THE US GOVERNMENT IS PICKING UP PACE ON CLIMATE CHANGE, AND BANKS' RISK DEPARTMENTS SHOULD FOLLOW SUIT

BANKS STRUGGLING TO CREATE ECONOMIC SCENARIOS TO REPLICATE CLIMATE PATHWAYS OUGHT TO REVIEW THE RECENT WHITEHOUSE WHITEPAPER ON HOW THEY ARE INCORPORATING CLIMATE CHANGE INTO THEIR OWN BUDGET FORECASTING. THIS MAY PROVE INVALUABLE FOR EVALUATING THEIR OWN POTENTIAL CLIMATE-RELATED CREDIT COSTS AND AVOID FUTURE LIQUIDITY ISSUES.

By **Marcus Cree,** FRM SCR

GREENCAP
www.greencap.live

GreenPoint Financial
www.greenpoint.financial

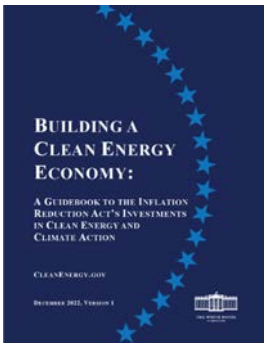
marcus.cree@greenpointglobal.com | sanjay@greenpointglobal.com

International Corporate Center, 555 Theodore Fremd Avenue, Suite A102 Rye, NY 10580

The US government has been more active in the climate space recently...

The current administration has been on a mission to put America on a 'net zero' path, which includes multiple executive actions designed to steer the economy in a 'green' direction. These are not limited to, but include:

- **20th January 2021 -** Newly inaugurated, President Biden signs the official instrument to put the US back into the Paris Accord
- **19th February 2021 -** US officially rejoins Paris Accord
- **22nd April 2021 -** US submits revised 'Nationally Determined Contribution' (NDC) to the UN
- **16th August 2022 -** US signs the 'Inflation Reduction Act' into law, including $391b on clean energy and climate change
- **13th March 2023 -** Whitehouse releases its 'Methodologies and Considerations for Integrating the Physical and Transition Risks of Climate Change Into Macroeconomic Forecasting for the President's Budget', explaining how costs of the administration's climate policies could be calculated



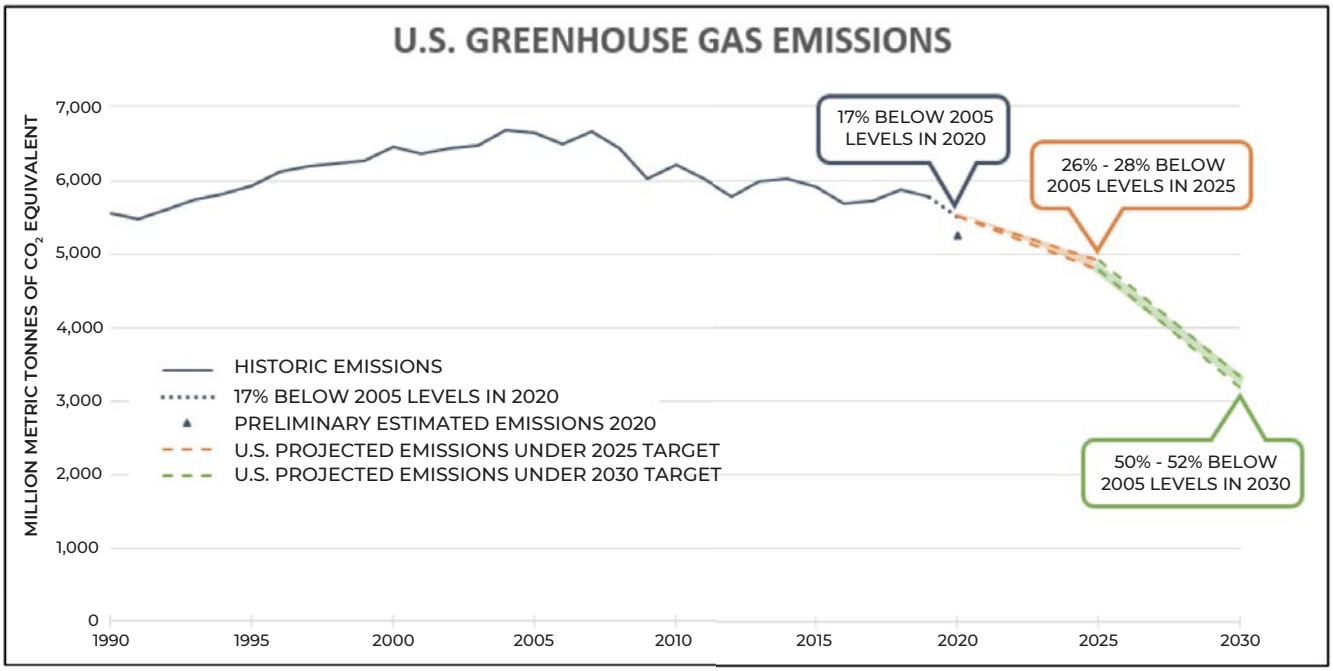
The above actions may have restored the US's standing in the eyes of the United Nations Framework Convention on Climate Change (UNFCCC), but they also represent a significant economic directional change, and as such, banks need to study both the policy changes and the estimated costs. A drastic switch away from a fossil fuel-powered 'brown' economy will have severe implications for the businesses and households that make up their balance sheets and loan books. This has the capacity to deteriorate credit profiles, increasing banks' credit risk and their need to hold economic capital against it. The more capital that needs to be held in reserve, the less profitable the bank, and the more likely it becomes of breaching liquidity floors.

