered industries/sectors
- This total is converted into notional carbon credits
- A percentage of the credits are allocated for free to specific emitters
- The remainder are normally auctioned off to the highest bidders
- Unused credits can then be traded in a valid carbon market
- The total emission allowance, and therefore the number of available credits, is reduced annually

ETS schemes have an advantage by being highly targeted by industry, and create an absolute, decreasing limit, in a way that general carbon taxes do not. That said, it is possible to build up a surplus of unused credits in the market, and there is no minimum price. These two issues result in an economic downturn, potentially making greenhouse gas emission rights cheap to buy on the open market, and thereby working against their design intent.

The EU has a highly developed ETS...

The EU implemented its ETS in 2005, and it currently stands as the largest in the world. Under the scheme, Greenhouse Gasses (GHGs) that are emitted by power plants, industrial factories, and the aviation sector are limited by a decreasing total 'cap'.

The EU ETS provides equivalency between CO2 and Nitrous Oxide (N2O) or Perfluorocarbons (PFCs), making it a comprehensive GHG control, rather than just a limit on carbon emission. Between 2021 and 2030, the emission cap is set to decrease by 2.2% per annum. This is an increase from 1.74% that prevailed from 2013 to 2020.

The allowance of international credits, coupled with the economic crisis of 2008, led to a surplus of credits in the market. The EU dealt with this via a postponement of the auction of 900 million credits and the establishment of a Market Stability Reserve (MSR). The reserve is used as a price control by holding back excess credits, and a potential source of liquidity for credits if needed.

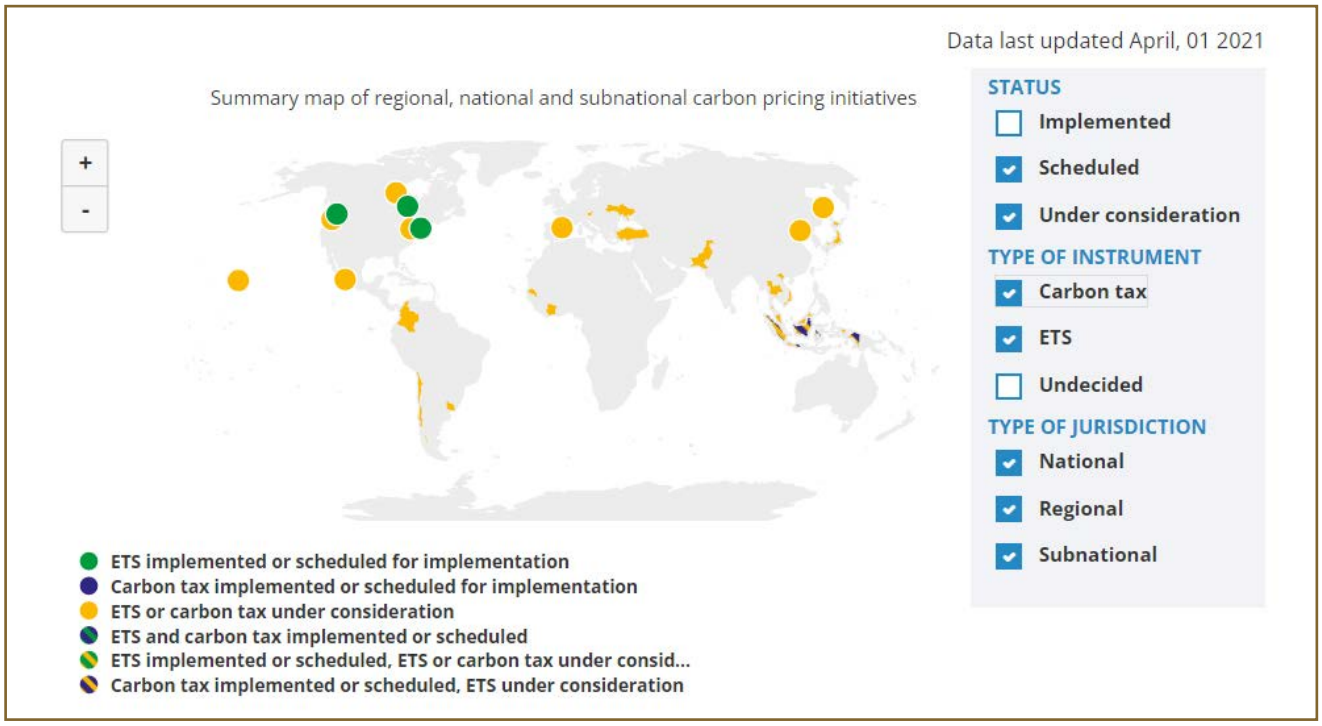
The increased reduction rate and use of the MSR are designed to maintain a GHG price level that disincentivizes processes that would prevent the bloc from achieving its ‘Green Deal’ objectives. Equally important is the expansion of the ETS to include maritime shipping and closer checks on ‘leakage’.

The two scheme types work in tandem, to create a market price...

With the two types of carbon pricing in active use, a global price for CO2 emission emerges. As border taxes, regime arbitrage, and cross-market credits develop, this price will stabilize and be usable as a guide to plan future additional business costs across economies and sectors.

Banks should take note of the growth of carbon pricing plans...

The EU is ahead but far from alone in the maturity of its carbon pricing. Along with the 45 countries with active schemes, which currently account for 22.5% of GHG emissions globally, plans are being discussed for several more around the world.



Source: The World Bank - Carbon Pricing Dashboard

Banks are currently engaged in monitoring and reporting their 'Scope 3' emissions, which equate to the CO2 they finance through loans and other credit facilities. Taken with careful analysis of the carbon pricing schemes in production or development, they can:

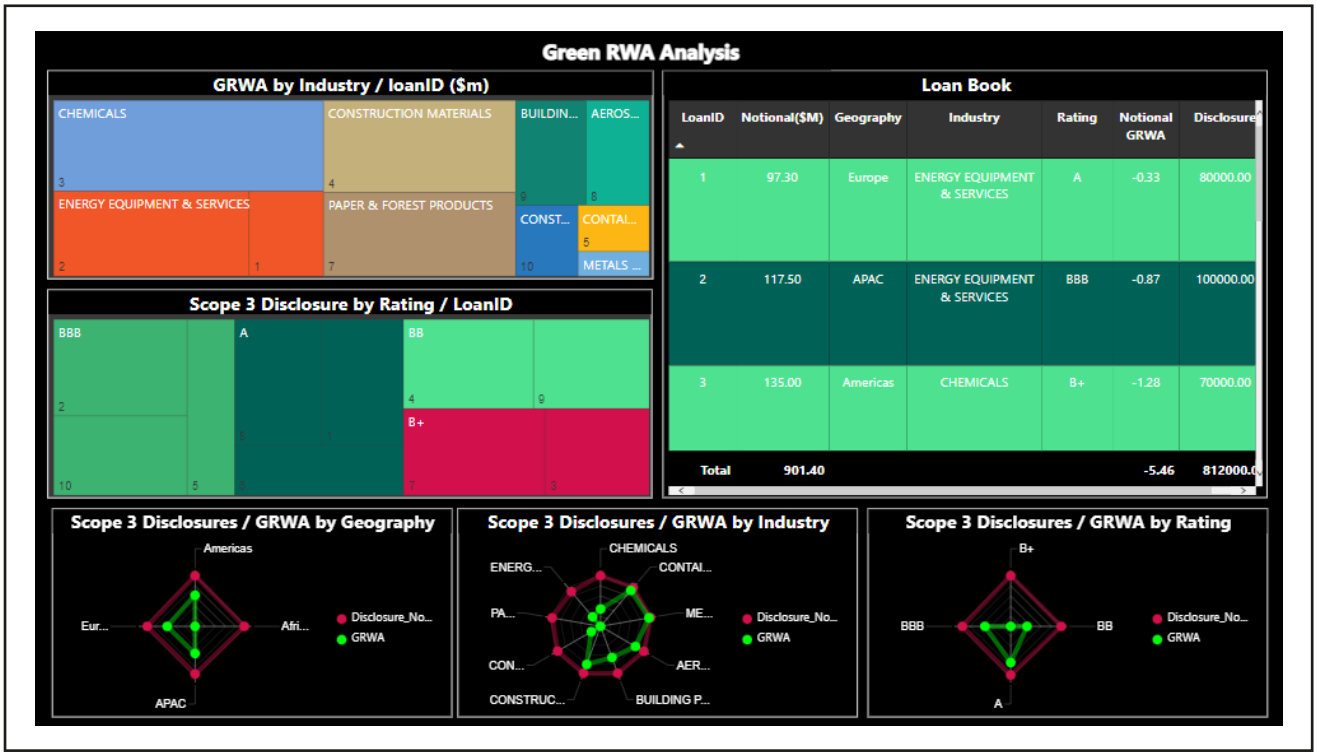
- Use climate pathways developed by the International Panel on Climate Change (IPCC)
- Set costs against those pathways as developed by the Net Greening of the Financial System (NGFS)
- Attribute costs to obligors according to industry and estimated impact
- Use the current emissions' costs generated by the carbon pricing market

- Fine-tune the attributable cost to business, making up the balance sheets according to their adaptation actions and CO2 reduction plans
- Re-price loans and facilities to reflect the changing cost environment
- Become green finance centers, based on scientifically-based sustainable incentives to borrowers

All data needed to begin this work and set up the internal businesses and processes is available, and the accuracy of that data will increase through the coming decade as national and regional targets firm up towards 2030.

GreenCap can help...

GreenCap is a stand-alone 'Risk As A Service' (RAAS) system that enables banks to consolidate their balance sheets in terms of Scope 3 emissions and the additional risk capital that will be expected to be reserved from the additional credit risks arising from the underlying borrowers' exposure to the increased risks from climate change policy and carbon pricing.



Visit GreenCap.live for more details.

Chapter 6

PUBLIC PRIVATE FNANCE SCHEMES AND EVOLVING SUBSIDIES ARE DIRECTIONAL MARKERS TO DE-RISKING GREEN FINANCING

DIRECT AND INDIRECT SUBSIDIES INTO SUSTAINABLE PROJECTS ENABLE BANKS TO RECOGNIZE THE FOCUS AND SPEED OF CLIMATE CHANGE MITIGATION/ADAPTATION.

Originally published on January 21, 2022

The gap that exists between the funding requirement of the transition to a greener global economy, and the budgeted plans from world governments, is currently estimated to be in trillions of dollars. Private finance is expected, and needed, to fill this gap, and banks will be the main conduit for the flow of funds.

Individual projects represent an increased credit risk. This can be a difficult determination for banks to make, as the success or otherwise of green projects is largely dependent upon the support provided by government funding. This 'de-risking' of specific projects is vital to attracting private funds, particularly those where the returns are expected over a longer timeframe, such as the many city infrastructure projects that are required to underpin the sustainability transition.

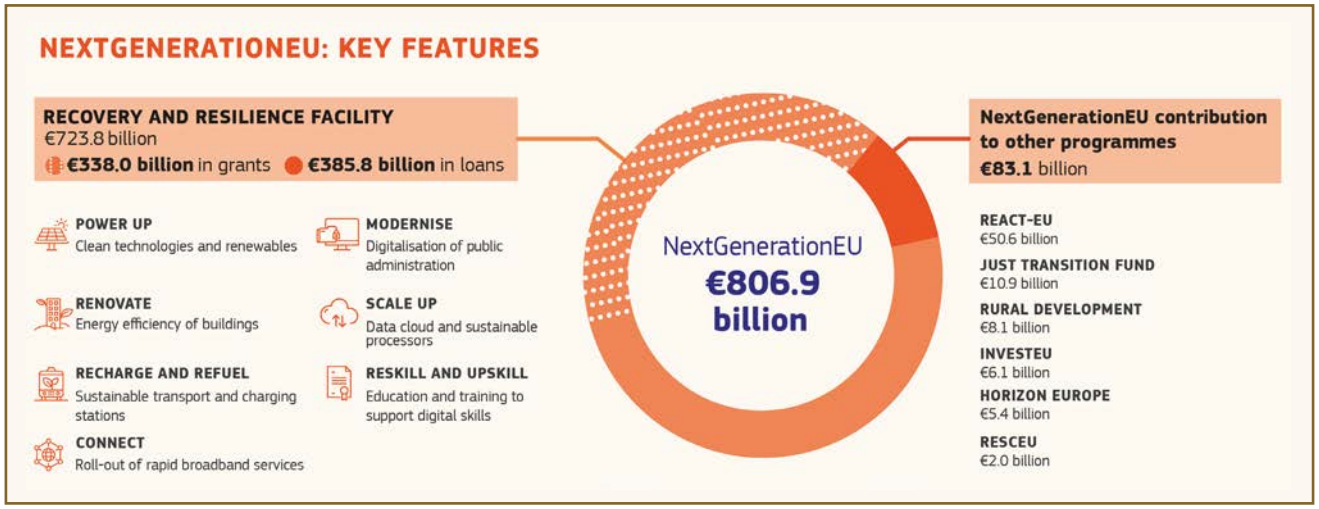
Regional and national governments are already putting down these 'market markers'...