To plan for potential credit shocks and to prevent these from becoming liquidity events, risk departments must look into the ambitions and costs of 'net zero' plans.

US NDC goes far, but more may be needed...

The United State of America
Nationally Determined Contribution

The US government has made a commitment to reduce CO2e emissions (CO2 or equivalent greenhouse gas) to 50-52% of 2005 levels by the year 2030.



United States Historic Emissions and Projected Emissions Under 2030 Target

The principle targets for change within the NDC are:

- **Electricity :** The United States has set a goal to reach 100 percent carbon pollution-free electricity by 2035.
- **Transportation:** Policies to reduce CO2 from the transportation sector will include -
  - Tailpipe emissions and efficiency standards
  - Incentives for zero-emission personal vehicles
  - Charging infrastructure to support multi-unit dwellings, public charging, and long-distance travel

- **Buildings :** The emissions reduction pathways for buildings consider include -
  - Support for energy efficiency and efficient electric heating and cooking in buildings via funding for retrofit programs
  - Wider use of heat pumps and induction stoves
  - Adoption of modern energy codes for new buildings
- **Industry :** Policies will incentivize -
  - Carbon capture
  - New sources of hydrogen – produced from renewable energy, nuclear energy, or waste
- **Agriculture and lands :** This will include -
  - Scaling of climate-smart agricultural practices
  - Reforestation
  - Rotational grazing
  - Nutrient management practices

This document should be used as guidance in all top-down economic scenario building.

Pricing of policy pathways is a major hurdle for risk departments...

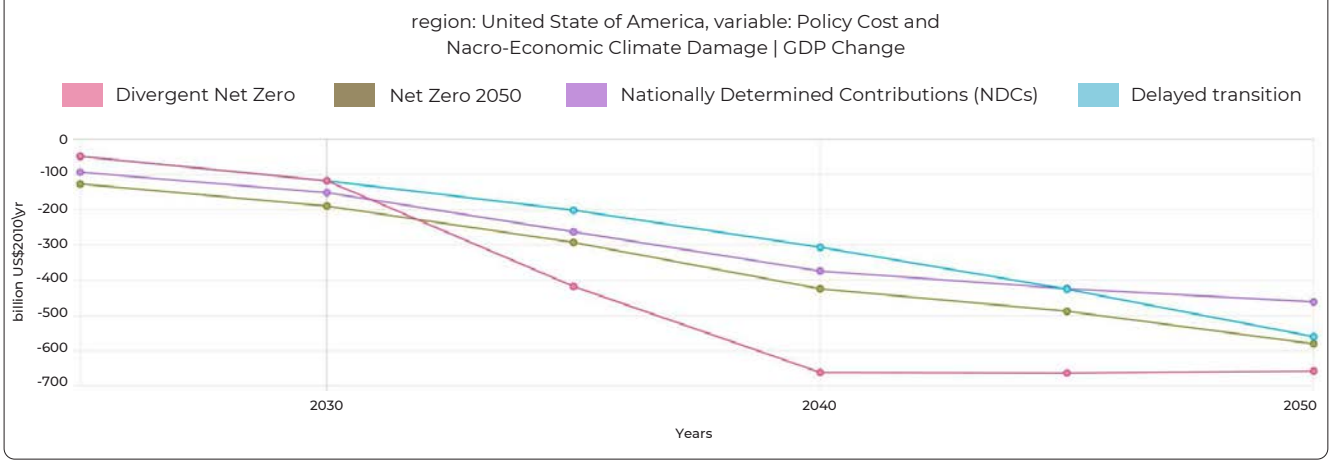
From an external perspective, the 'Network for Greening the Financial System' (NGFS) can be used as a resource to obtain pathway costs. The group has researched multiple potential scenarios per country, including:

- **Current policies -** Assuming actual policies currently in place are not built upon, but are enacted
- **NDC -** Assuming the commitments stated within the NDC are met on the timescales indicated
- **NDC delayed -** Assuming a two-year delay in implementation of NDC plans
- **2-degree limit -** Assumes a scaling up from the NDC towards a 'fair share' CO2e reduction to meet a globally agreed target of limiting global warming to 2 degrees by 2100
- **1.5-degree limit -** Assumes a scaling up from the NDC towards a 'fair share' CO2e reduction to meet a globally agreed aspiration of limiting global warming to 1.5 degrees by 2100

All of these consider both transitional (policy) and physical (damage) costs that are estimated by the NGFS for each scenario.

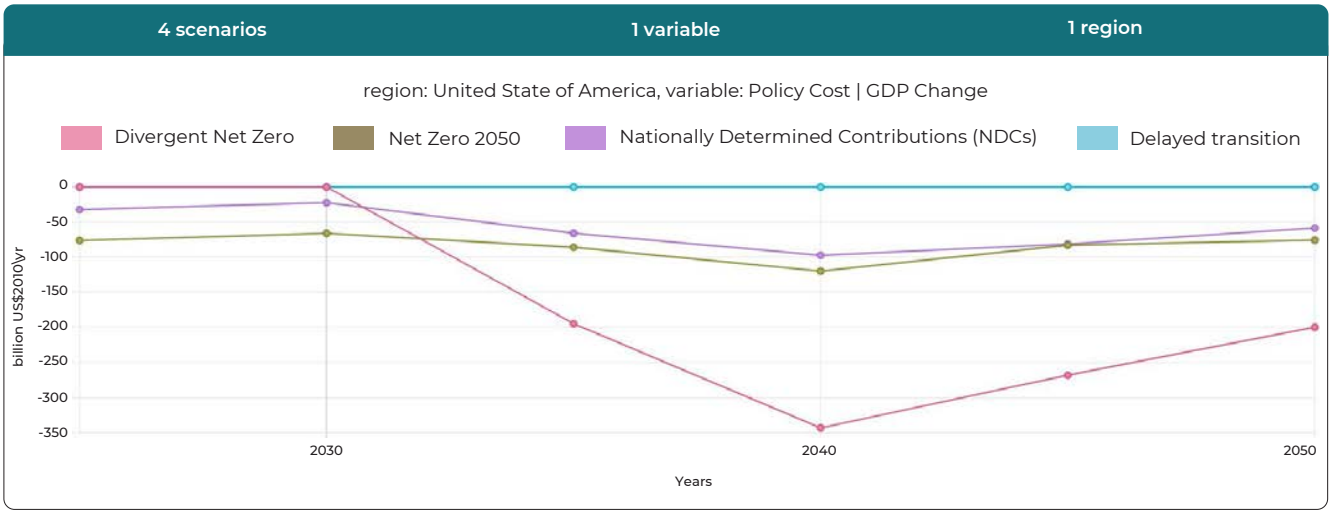
GDP

4 scenarios | 1 variable | 1 region



GDP

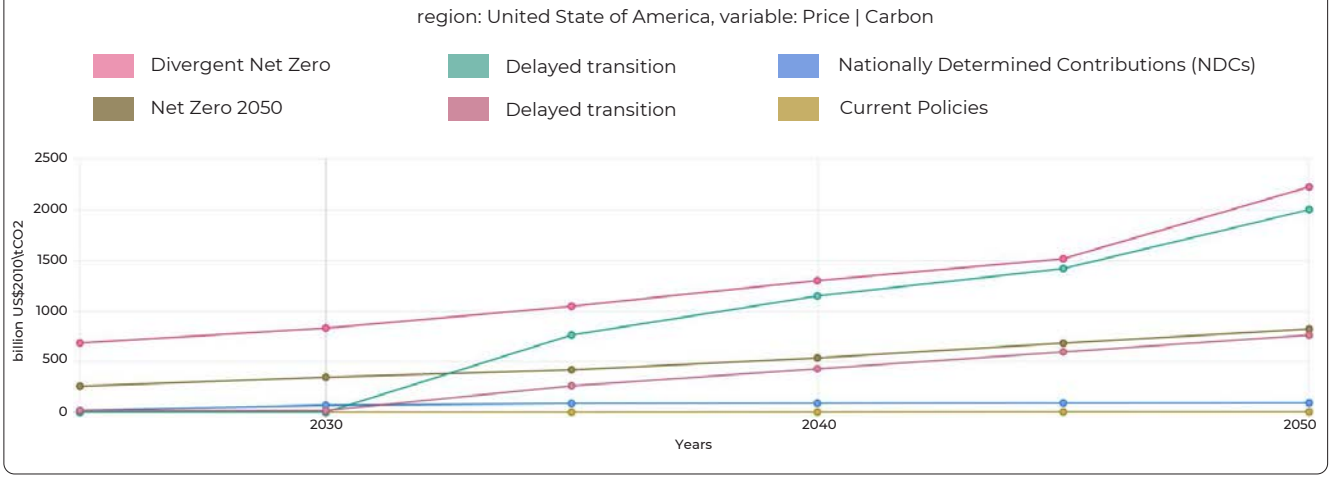
4 scenarios | 1 variable | 1 region



Alternatively, the NGFS also run a policy-specific estimate of the implied price of carbon, which can also be used, in conjunction with the headline reduction pledge, to arrive at a policy cost per year.

Carbon price

6 scenarios | 1 variable | 1 region



Notably, the NGFS treats countries as single units, including the US. This approach may develop

errors as the size of the country and distribution of its industrial and agricultural assets are suited to a more intra-regional way of thinking.

The administration has published ways its policies can be costed out...


WHITE PAPER

COUNCIL OF ECONOMIC ADVISERS
&
OFFICE OF MANAGEMENT AND BUDGET

METHODOLOGIES AND CONSIDERATIONS FOR INTEGRATING THE PHYSICAL AND TRANSITION RISKS OF CLIMATE CHANGE INTO MACROECONOMIC FORECASTING FOR THE PRESIDENT'S BUDGET

March 13, 2023

White Paper
Council of Economic Advisers &
Office of Management and Budget

This document considers multiple methodologies that can be used to include transitional costs and physical damage estimates in the 10-year economic forecast and the 'Long-Term Budget Outlook' (LTBO). This includes appropriate measures to use, such as 'debt to GDP', as well as actual econometric methodologies.

Both physical and transitional factors are taken into account with listed physical factors including:

Table 2: Examples of pathways by which climate change can affect macroeconomic variables