The EU, as an example, has developed its 'NextGenerationEU' (NGEU) and 'Recovery and Resilience Facility', which are designed to stimulate a sustainable recovery across the bloc.

The NGEU represents the regional ambition across its core sustainable objectives as specified in the 'Green New Deal' which is:

- No net emissions of greenhouse gasses by 2050
- Economic growth decoupled from resource use
- No person and no place left behind

The NGEU aims to mobilize 800 billion euros of funding in the form of grants and loans to make the EU Green Deal a reality.



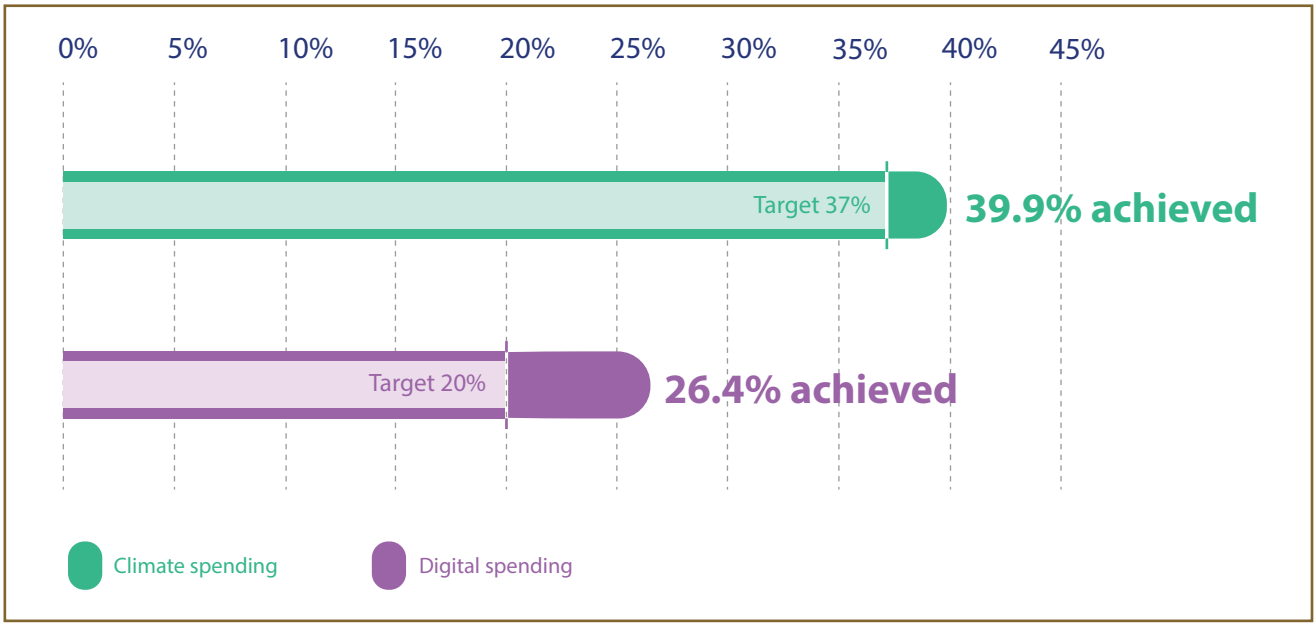
Source: European Commission

The 'Recovery and Resilience Facility' (RRF) is a major offshoot of the NGEU, aiming to fund the following areas of the EU's long-term growth:

- **Power up -** Greening the energy mix of the union
- **Renovate -** Greening the built environment
- **Recharge and refuel -** Greening European transport
- **Scale-up -** Greening the cloud facilitation
- **Connect -** Rapid broadband availability
- **Modernize -** Digitalization of the EU administration
- **Reskill and upskill -** Skills for a modern greener economy

As can be seen, the RRF supports two growth ambitions within the EU - climate neutrality and digital transition. It is a temporary facility, wherein commitments have been made regarding investment allocation, to assist member states in kick-starting their individual investment plans.

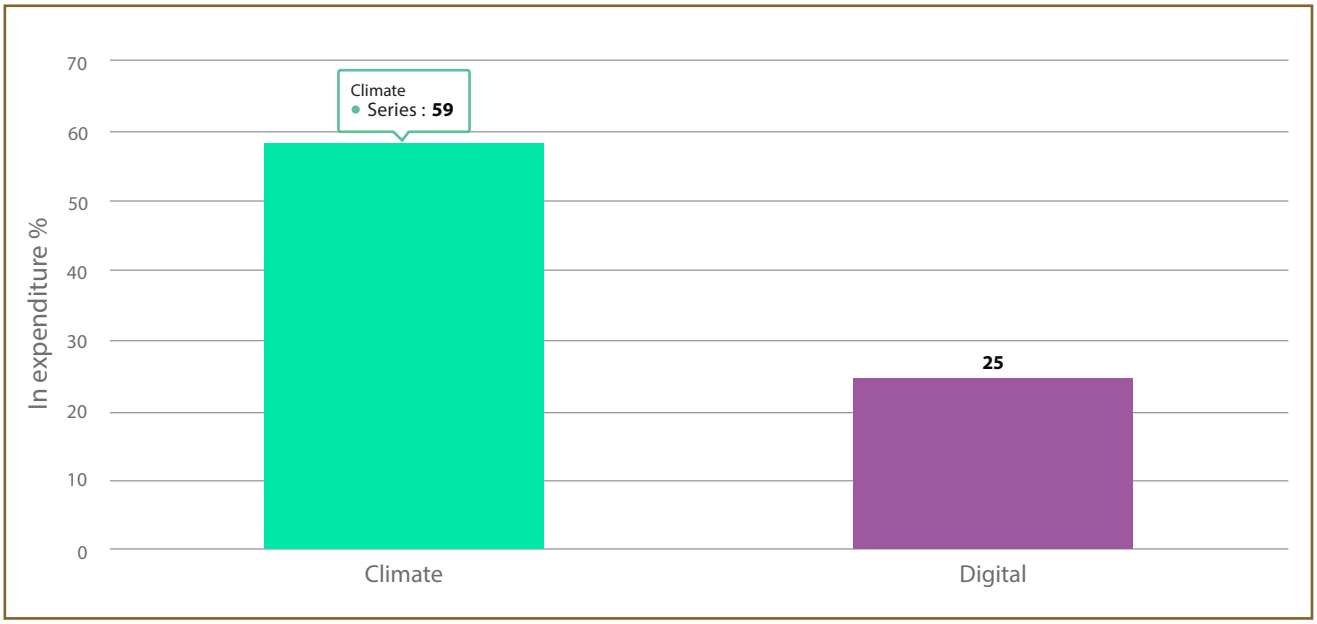
Across the 27 states that form the European Union, 22 have submitted resiliency plans. Targets set by the EU for climate mitigation and digitalization include 37% and 20% allocations within these plans, respectively.



The top-down planning is already paying dividends, with the 22 plans collectively allocating above the target levels in both ambitions.

Individual countries' plans may go deeper with their green market markers...

Denmark's plan is a specific example of a resiliency plan, wherein 59% (or 923 million euros) represents green investments.



This includes:

- Green tax reform
- Reprioritization of the registration tax of vehicles
- Research program in a green solution
- Carbon-rich soils
- Energy-efficient measures

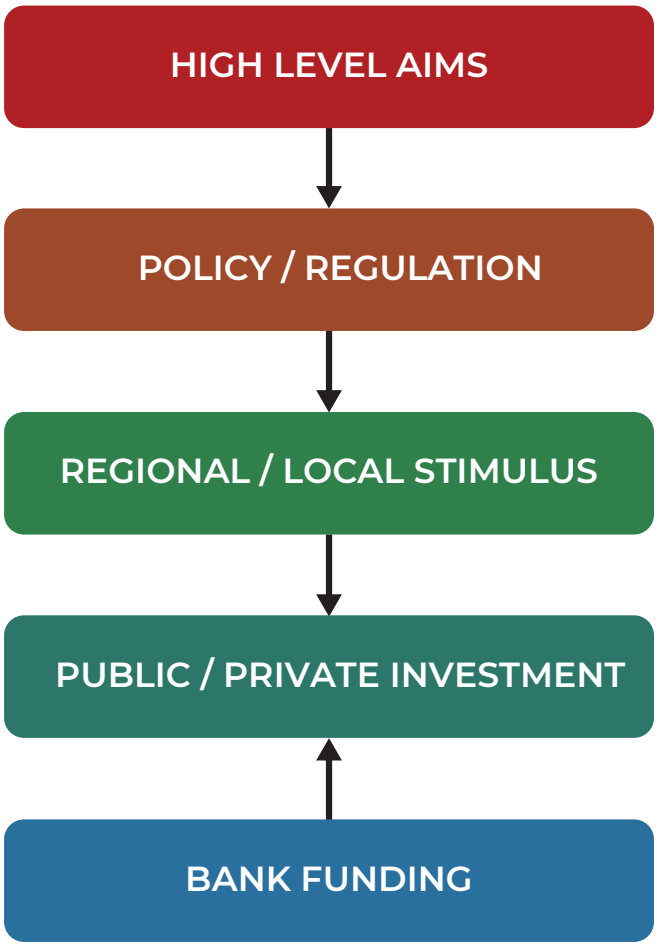
These are all geared to act as incentives rather than complete solutions. An example is the green tax reform, which initially increases taxes based on a business's energy consumption but will ultimately become a Greenhouse Gas (GHG) emission tax.

Environmental resiliency plans are emerging globally...

The examples cited in this paper are just a small sample of the policies and initiatives underway across the world. Each region has aims, policies, public funding, and private investment plans. The uniting characteristic is de-risking of the green transition.

Banks need to monitor plans to gauge the rate of green transition...

The overarching aim of resiliency plans is to stimulate growth and de-risk private investments. The top-line ambition is translated into specific targets and plans, which lead to public-private ownership of the transition and the capital required to make it real.



The industries and projects that attract support through tax incentive schemes, direct grants, or subsidized loans will enjoy an increasingly benign business environment and lower credit risk on any additional private investment.

These are the indicators that allow banks to construct matrices that map out the correlation between 'brown to green' transition pathways (scenarios) and the impact on individual sectors, firms and projects.

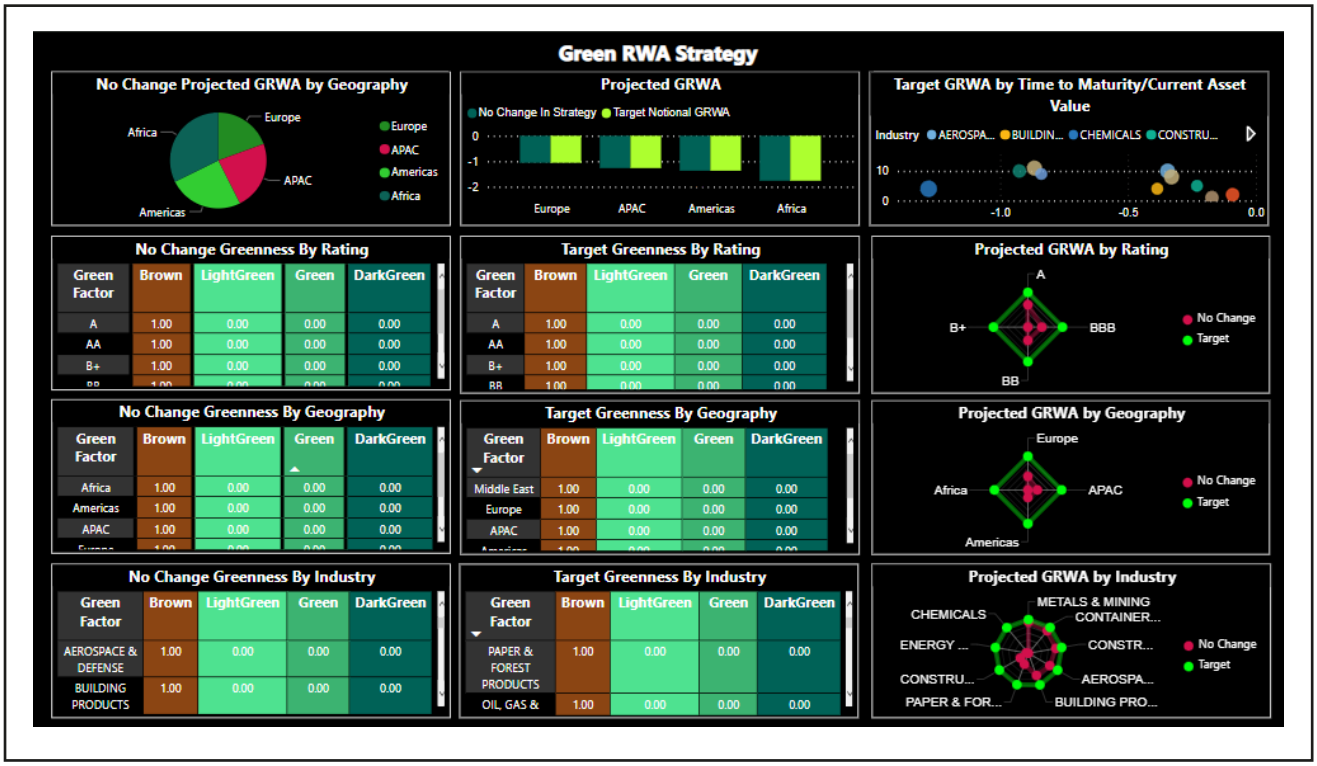
Once this is built, green funding, or at least loans into clearly supported areas can be made at interest rates that reflect the lower risk they represent to the bank. From the amount that needs to be held as risk capital, the risk can be quantified and translated into an appropriately lower spread on the interest rate.