Broad Pathway	Specific Climate Pathway	Discussion	U.S. Government Analytic Capacity	References
Labor	Migration	Climate change, including displacement from sea-level rise, could affect the propensity to migrate to and from the United States in complex ways, as well as the distribution of population within the United States	Limited	Benveniste et al. 2020; Benveniste et al. 2022; Jessoe et al. 2018
	Workweek	Changes in extreme temperatures alter hours worked, particularly in more exposed industries (e.g., construction, agriculture)	Good	Rode et al. 2022; Graff-Zivin and Neidell 2014
	Population Growth - Fertility	There is some suggestion climate change may affect fertility decisions, though magnitudes may be small for a services-led economy with high air conditioner penetration like the United States	Limited	Casey et al., 2019; Barreca et al., 2018

Broad Pathway	Specific Climate Pathway	Discussion	U.S. Government Analytic Capacity	References
	Population Growth – Mortality	Substantial evidence that temperature extremes lead to premature mortality, though effect sizes are smaller for prime workforce ages. Other mortality effects operate through changes in disease and extreme weather events	Good	Carelton et al. 2022; Cromar et al. 2022; Bressler et al. 2021
Capital Services	Destruction	Climate-change-related extreme events could destroy capital investments. Resources required for recovery may be diverted from productive investments.	Partial	Hallegatte et al. 2007; Otto et al. 2023; studies referenced in Martinich and Crimmins 2019
	Uncertainty	Additional uncertainty from climate-change-related weather extremes raises risk premia on certain assets and financing costs for related investments. Climate uncertainty could limit availability or increase costs of disaster insurance in certain markets, slowing recovery.	Limited	Fernando et al. 2021; Otto et al. 2023
Factor Productivity	Labor	Extreme hot temperatures lower labor productivity in highly exposed industries	Good	Lima et al. 2021; Kjellstrom et al. 2010
	Capital Services	Changing climate may alter the productivity of climatesensitive capital such as dams, electricity transmission and generation, and roads.	Partial	Studies referenced in Martinich and Crimmins 2019; EPRI 2022
	Land	Higher temperatures and CO2 concentrations affect agricultural yields and forest productivity	Good	Beach et al. 2015; Moore et al. 2017; Baker et al. 2022

Note: Modeling capacity definitions: "None" = potential pathway but not quantified or modeled; "Limited" = pathway has been fully or partly modeled in the academic literature, but adapting results for Budget forecasting purposes remains challenging; "Partial" = capacity exists to quantify some but not all of these effects; "Good" = capacity exists to quantify the bulk of these effects and/or used in existing U.S. Government work

Transitional factors are also listed, including:

Table 3: Examples of pathways by which the energy transition can affect macroeconomic variables

Broad Pathway	Specific Energy Transition Pathway	Discussion	U.S. Government Analytic Capacity	References
Labor	Skill and Geographic Mismatch	The energy transition will decrease labor requirements in some industries while increasing them in others. Differences in the skill requirements and location of growing compared with shrinking sectors, combined with labor market frictions, could lead to localized unemployment or labor shortages.	Limited	Council of Economic Advisors 2022; Hafstead et al. 2022; Greenspon and Raimi 2022; Castellanos and Heutel 2019
Capital Services	Investment	A rapid energy transition requires large investments in new energy infrastructure. Macroeconomic effects of this investment might result from diversion of investment from other productive uses and economic stimulus under certain circumstances. Capital adjustment frictions could lead macroeconomic costs to increase with the speed of the transition.	Good	See discussion of macroeconomic models in following sections.
	Policy Uncertainty	Energy infrastructure investments are forward-looking and depend on investor expectations regarding future returns. Policy uncertainty around the speed and nature of the energy transition could lead	Limited	IMF 2022 (Chapter 3)

Broad Pathway	Specific Energy Transition Pathway	Discussion	U.S. Government Analytic Capacity	References
		to higher financing costs and under-investment in energy generally, with implications for energy prices and volatility.		
Factor Productivity	Energy and Energy-Intensive Infrastructure	Rapidly changing policy conditions could lead energy infrastructure to under-perform relative to expectations. Capital in downstream, energy-intensive industries may also be rendered prematurely obsolete or less productive as energy markets and technology change.	Partial	A substantial literature on asset stranding associated with energy transitions exists, including Fofrich et al 2020; van der Ploeg and Rezai 2020; Grubert 2020
Energy	Price Levels	Energy prices can affect macroeconomic conditions. For instance, oil prices are a standard factor in macroeconomic forecasting (Figure 3). The energy transition may change energy prices in the near-term, particularly if it is disorderly. The longer-term effects on energy prices are unclear, as they depend on future technological evolution and policy that could lead to either decreases or increases in energy prices.	Partial	McKibbin et al. 2020
	Price Volatility	Volatile energy prices increase uncertainty for producers and consumers, potentially with macroeconomic implications. A disorderly transition could increase energy price volatility in the short- to medium-term. In the longer-run, the declining share of fossil fuels in the energy mix could lower price volatility.	Limited	

Note: Modeling capacity definitions: "None" = potential pathway not quantified or modeled; "Limited" = pathway has been fully or partly modeled in the academic literature, but adapting results for Budget forecasting purposes remains challenging; "Partial" = capacity exists to quantify some but not all of these effects; "Good" = capacity exists to quantify the bulk of these effects and/or used in existing U.S. Government work

The requirements for viability are that these factors are incorporated into the model as well as:

- Model has been properly peer-reviewed
- Sub-national level results within the US
- Includes capital and labor frictions

While some models produce state-level results, one, EPA-SAGE divides the country into four regions for analytic purposes.