- Assess the loan in terms of the borrower's current credit profile
- Calculate the risk capital requirement of the loan
- Adjust the profile to reflect the correlation to established green transition planning
- Calculate the green risk capital adjustment
- Adjust the interest rate spread that is required

Banks can use this to either improve the monitoring of climate-related risks on their balance sheets or establish internal centers of expertise in green lending.

GreenCap can help...

GreenCap is a climate-specific 'Risk as a Service' (RaaS) that enables banks to build climate pathway-specific risk analysis for their current and future balance sheets. The system is designed to work as a calculator to assist in risk management and specific green finance pricing.



Visit GreenCap.live for more details.

Chapter 7

THE EMERGENCE OF BORDER CARBON ADJUSTMENTS MUST BE ON BANKS' RADARS

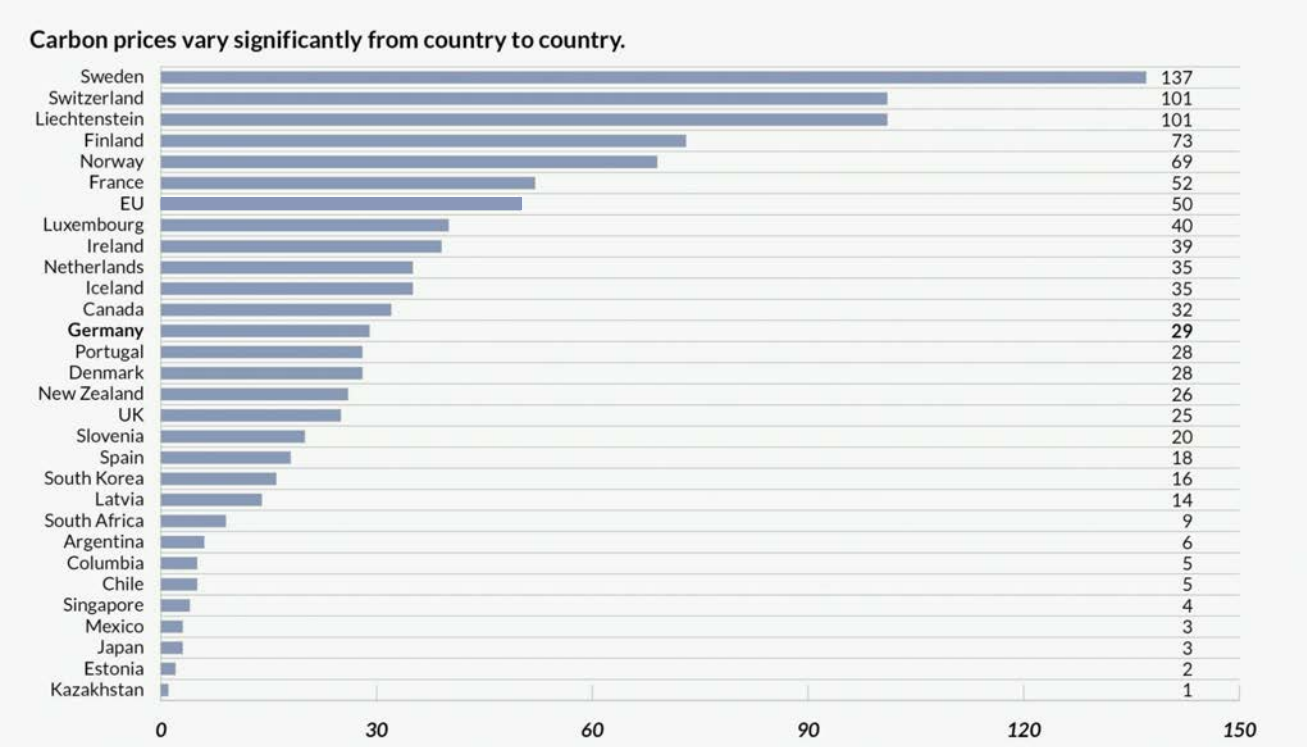
BORDER CARBON ADJUSTMENTS (BCAs) ALTER THE IMPACT OF CARBON PRICING ON CREDIT RISK MANAGEMENT. BANKS MUST UNDERSTAND THESE NUANCES TO PROPERLY MANAGE THEIR BALANCE SHEET RISKS.

Originally published on January 28, 2022

Carbon pricing increases the risk of carbon leakage...

The ultimate goals for reducing CO2 and other Greenhouse Gases (GHGs) are agreed upon at a global level, at the Conferences of Parties (COPs). Importantly, in 2015, at the Paris COP, one of the most celebrated outcomes was the establishment of nationally self-determined targets. This meant that rather than have limits imposed upon them, each government would decide what it could commit to, and monitor that target accordingly.

Once individual governments have set their own targets and systems to monitor them, they will typically create policies that are designed to meet those goals. The two most common policy tools are carbon taxes, whereby a price is imposed on per tonne of carbon produced, or, the development of an Emission Trading Scheme (ETS). Differential GHG policies around the world create a situation where there is a very wide range of carbon 'prices'.



Source: World Bank. State and Trends of Carbon Pricing (nominal prices in US Dollars, as of April 1, 2021

One unintended consequence of these regional carbon pricing schemes is carbon leakage.

Carbon leakage refers to the tendency of companies to move high GHG emitting production between regulatory regimes to avoid paying higher costs associated within the region with more aggressive climate change mitigation targets. In effect, such activity creates two problems:

- Economic damage to countries with ambitious climate goals
- Targets being met regionally, but an overall increase in GHG emissions globally

BCAs are designed to remove this risk...

BCAs, sometimes referred to as Border Tax Adjustments (BTAs) or Carbon Border Adjustment Mechanisms (CBAMs), are taxes aimed at ensuring that goods entering a carbon-regulated country are charged an equivalent amount as though they are produced in the country.

BCAs have proponents and critics. Proponents argue that they are required to ensure that the result of progressive climate policies in developed countries avoid:

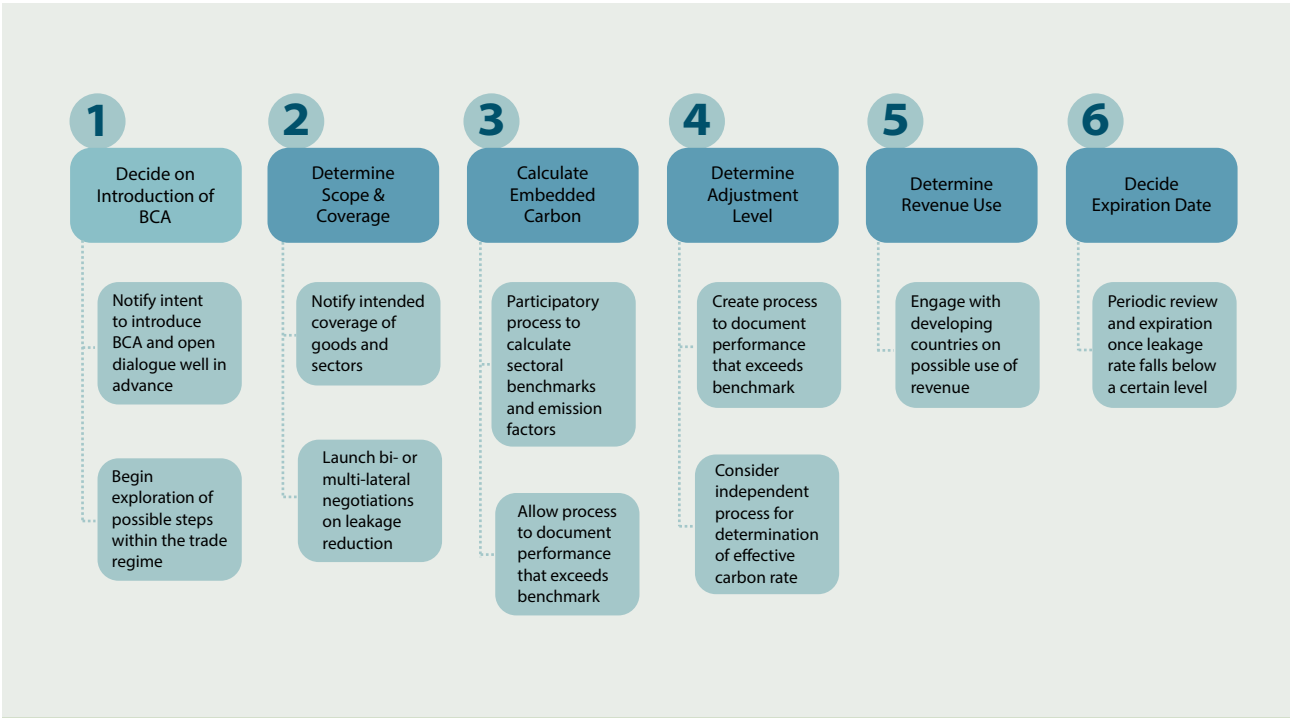
- Exporting emissions to less-developed nations and destabilizing industries in the regulated country
- Creating systems where the effective price, including free carbon credits and subsidies, is too high to act as a disincentive to GHG emitters

Meanwhile, critics point to the possibility of BCAs:

- Disproportionately impacting less developed countries
- Negating COP15's introduction of individual nations setting and monitoring their own climate targets
- Violating existing trade agreements

There is a blueprint for constructing BCAs...

Climate Strategies, an international, not-for-profit research network published a guide to BCA design and implementation, which can be read here. The report recommends specific steps and considerations that must be taken into account for a scheme to be fair and effective.



The crucial point is that, if the overall goal of reducing GHG emission is to be reached in a globally fair manner, then the resultant carbon price must be carefully monitored. In this scenario, the harder hit countries must become stakeholders rather than victims of the scheme.

Governments are exploring BCAs...

Currently, California runs the only active BCA, but in 2021, the EU introduced legislation for its own CBAM to support the EU Green Deal. The bloc states that 'the CBAM will equalize the price of carbon between domestic products and imports and ensure that the EU's climate objectives are not undermined by production relocating to countries with less ambitious policies'.

The EU's CBAM will use a system of certificates that cover the cost of 'embedded carbon' in imports into the bloc. EU importers will need to purchase the certificates, whose pricing will be based on the EU's ETS carbon price. Areas where it can be shown that a carbon price has already been paid, this cost will be deducted from the importer outside of the EU.

Other leading economies looking closely at BCAs include Japan and Canada. In the US, BCA legislation was also introduced to the Congress in July 2021 that was substantially similar to the European plan.

Banks need to keep track of BCAs...

Policies designed to mitigate climate change through the regulation of GHGs create additional costs for firms in impacted industries. These costs have a knock-on effect on the business models and credit profiles of the firms. Lending officers and risk managers must ensure that any risk-related effects are understood and built into the risk management systems and processes.

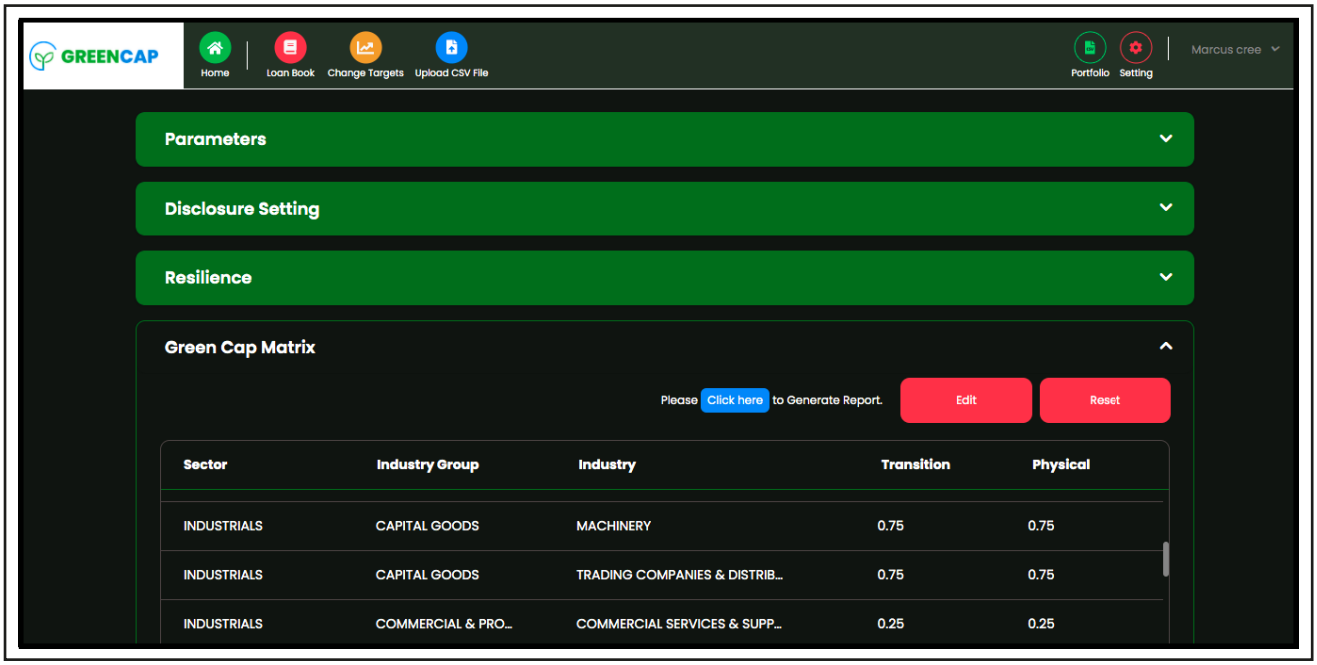
Including climate change risk within the risk frameworks of financial institutions involves a number of steps, which include:

- Building scenarios based upon IPCC climate pathways, which cover global and regional routes to net-zero economies
- Costing of the scenarios using Network for Greening the Financial System (NGFS) estimates, which are given as GDP impacts
- Determining the speed at which the scenarios may become a reality
- Applying the fully-costed scenarios to the existing assets to ensure that impacts on the Risk-weighted assets (RWA) of banks are estimated
- Pricing new loans to incorporate the climate risk 'spread'

BCAs mean that carbon pricing schemes in one regulatory jurisdiction will impact regions with different prices, plans, and goals. This means that banks must include additional nuances within their scenarios to reflect the new export tax.