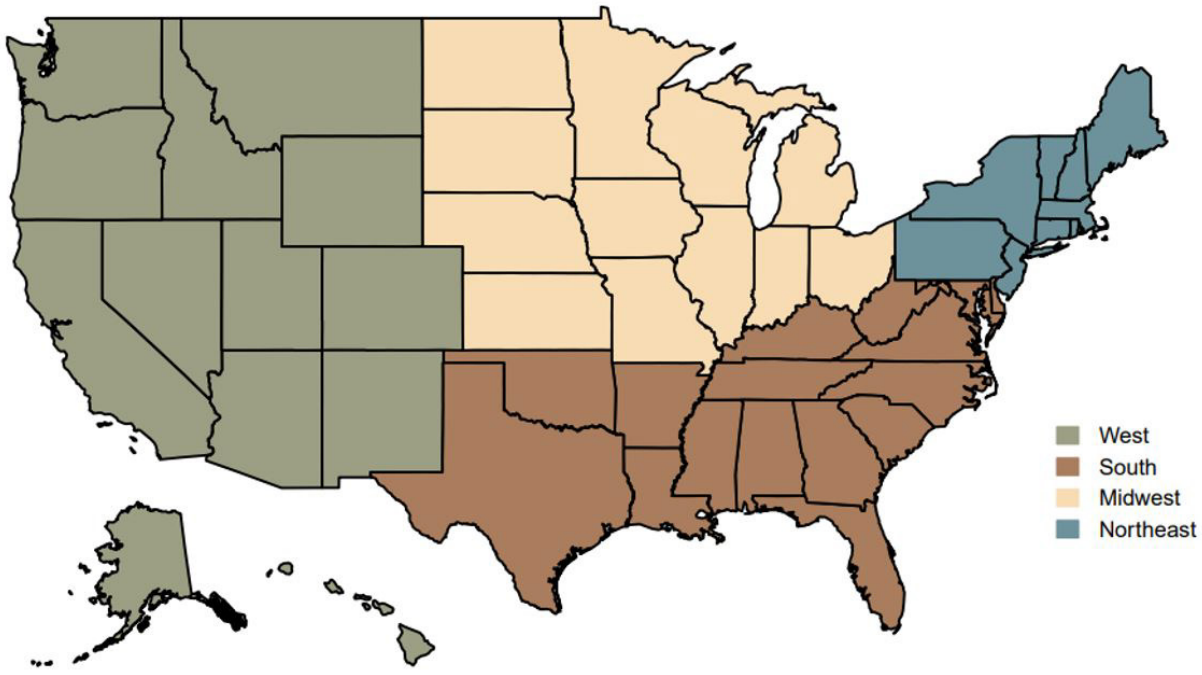
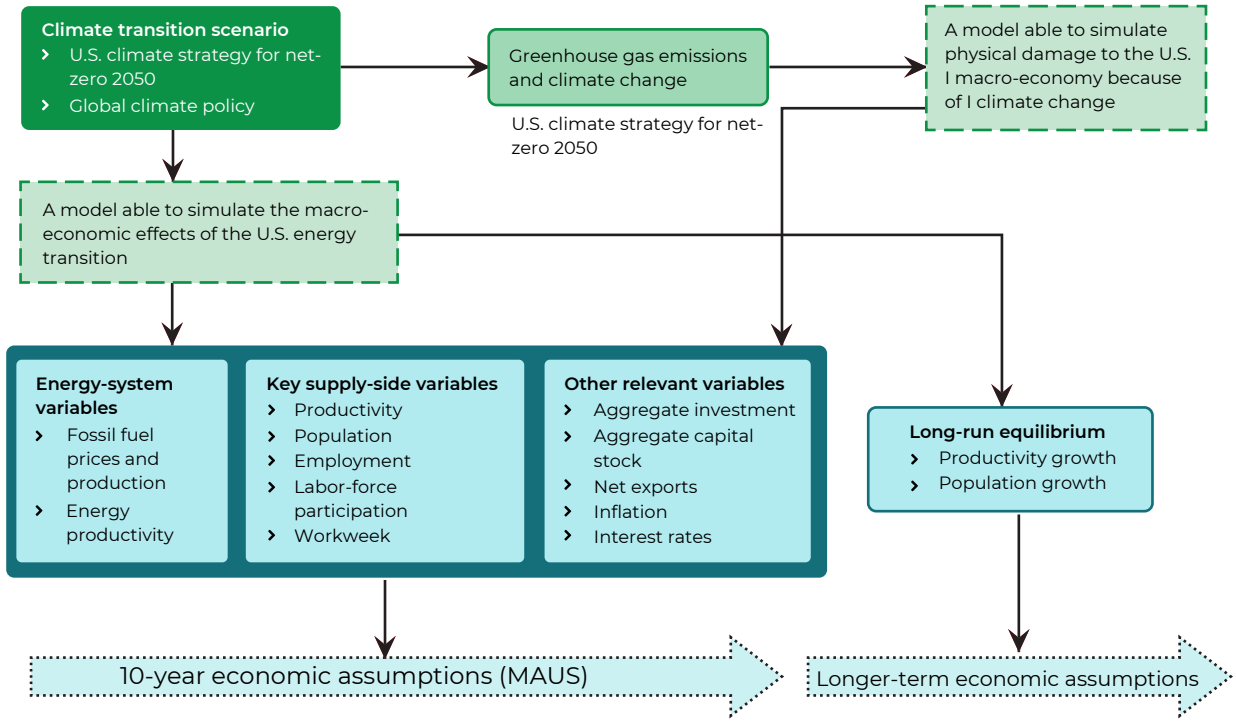


Figure 2: SAGE Regions

The general framework for modeling climate risks econometrically is summarized as follows:

Figure 4: Illustration of modeling framework able to integrate climate risks into the economic assumptions.



Note: Boxes with dashed outlines denote required modeling capabilities. Boxes with solid lines indicate input or output variables from modeling process

It is incumbent upon banks to extend budget thinking into stress scenarios...

The previous sections summarize how the administration is developing and pricing its climate policy. This thinking must be adopted by banks in order that they develop scenarios that are able to expose upcoming credit risks to their own loan books and balance sheets, with a view to building contingency plans to avoid the resultant liquidity shocks.

To do this, they will need to:

- Identify top-down industry-level impacts
- Decide on an approach to price these impacts nationally and regionally
- Detail any adaptations that are specified or implied by the transitional policies of industry
- Convert the pricing into a credit risk measure

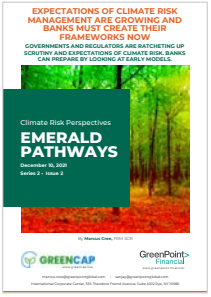
Once such a framework is built, transitional and physical costs can be attributed by applying a general top-down approach, but adjusting at the loan level according to investments/adaptations already made by the borrower.

While challenging, once built, climate risks could be calculated and reported alongside market, credit and liquidity risks, and included in the overall risk framework and appetites.

Building climate into banks' risk management frameworks has been covered in:

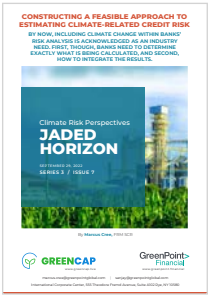
Avoiding bank liquidity risks arising from climate change

Expectations of climate risk management are growing and banks must create their frameworks now

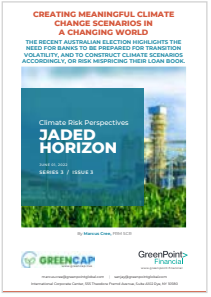


And climate scenario construction has been covered in:

Constructing a feasible approach to climate-related credit risk



Creating Meaningful Climate Change Scenarios in a Changing World



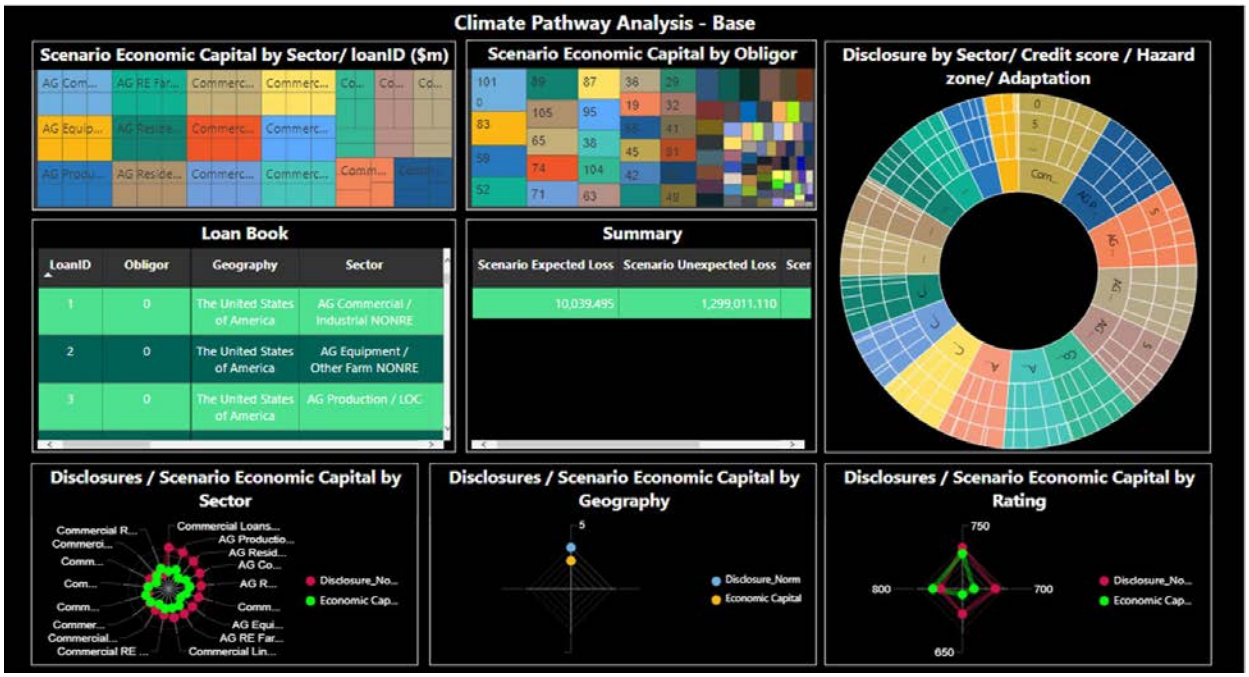
GreenCap can help...