GreenCap can help...

GreenCap is a 'Risk as a Service' (RaaS) solution that enables banks to construct climate pathways as scenarios to be applied to their balance sheets. Industry and firm-level exposure to the policy routes is reflected within matrices that represent each scenario.



The system allows scenarios to be fine-tuned in a way that captures the full spectrum of exposure, including the cross-border effects of BCAs, and hence provides a full 360-degree view of the financial risks that banks will need to deal with as we move through the green economic transition.

Visit GreenCap.live for more details.

Chapter 8

MANAGING THE RISK OF CLIMATE CHANGE WITHIN BANKS MAY REST ON INTERPRETING CARBON INTENSITY CORRECTLY

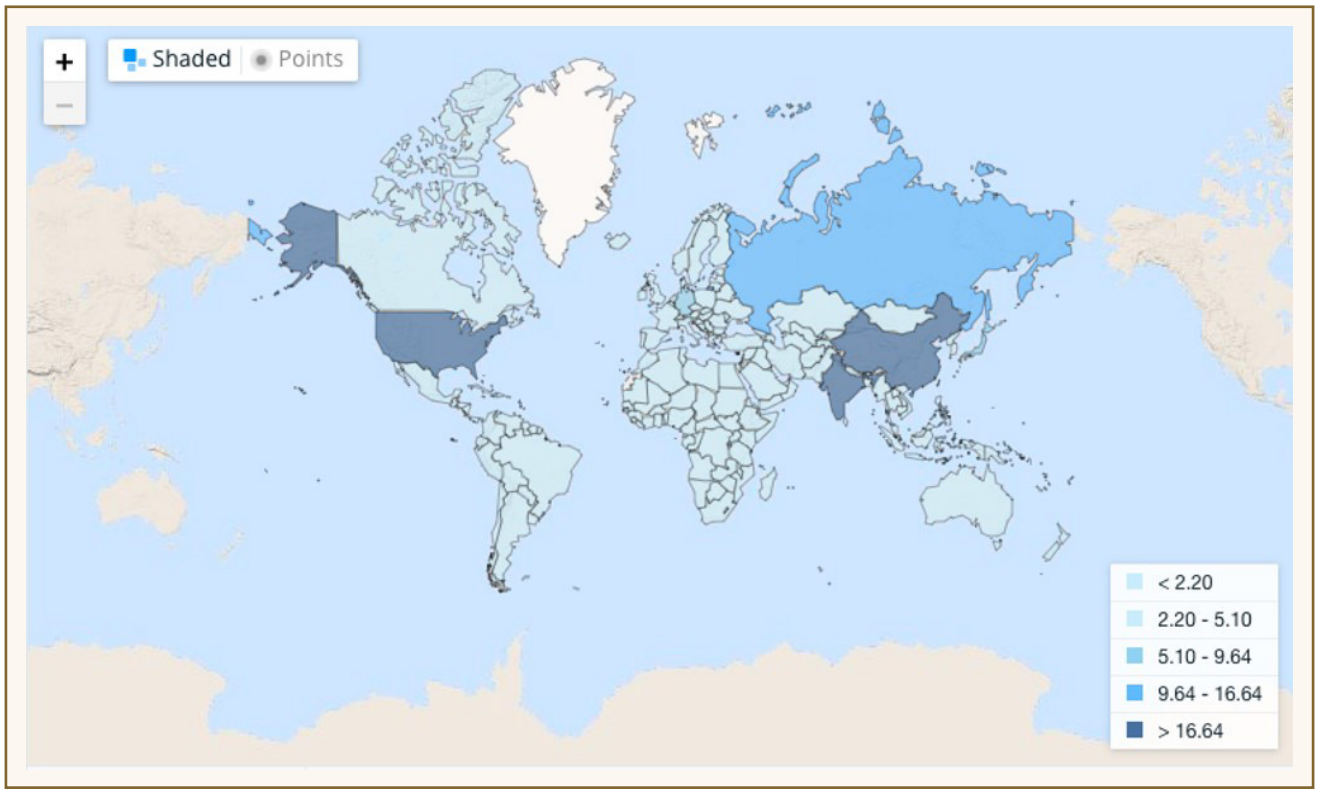
CARBON INTENSITY IS A MUCH-QUOTED, BUT DECEPTIVELY NUANCED METRIC. THE BANKING SECTOR NEEDS TO UNDERSTAND IT FULLY FOR CARBON DISCLOSURES AND RISK MANAGEMENT.

Originally published on February 4, 2022

Carbon Intensity is a common metric for comparative carbon auditing...

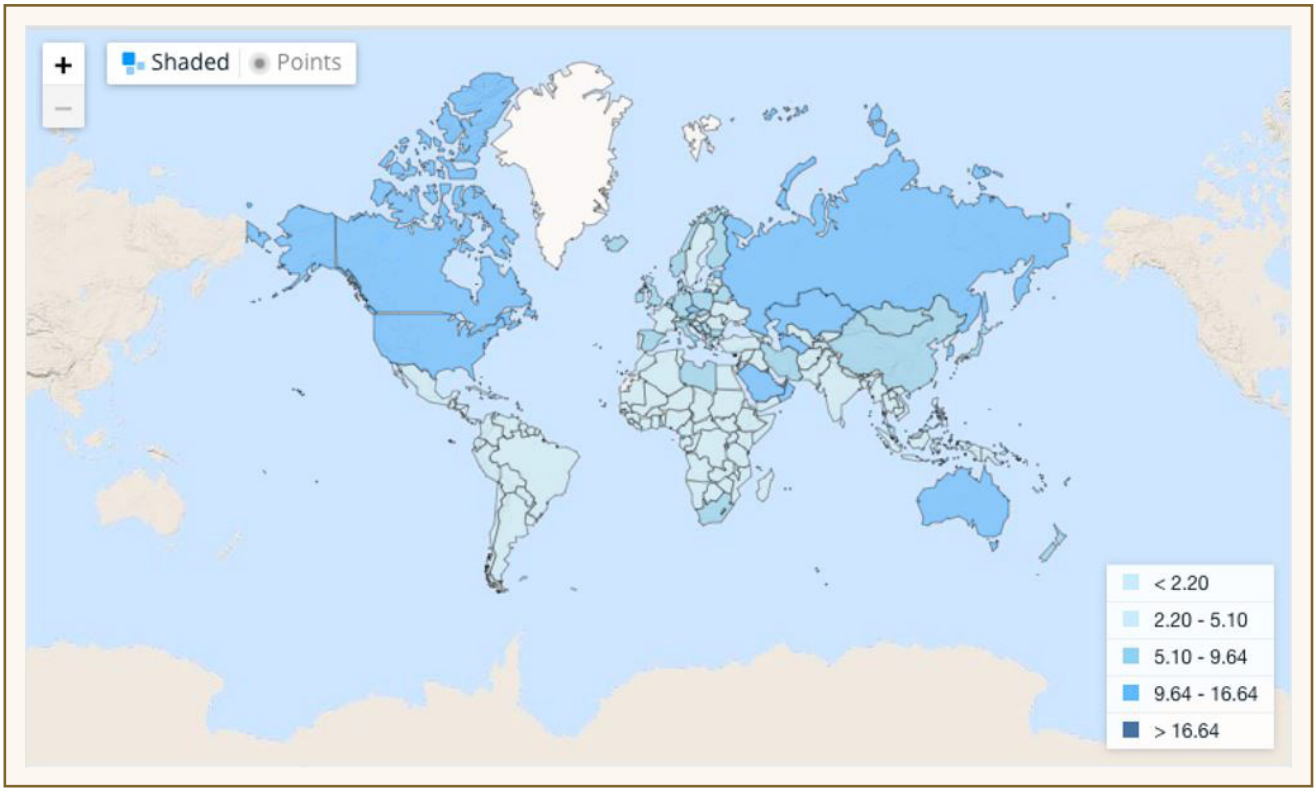
CI, as a metric, represents the amount of carbon emitted per unit of activity. This is typically expressed as 'KgCO2 per unit', with the unit being representative of the activity. CI is useful for comparisons and emission targets such as - when the global distribution of CO2 emission is considered.

2018 CO2 emission by country (from worldbank.org) shows the main industrial economies producing the most GHG in absolute terms.



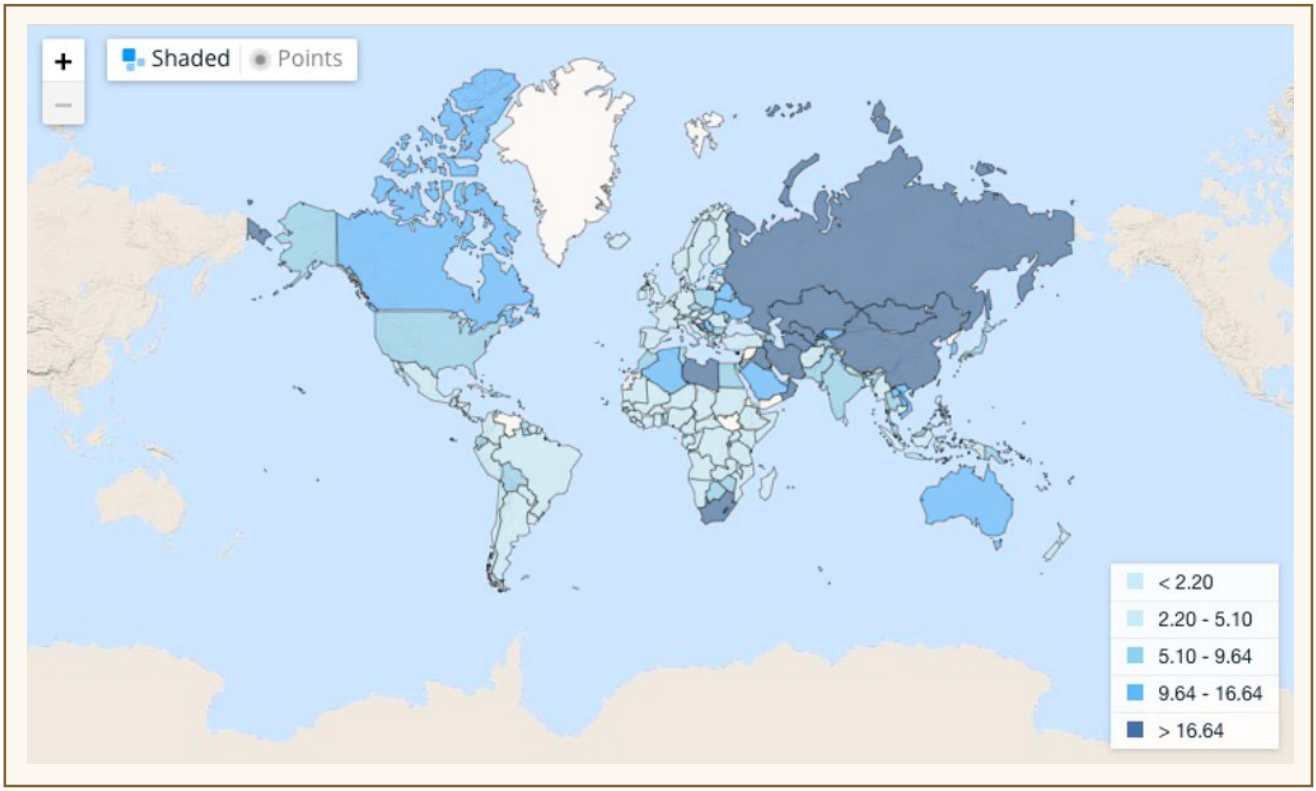
Source: worldbank.org

When this is converted to a 'per capita' basis, the chart changes considerably.



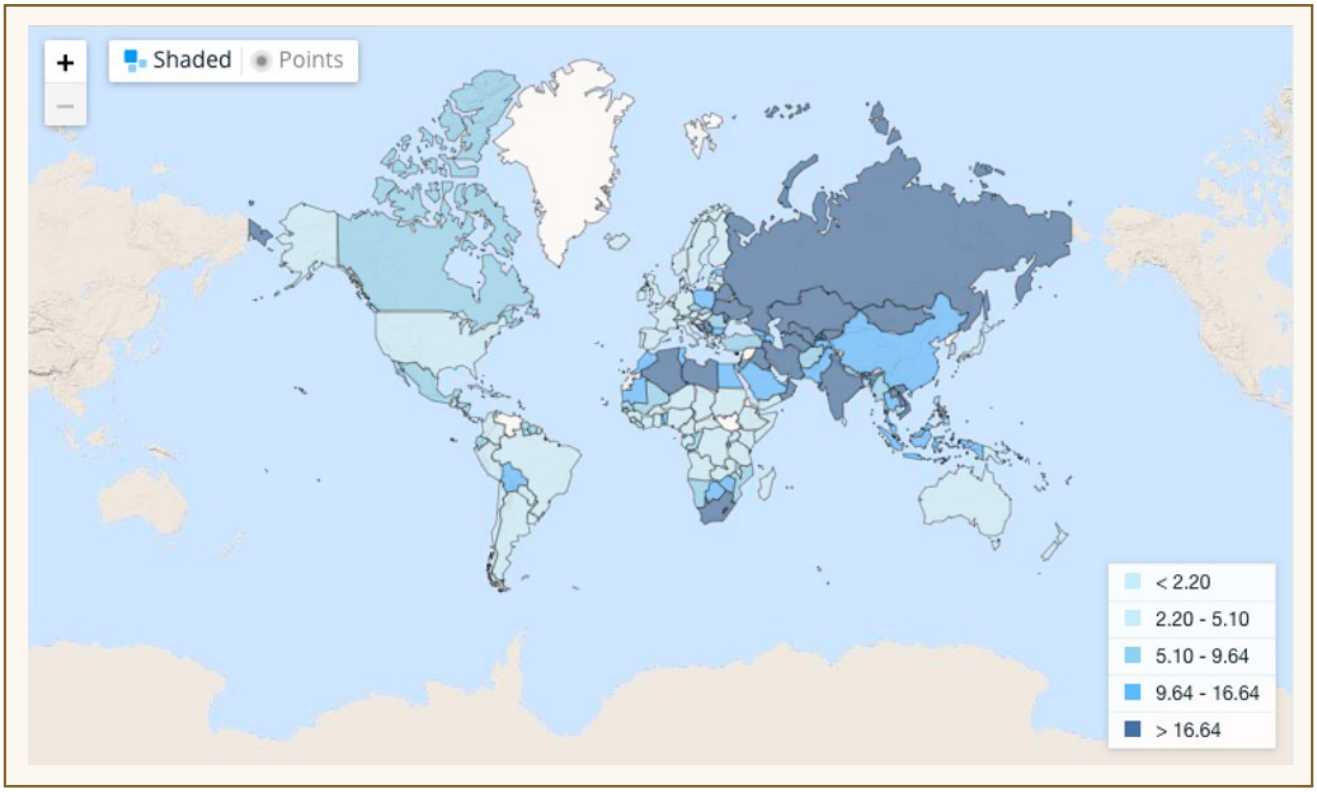
Source: worldbank.org

When converted again to CO2 per $PPPGDP - GDP in dollar terms normalized to an international standard (Purchasing Power Parity) using the price of a wide basket of goods as the normalizing factor.



Source: worldbank.org

Finally, CO2 per $GDP



Source: worldbank.org

Of particular interest is the role of the US in terms of CO2 intensity, and how it change with the metric selected as the unit of division. With each successive change, from 'pure emissions' to 'emissions per $GDP', the country moves down an intensity grade.

This has clear ramifications as to the pathway to a greener economy that countries take, and their consequences on the wider global ambition of 'net zero' by 2050. Note that the US Department of Energy (DoE) uses the 'CO2 per $GDP' formulation.

The unit used by banks for their 'Scope 3' disclosure, is 'CO2 per $m revenue'.

Even the definition of CO2 emissions is variable...

Carbon emissions in a particular activity is not a simple calculation. There are four commonly used definitions for this, with each having its specific pros and cons:

- *Basic* - Carbon emissions are calculated for a specific process only without considering GHGs involved in material production or end-of-life processes for those materials. This method is the simplest as it is self-contained, and avoids double counting of total carbon emissions. However, it tends to obscure the total carbon footprint of a product, potentially leading to a greenwashing effect.

- *Well-To-Wheels (WTW)* - Carbon emissions for specific processes, and any upstream activities that extract, refine, and deliver materials needed for the process. Notably, end-of-life process emissions are not included, which excludes decommissioning of plants and machinery. This is attractive as a carbon audit standard as it allows an industry such as vehicle manufacture to be segmented into manufacture, recovery, and disposal. This avoids double-counting along the specific chain but also leaves room for greenwashing certain activities.

- *Life Cycle Assessment (LCA)* - Carbon emissions are counted over the entirety of the process, from raw material extraction to end-of-life treatment. This is the most complete carbon audit, as it captures all emissions involved. Banks that finance multiple parts of the same supply chain may double count some emissions but the main issue is the complexity of the audit itself. There are a number of variables needed, such as the length of life of a plant or machine, which impacts the unit numbers and therefore the final 'intensity' number. End-of-life emissions also require estimates about processes outside of the control of the firm under audit.

- *WTW-LCA Hybrids* - Between the two lifecycle methods, there are a number of systems. These are designed to provide a consistent measure. An example is the inclusion of end-of-life treatment for batteries for electric vehicles. These schemes retain the WTW ease while attempting to avoid carbon undercounting within specific industries.

One such hybrid scheme is the Greenhouse Gases, Regulated Emissions, and Energy use in Transportation (GREET) model, which is used by the US DoE's Office of Energy Efficiency and Renewable Energy. This allows a more comprehensive comparison of the relative environmental merits of different vehicle types.

More than just carbon is audited for CI computation...

CO2 is the most commonly referenced Greenhouse Gas (GHG). This is because it is the longest-lasting in the atmosphere, effectively meaning that every kg released into the atmosphere has a warming effect for centuries. Other gases, such as methane or nitrogen, have greater potency, but often remain in the atmosphere for far less time - for decades rather than centuries.

The nature of climate pathways and potential environmental 'trigger points', where positive feedback loops are activated by temperatures being temporarily above the target range, means that these gases must be accounted for. To include other GHGs, a scientific formulation is used that compensates for both the potency and longevity, effectively amortizing the effect over a time range. This results in the terminology 'Carbon Dioxide or equivalent' (CO2e).

Banks must use **'CO2e tonnes per $m revenue'** as their CI calculation base.

The Bank for International Settlements (BIS) issued guidance for syndicated loans on this topic in June 2021.

With the banking metric understood, data needs to be interpreted...

As mentioned in an earlier section, each industry uses a specified unit for its own reported CI. When calculating their own 'Scope 3' disclosures, banks must be able to disentangle the reported numbers they obtain from their customers. Below is a range of unit descriptions, as reported by the Bank of England (BoE) in their own disclosure documents.

	Intensity measurement
All	Tonnes of CO_2e per total £m sales revenue
	Tonnes of CO_2e per total £m Earnings Before Interest, Tax, Depreciation and Amortization (EBITDA)
	Tonnes of CO_2e per full time equivalents
Integrated oil and gas	Tonnes of CO_2e per tonne of output, broken down for: Exploration and production Refining Petrochemicals
Transport sectors	Tonnes of CO_2e per revenue tonne kilometer (RTK — revenue from transporting one tonne over a distance of one kilometer)
	Tonnes of CO_2e per pallet cases
Passenger carrying sector	Grammes of CO_2e per passenger kilometer
Beverages	Grammes of CO_2e per total liters of beverage e.g., beer, spirit
Retail	Tonnes of CO_2e per square meter of gross store area
Banking	Tonnes of CO_2e per £ million of income
Manufacturing	Tonnes of CO_2e per total million tonnes of production
Postal services	Grammes of CO_2e per 1000 items
Water utilities	Tonnes of CO_2e per megaliter broken down by clean and wastewater
Electricity utilities	Tonnes of CO_2e per megawatt hour

Telecommunications internet, software and services	Tonnes of CO_2e per gigabyte transmitted
Property sector	Tonnes of CO_2e per total square meter

In order to properly understand the levels of GHG being financed by the bank, they should break down the available data and report on the following:

- Sector level CI benchmarks and values for assets on the balance sheet
- Bank-level CI
- Explanatory notes on CI formulation
- Explanatory notes on sector level CI factors

In addition to carbon disclosures, the above information is used for:

- Internal climate risk governance
- Inclusion of climate change in risk reporting
- Determination of likely climate strategy paths to be encoded into risk scenarios and stress testing

It is with regard to stress testing that the calculated outputs become most useful for financial risk management. Climate pathways are determined by the International Panel for Climate Change (IPCC) and are designed to represent valid routes to preset global warming targets. Individual governments commit to their own targets, based in part, on these pathways. The priority of climate action within each nation will differ according to their own emission profile and metrics. Understanding how a government views its national emissions is a useful indicator as to the speed of transition within each area and alters the likely impact on business models within specific sectors. These impacts will determine the likely credit profile of firms within these sectors and those that represent the banks' customers.

Strategies to deal with increased credit risks faced by the bank as a lender, and advisory services provided by the bank around climate adaptation, are determined by these pathways and resultant risk profile changes.

GreenCap can help...

GreenCap is a 'Risk as a Service' (RaaS) solution, designed to determine the risk-based capital increases a bank will face as the green economic transition progresses. The solution translates climate science into recognizable risk management outputs based on IPCC pathways and well-understood risk metrics.

With GreenCap, banks can expand their risk management frameworks to include climate change in their risk governance and reporting. They are also able to ensure that assets are priced in a way that reflects these increased risks, enabling climate advisory services to be provided, with the explicit aim of becoming a key part of the global warming solution.

Visit GreenCap.live for more details.

Chapter 9

CONTAINING CLIMATE CHANGE REQUIRES FINANCING, INNOVATION, ADAPTATION, AND MITIGATION PROJECTS

BANKS MUST UNDERSTAND THE DIFFERENCES AND INTERSECTIONALITIES BETWEEN THESE TO INTERPRET AND USE THE MARKET SIGNALS THAT DETERMINE THE CREDIT RISK STATUS OF SUSTAINABILITY PROJECTS.

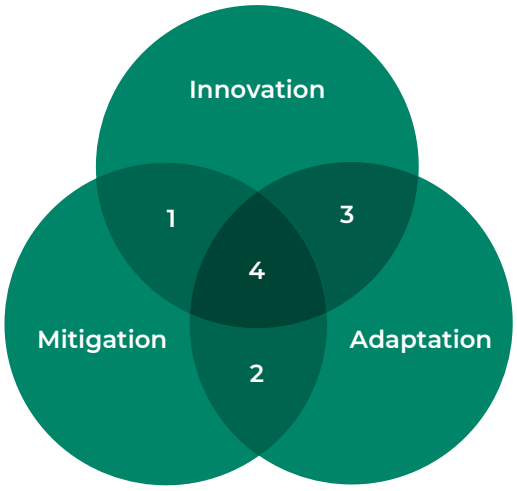
Originally published on February 11, 2022

Meeting climate pathway targets needs Innovation, Adaptation, and Mitigation...

Climate change is happening, and its impacts are already being felt, from successively hotter years and decades to once-in-a-century floods becoming regular occurrences. As CO2 and other Greenhouse Gases (GHGs) are still being released at increasing annual rates, the scientific consensus is that, even if climate targets are ultimately met, extreme and volatile weather patterns must be viewed as part of life in the 'new normal'.

This means that the world has to invest to adapt to consequences that are already locked into the system. Simultaneously, there is an urgent need to lower GHG emissions and to stay within the agreed carbon budget - the amount of CO2 or equivalent alternative gas (designated as CO2e) that can be emitted while limiting resultant global warming to specific targets. In order to remain within the carbon budget for a 2-degree rise in average global temperatures by 2100, investments in industries across the economic spectrum must be targeted towards more sustainable products and processes.

Innovation in both current industries and new technologies such as Carbon Capture and Sequestration (CCS), needs funding in the order of tens of trillions of dollars to meet the 2-degree global warming target and adapt the world to what just that increase means in terms of extreme weather.



Sustainability funding can be split between:

1. New technologies and projects to actively prevent global warming. This will include new CCS designs, livestock feed production, or alternate power generation such as solar, wind, or nuclear.
2. Projects within existing firms to convert their operations to a more sustainable basis, using existing technology. This would include electrification of delivery fleets, carbon capture at coal-powered power plants, and other process adaptations that prevent GHG emissions.
3. Costs of projects to protect assets from the impacts of climate change that are already occurring or are most likely to occur. This will include innovative processes such as coastal defenses or agricultural land use.

4. Financing projects that use new technology to not only protect assets but to actively stop further emissions. This can entail wholesale changes to business models, but also critically looks to adapt existing equipment and resources to be useful in a new greener economy.

Credit risk is inherent in sustainable investment, but even more so in doing nothing...

The fact that lending creates credit risk is encoded into obligor credit assessment practices as well as calculations they perform to estimate the amount of capital that needs to be held as High Quality Liquid Assets (HQLA), to insulate the banks from losses arising from potential defaults.

Climate change creates new and specific considerations in credit profiling. In addition to analysis of credit facilities in the context of the current economic environment, judgments need to be made considering possible future economic scenarios.

The International Panel for Climate Change (IPCC) produces pathways that will, if followed, lead to specified limits on global warming. These pathways are global by definition and necessity. Following the Conference of the Parties (COP) in 2015, convened in Paris, individual countries create their own targets for CO2e. These nations are also responsible for monitoring and reporting their own progress. COP26, in Glasgow, brought to light the fact that all 'local' plans combined are currently insufficient to reach the global goal. To make things worse, even these targets are not currently being met.

The inevitable conclusion is that plans will accelerate and present real challenges to firms working in impacted industries. Regulatory costs will rise in transport, building, energy, agriculture, infrastructure, and manufacturing, as countries increase pressure on their private sectors to lower their emissions. The slower the mitigation plans are put into place and run through the system, the greater the need for adaptation. In the common parlance of climate change pathways, a quickly implemented route to a 2030 milestone is referred to as an 'orderly' transition. The alternative is a 'disorderly' transition, where plans are slow to be created, instituted late, and cause increased economic disruption as well as allowing greater global warming to become inevitable.

Transition risk, which is defined as the risk to firms from climate regulation costs being too onerous for them to survive, becomes a key component for mid- and long-term financing analysis. Banks must build both transitional and physical risks to obligors' assets into lending decisions and credit facility pricing.

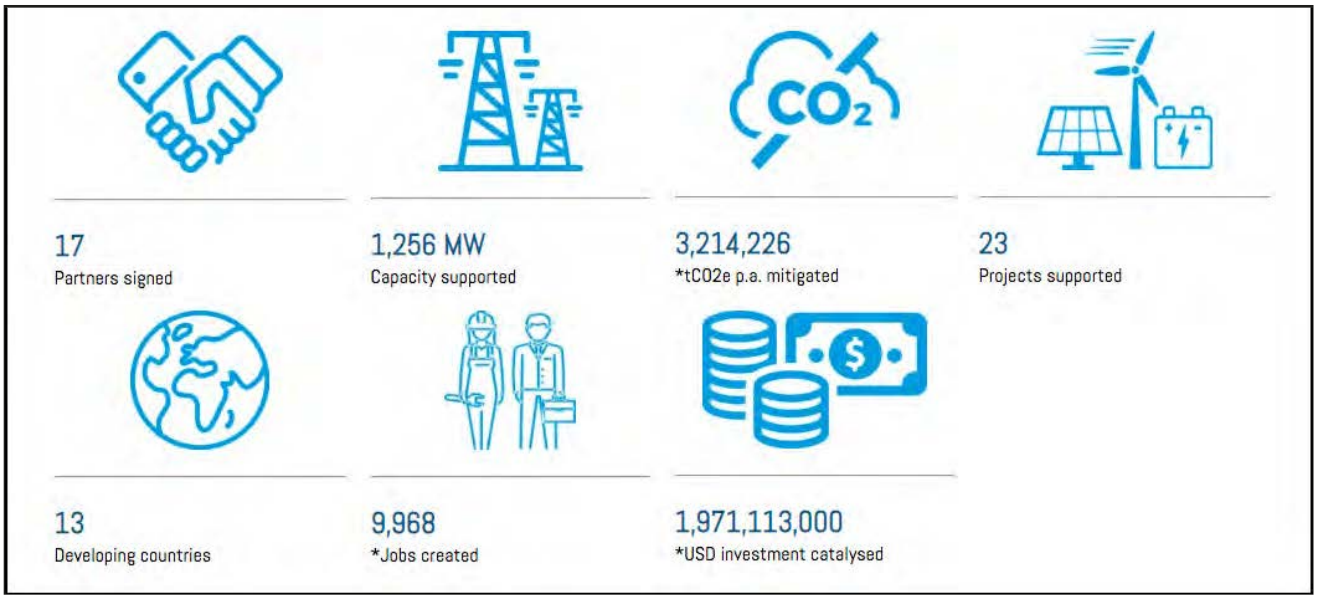
Projects can be de-risked by government support...

Policy initiatives in areas like energy and agriculture indicate exactly where regulatory pressure will originate from. Instruments such as Border Carbon Agreements must also be taken into account as they effectively transfer climate policy costs from one economic regime to another.

Using all of these as the basis for climate-specific scenarios allows bankers to assess obligors in a way that shows likely future costs that will be incurred by firms that continue to operate in a non-sustainable manner.

An important area of government policy to examine is innovation funding. Both the EU and the US have specific programs, as does the UN.

The UN's Seed Capital Assistance Facility (SCAF) works with financing partners such as project development companies and private equity firms to de-risk early stages of innovative climate change mitigation projects, particularly in Southeast Asia and Sub-Saharan Africa. The aim of SCAF is not to finance projects but to provide cost-sharing and co-financing with those partners, until projects are demonstrably financially viable, at which point, other private financing takes over.



Source: www.scaf-energy.org

The European Green Deal also has an innovation fund, the aim of which is to provide EUR1.5 billion (in 2022) to 'finance breakthrough technologies for renewable energy, energy-intensive industries, energy storage, and carbon capture, use and storage'. The fund takes submissions annually, awarding EUR1 billion in 2021 across a range of approved projects.

Source: ec.europa.eu

In the US, the Biden/Harris administration announced a $100 million innovation fund from the Department of Energy (DoE), whose aims include:

- Zero net carbon buildings at zero net cost, including carbon-neutral construction materials
- Energy storage at one-tenth the cost of today's alternatives
- Advanced energy system management tools to plan for and operate a grid powered by zero-carbon power plants
- Very low-cost zero-carbon on-road vehicles and transit systems
- New, sustainable fuels for aircraft and ships, as well as improvements in broader aircraft and ship efficiency and transportation management
- Affordable refrigeration, air-conditioning, and heat pumps made without refrigerants that warm the planet
- Carbon-free heat and industrial processes that capture emissions for making steel, concrete, chemicals, and other important industrial products
- Carbon-free hydrogen at a lower cost than hydrogen made from polluting alternatives
- Innovative soil management, plant biologies, and agricultural techniques to remove carbon dioxide from the air and store it in the ground
- Direct air capture systems and retrofits to existing industrial and power plant exhausts to capture carbon dioxide and use it to make alternative products or permanently sequester it deep underground

Banks can use the emergent innovation funding maps to divine pathway directionality...

Early investment in adaptation and mitigation will put firms in a position to avoid future regulatory costs and to gain market share as a new green economy. This advantage can be priced into such credit facilities, enabling banks to incentivize sustainability across their balance sheets.

Examining where official innovation funding is being directed allows banks to make informed choices when building scenarios internally that replicate real-world pathways created by the IPCC.

These scenarios need to include economic impacts and be designed in such a way that industry and even loan-specific impacts can be included to reflect adaptations and investments that will lead to avoidance of climate transition risks and costs.

Understanding these impacts on customers and their business models allows banks to forecast any impacts on their own credit provisioning and even loan pricing. Loans to businesses with models that are resilient to expected transitional changes ought to attract preferential borrowing rates that reflect that resilience.

Under current banking regulations, to achieve this, a strong supporting analysis of climate risks is critical.

GreenCap can help...

GreenCap is a Risk as a Service (RaaS) that was built to provide banks with the ability to design and shape economic scenarios in such a way that climate pathways, the speed at which they are implemented, and their impacts on customers' credit profiles can be measured.

With GreenCap, banks can reliably predict the increases in credit-related capital provision they will face as global and regional climate plans are put into action. This can also be translated directly into loan pricing, giving banks the capacity to price sustainable incentives into loan facilities.

Visit GreenCap.live for more details.

Chapter 10

SYSTEM THINKING AROUND TIPPING POINTS IS NEEDED FOR BANKS' CLIMATE RISK STRATEGIES

CLIMATE PATHWAYS ARE A MIX OF ADAPTATION AND MITIGATION. UNEXPECTED PHYSICAL IMPACTS AND POSITIVE FEEDBACK LOOPS WILL DICTATE PRIORITIZATION OF POLICY ROLLOUT.

Originally published on February 18, 2022

Climate pathways are built on a range of predictive models...

Scientists engaged with climate change have been building effective potential climate pathways since the early 1990s. These are collated and curated by the Intergovernmental Panel on Climate Change (IPCC), and are referred to as, 'Representative Concentration Pathways' (RCPs), indicating that the objective is to predict the building concentrations of Greenhouse Gases (GHGs) under various possible futures. RCPs run through to 2100 and are regularly updated to reflect the current status and final warming effect that would be achieved under each. The main RCPs used for scenario analysis are:

- **RCP2.6** - Pathway that results in radiative forcing of 2.6 W/m^2 2100. This is the pathway most commonly used as the target by the world's governments at the Conferences of the Parties (COPs). It represents the level where most catastrophic global warming effects are avoided.

- **RCP4.5** - Pathway that results in radiative forcing of 4.5 W/m^2 2100. This is the lower end of the range where certain effects are felt, but with planned adaptation, can be 'lived with'.

- **RCP6.0** - Pathway that results in radiative forcing of 6.0 W/m^2 2100. This is the higher end of the range where survivable effects are felt, but it is considered far worse than the 4.5 option as more 'tipping points' are encountered.

- **RCP8.5** - Pathway that results in radiative forcing of 8.5 W/m^2 2100. This is considered the equivalent of 'business as usual', with little effort being made to prevent the rise in global warming.

The IPCC produces advice for policymakers, based on observed and predicted climatic impacts, wherein they illustrate emergent and future risks along the pathways. The latest of these regarding sea levels is the 2019 'Special Report on the Oceans and Cryosphere in a Changing Climate' (SROCC), which is of particular interest to governments when setting sustainability targets and forming their policy agendas.

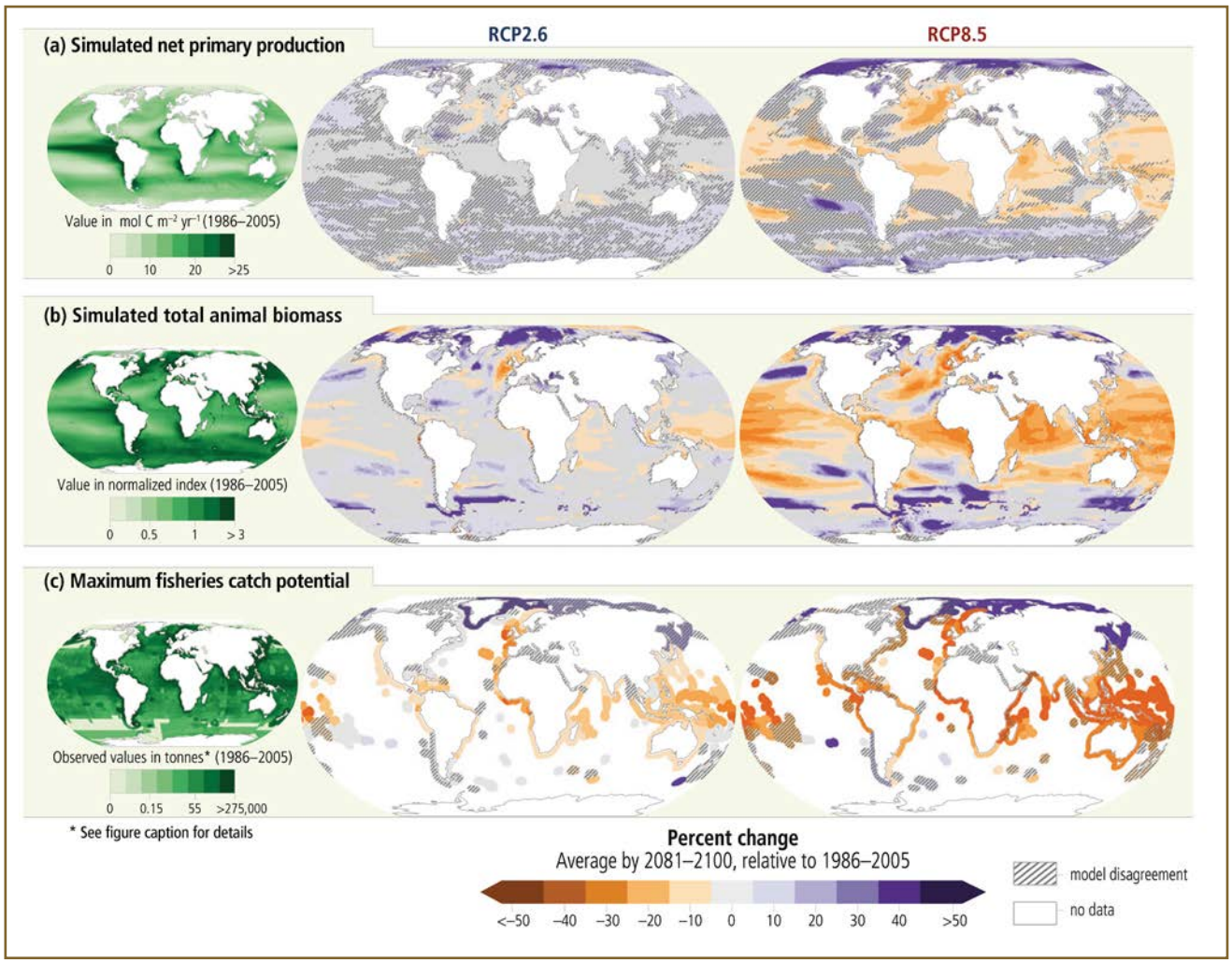
The latest projections for the global mean surface temperature change, relative to 1850 -1900 averages, for each of the main RCPs, are:

	Near-term: 2031-2050		End-of-century: 2081-2100	
Scenario	Mean (°C)	*Likely* range (°C)	Mean (°C)	*Likely* range (°C)
RCP2.6	1.6	1.1 to 2.0	1.6	0.9 to 2.4
RCP4.5	1.7	1.3 to 2.2	2.5	1.7 to 3.3
RCP6.0	1.6	1.2 to 2.0	2.9	2.0 to 3.8
RCP8.5	2.0	1.5 to 2.4	4.3	3.2 to 5.4

Source: ipcc.ch

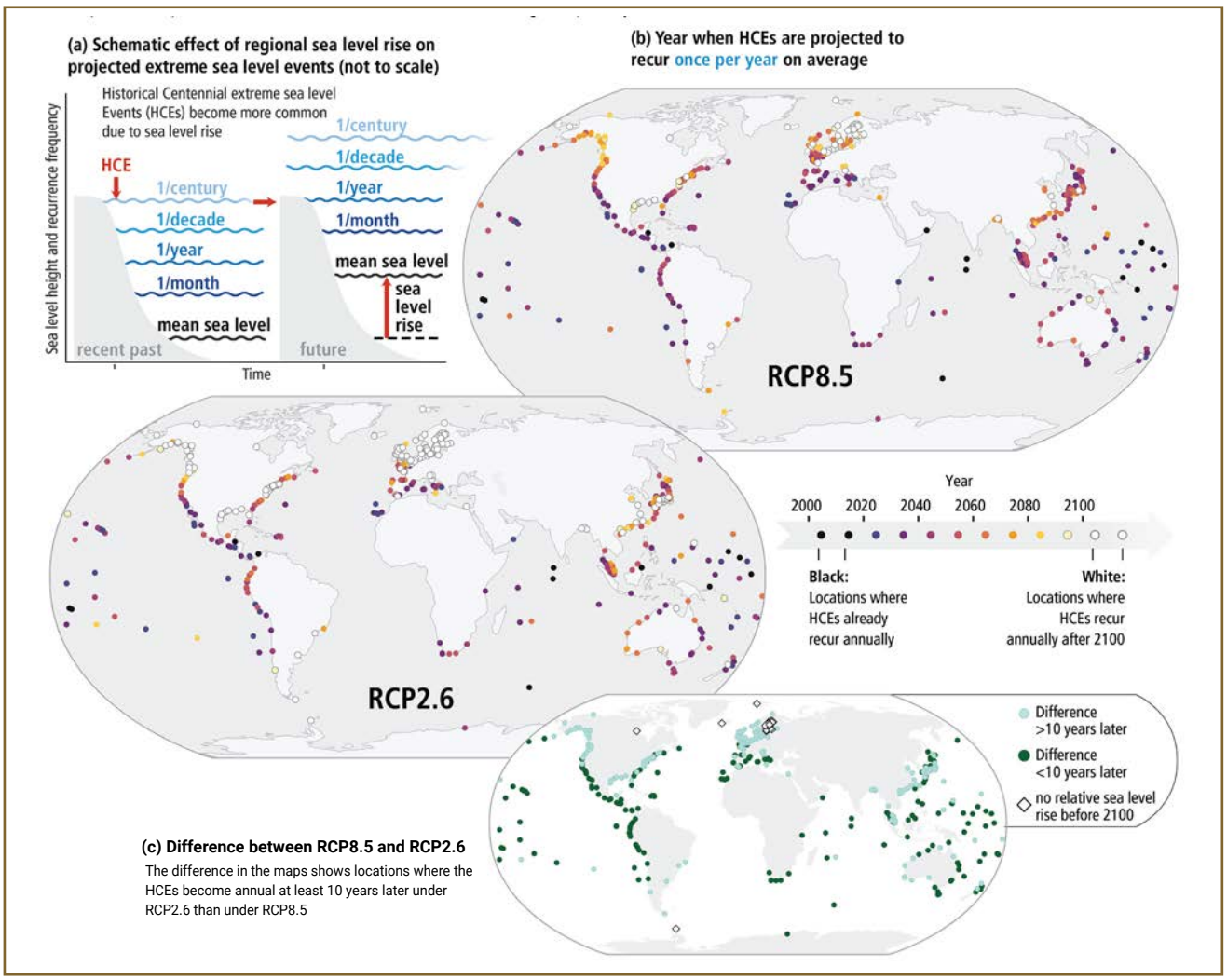
For analytic comparisons of rising sea levels and consequential hazards, the SROCC compares RCP 2.6 and 8.5. These comparisons illustrate the risks to oceans, coastal communities, and economies, which rely so heavily on them.

The differential impact of the RCPs on fisheries, as an example, is stark, creating both food production and economic issues for governments to take account of in their climate strategies.



Source: ipcc.ch

Climate economics is also hinged on the balance between adaptation and mitigation. Less action in the short term on direct mitigation raises the likelihood of RCP8.5 and substantially increases the rate at which 'Historically Centennial Events' (HCEs) occur, which have a direct impact on the amount of climate-related budget that will be allocated to adaptation.



Source: ipcc.ch

Effectively, the third global chart illustrates the additional 'events' that will require aid and funding, should the world elect to move slowly and allow itself to range towards RCP8.5 rather than RCP2.6.

Outside of the IPCC, respected bodies such as Cambridge University's 'Centre for the Study of Existential Risk' (CSER) have studied the environmental and societal impacts of rising temperatures during the current century.

Environmental	Potential Impacts	Human
Indicative findings from selected research	6°C	End of civilization?
Mass extinction of >95% of species		General social breakdown: survival
Global food productivity collapses	5°	
Majority of agricultural land lost		Large areas are uninhabitable
Coasts eroded, flooded, aquifers saline		Conflict / war: resource competition
Widespread drought US, Africa, Med, India	4°	Many deaths from weather disasters
Biosphere switches to net emitter of CO_2		Global GDP materially reduced
Loss of majority of Amazon rainforest	3°	
c.20% loss of crop productivity		Repeated famines, mass migration
Ocean acid kills off base of marine food-webs		Infectious diseases spread
Committed to full ice-cap melt (sea-level eventually up +100ft/31m @2m/century)	2°	Widespread hunger and water stress
Glacier loss: S.Asia summer river flow -70%		Rising tensions over resources
Worse flood/wind/wildfire/droughts/heat	1°	Impacts already felt by those in poverty
Average 60% drop in animals & insects		
	0°	

Source : cser.ac.uk/

Higher temperature ranges that result from slower, more passive, climate policies, create drastically higher risks and costs in the future, the prevention of which must inform shorter-term planning.

Governments provide indicators of their longer-term considerations...

The US government and military published two important documents in 2021.

The White House issued 'The Report On The Impact Of Climate Change On Migration', detailing concerns and required planning around:

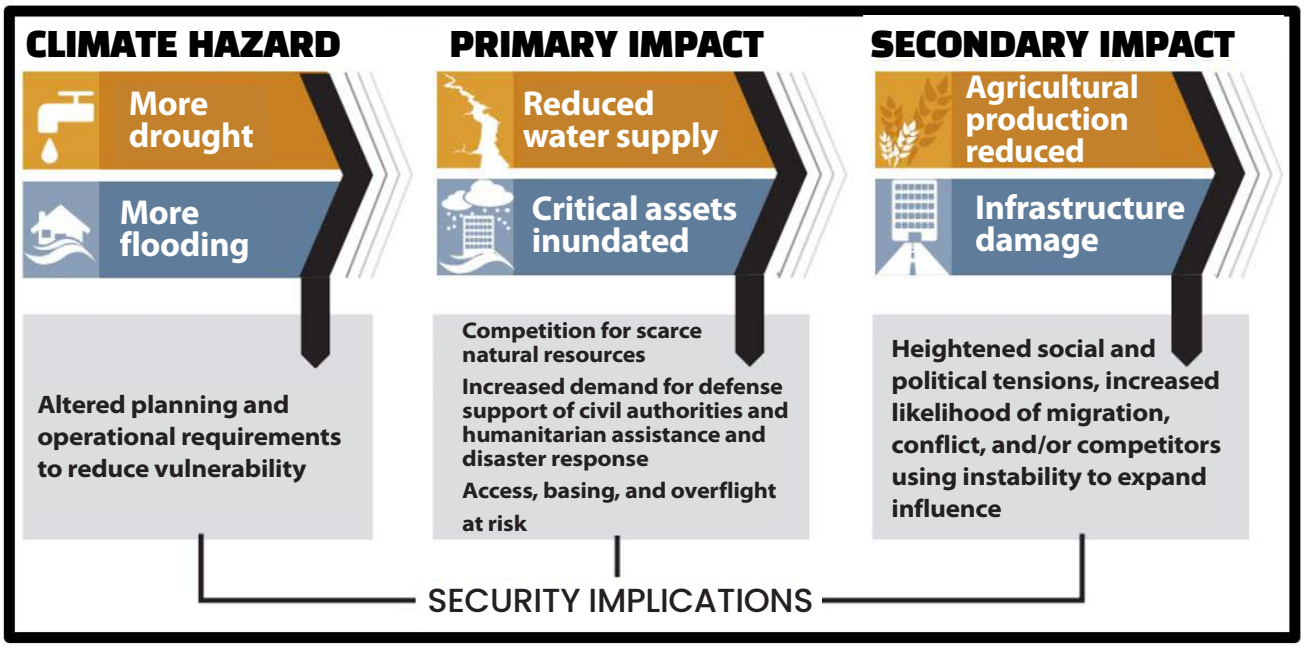
- International aid to displaced peoples
- Dealing with impacts from increased US migration
- Technical support for identification and mitigation
- Financing mitigation and adaptation strategies

It is noted that geo-instability increases with rising global temperatures.

"Migration is an important form of adaptation to the impacts of climate change and in some cases, an essential response to climate threats to livelihoods and wellbeing; therefore, it requires careful management to ensure it is safe, orderly, and humane. It is critical to mitigate risks to the human security of migrants and receiving communities, such as risks to food and water security, access to necessary resources, and conflict at both the local and intercommunal levels. Large-scale migrations in response to destabilizing climate events within areas of particular economic or political importance can result in a disproportionate impact to a nation's condition overall. This will likely be the case for the world's coastal populations where sea level rise is predicted to displace a disproportionate number of people."

Source: White House Report on the Impact of Climate Change on Migration

As the federal government detailed US concerns, the Pentagon also released its own report – 'The Department of Defense Climate Risk Analysis'. In this publication, the US DoD details issues created by climate change, both within the US and abroad, along with its high-level plans to assist with the causes and effects.



Source: Department of Defense, Office of the Undersecretary for Policy (Strategy, Plans, and Capabilities). 2021.
Department of Defense Climate Risk Analysis. Report Submitted to National Security Council.

It is increasingly clear that while climate change planning is primarily a domestic agenda, the wider global implications and impacts are being factored into decisions and budgeting around these plans.

Potential tipping points dictate the timing of specific climate measures...

Positive feedback loops within climate change are of particular concern to policymakers. A popular example is the 'Methane Accelerator', which was described by the World Business Academy in 2019, in their paper bearing that name. The publication explains how current levels of oceanic methane release put the world at considerable risk through:

- Global warming arising from CO2 emissions heats oceans and causes the release of trapped methane from the seafloor.
- Methane, while persisting for less time than CO2 in the atmosphere, is 84 times more potent as a heating agent.
- Increased methane concentration in the atmosphere speeds up the heating on the surface and oceans.
- Faster rising temperatures, caused in part by increasing methane concentrations, reduce ice coverage quicker than predicted, reducing the albedo effect (snow and ice are highly reflective and as such, reflect solar energy back into space) of the ice shelves.
- More solar energy retained in the atmosphere creates more heat to be absorbed by oceans, which in turn, speeds up the release of trapped methane.
- This positive feedback loop drastically reduces the time remaining for meaningful action to be taken to avoid the most catastrophic effects of global warming.

Governments aiming to protect their own countries and populations from the worst global impacts of climate change need to adjust policy and policy timing to avoid damaging positive feedback loops that threaten to undermine their best efforts at orderly transitions.

System thinking is needed to create effective, realistic scenarios...

Financing the global transition towards sustainability requires trillions of dollars from the private sector. Just as governments build transition plans that maintain physical, energy, and food security, banks must provide credit facilities that maintain their institutions and the financial system's financial security.

This means that banks must continue to work within a regime governed by:

- IFRS9/CECL forces banks to hold accounting capital against conservatively estimated future credit losses
- Basel 3/Dodd Frank regulations put emphasis on the relationship between credit risk, liquidity, and financial stability
- Liquidity stress tests that ask banks to assess their internal liquidity in theoretically stressed economic conditions, and hold capital to survive these extremes

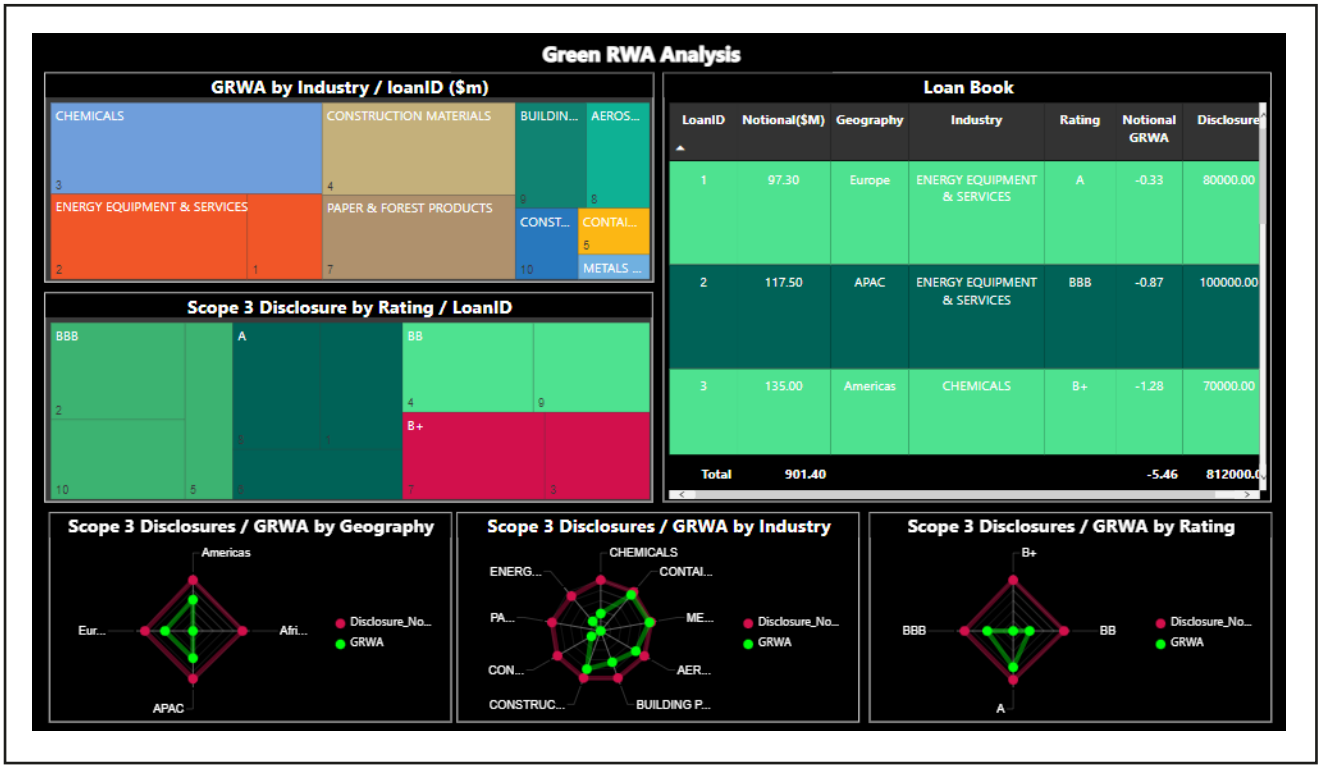
In order to be an effective conduit of sustainable finance, banks need to build economic scenarios that are equivalent to the RCPs and value their books against them. The issue that persists is the speed at which the RCP, or its regional counterpart, is enacted and the implied economic risks that this entails.

System thinking is where entire chains of effect are considered for analysis, with the system as a whole, being the focus rather than any single emission type or industry. When such thinking is applied to climate change, it becomes apparent that policy planning must include aspects of adaptation and mitigation, and policy priorities must be dictated by their longer-term feedback loop potentiality.

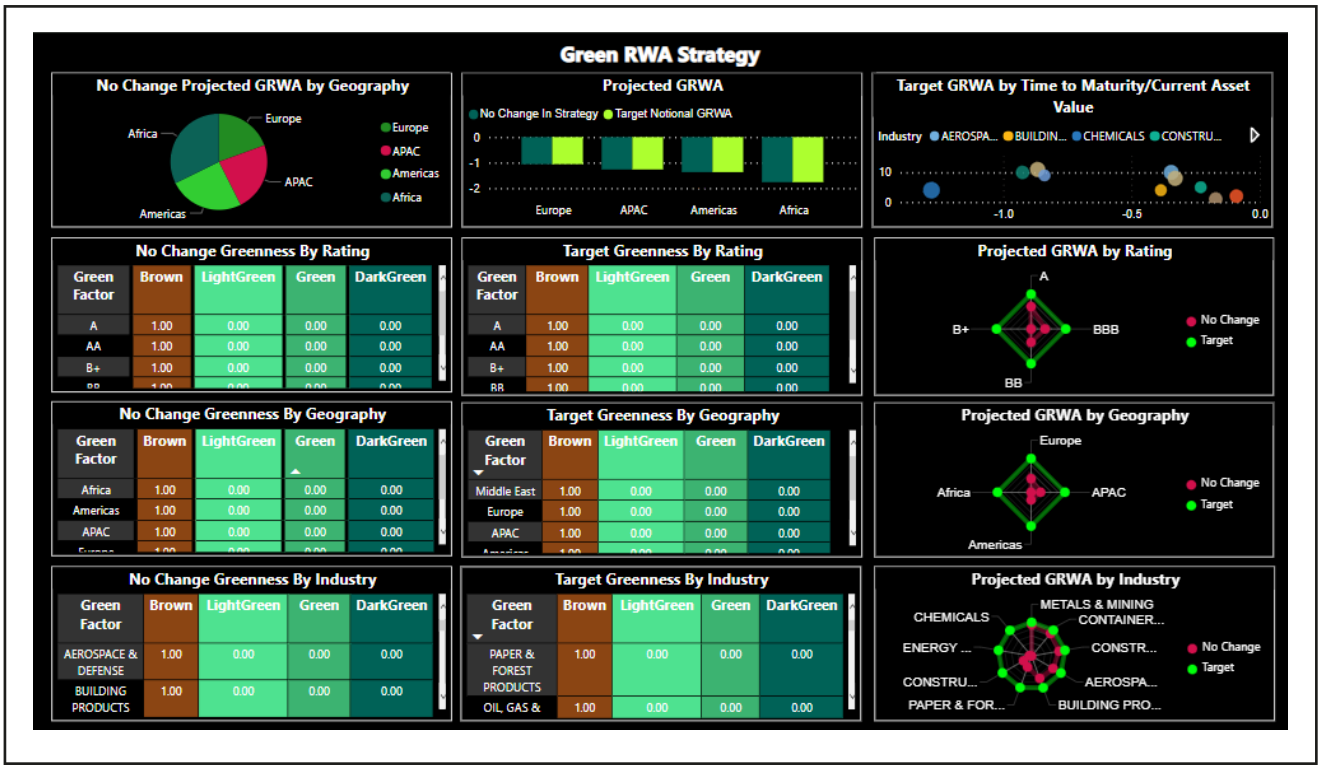
This implies that dealing with methane, and its greater heating potential may take greater priority than CO2. Banks need scenarios that reflect the RCPs at varying speeds and priorities that are and will become more urgent. This demands a bank climate stress testing system that is agile and can transform to reflect new research that can change policy, clearly showing how policy choices change credit risks and therefore a bank's stability.

GreenCap can help...

GreenCap is a Risk as a Service (RaaS) solution that is designed to supply banks with the capacity to build smart, climate-based scenarios that reflect the best estimates of bankers and scientists from the IPCC as well as economists from the Net Greening of the Financial System (NGFS).



GreenCap models transition and physical-based credit risk and enables banks to adjust economic impacts for policy priorities. Using the system, bank risk teams can effectively build climate risk into their current frameworks and supply, reporting against climate-related risk targets to senior management for risk governance purposes.



Visit GreenCap.live to read further insights into green finance, and to access a range of resources curated to assist banks in building their sustainable financial divisions.

ABOUT **GREENCAP**

- GREENCAP is a turnkey 'Risk as a Service' (RaaS) solution, designed for banks to include climate change as a category in their risk management frameworks.
- The solution allows banks to replicate climate pathways within their scenarios for economic impact and risk analysis.
- Using GreenCap, banks can modify pathways and scenarios to include the timing effects of delayed sustainability transition measures.
- Loans and credit facilities are measured and monitored against risks arising from both ‘physical’ and ‘transition’ impacts.
- GreenCap provides support for risk reporting and governance in the areas of ‘Responsible Banking’ and climate change.
- With GreenCap, banks can ensure that their climate strategies are financially grounded, and loan pricing is optimized throughout the transition to a green global economy.

ABOUT **GREENPOINT FINANCIAL**

- GreenPoint Financial is a division of GreenPoint Global, which provides software-enabled services, content, process and technology services, to financial institutions and related industry segments.
- GreenPoint is partnering with Finastra across multiple technology and services platforms.
- Founded in 2006, GreenPoint has grown to over 400 employees with a global footprint. Our production and management teams are in the U.S, India and Israel with access to subject matter experts.
- GreenPoint has a stable client base that ranges from small and medium-sized organizations to Fortune 1000 companies worldwide. We serve our clients through our deep resource pool of subject matter experts and process specialists across several domains.
- As an ISO certified by TÜV SÜD South Asia, GreenPoint rigorously complies with ISO 9001:2015 and ISO 27001:2013 standards.
- GreenPoint is owned by its founders and principals and is debt free.

Marcus Cree

MANAGING DIRECTOR AND
CO-HEAD OF FINANCIAL TECHNOLOGY AND SERVICES

Marcus has spent 25 years in financial risk management, working on both the buy and sell side of the industry. He has also worked on risk management projects in over 50 countries, gaining a unique perspective on the nuances and differences across regulatory regimes around the world.

As Managing Director, Marcus co-heads GreenPoint Financial Technology and Services and has been central in the initial design of GreenPoint products in the loan book risk area, including CECL and sustainability risk. This follows his extensive experience in the Finastra Risk Practice and as US Head of Risk Solutions for FIS. Marcus has also been a prolific conference speaker and writer on risk management, principally market, credit and liquidity risk. More recently, he has written and published papers on sustainability and green finance.

Marcus graduated from Leicester University in the UK, after studing Pure Mathematics, Phycology and Astronomy. Since graduation, Marcus has continually gained risk specific qualifications including the FRM (GARP's Financial Risk Manager) and the SCR(GARP's Sustainability and Climate Risk). Marcus's latest academic initiative is creating and teaching a course on Green Finance and Risk Management at NYU Tandon School of Engineering.

Sanjay Sharma, PhD

FOUNDER AND CHAIRMAN

Sanjay is the Founder and Chairman of GreenPoint Global - a risk advisory, education, and technology services firm headquartered in New York. Founded in 2006, GreenPoint has grown to over 380 employees with a global footprint and production and management teams located here in the U.S, India and Israel.

During 2007-16 Sanjay was the Chief Risk Officer of Global Arbitrage and Trading Group and Managing Director in Fixed Income and Currencies Risk Management at RBC Capital Markets in New York. His career in the financial services industry spans over two decades during which he has held investment banking and risk management positions at Goldman Sachs, Merrill Lynch, Citigroup, Moody's and Natixis. Sanjay is the author of "Risk Transparency" (Risk Books, 2013), Data Privacy and GDPR Handbook (Wiley,2019) and co-author of "The Fundamental Review of Trading Book (or FRTB)- Impact and Implementation" (RiskBooks,2018).

Sanjay was the Founding Director of the RBC/Hass Fellowship Program at the University of California at Berkeley and is an Adjunct Professor at EDHEC, Nice in France. Sanjay is also Adjunct Professor at Fordham University where he teaches a similar master's capstone course and at Columbia University. He has served as an advisor and a member of the Board of Directors of UPS Capital (a Division of UPS) and is a frequent speaker at industry conferences and at universities. He served on the Global Board of Directors for Professional Risk International Association (PRMIA).

He holds a PhD in Finance and International Business from New York University and an MBA from the Wharton School of Business and has undergraduate degrees in Physics and Marine Engineering. Sanjay acquired his appreciation for risk firsthand as a merchant marine officer at sea where he served for seven years and received the Cheif Engineer's certificate of competency for ocean-going merchant ships. Sanjay lives in Rye, NY with his wife and two teenage sons.