GreenCap is a 'Risk as a Service' (RaaS) solution that gives banks the capacity to build meaningful climate scenarios that mirror multiple climate pathways and stress test their balance sheets.

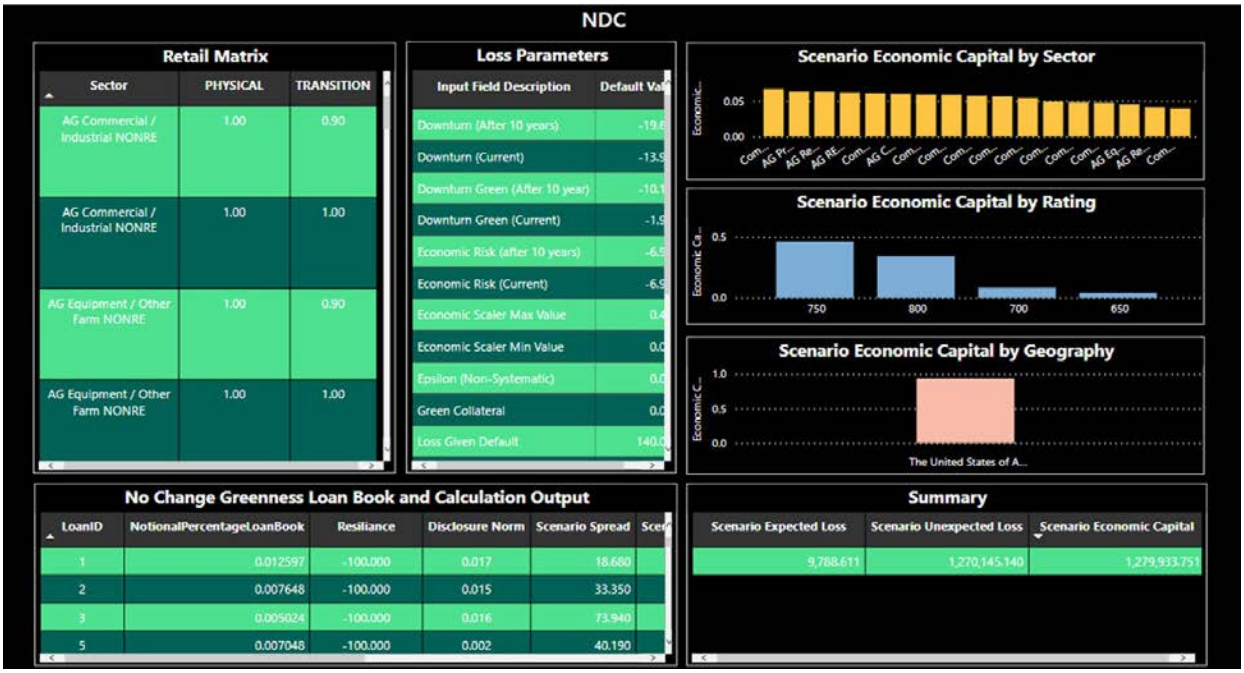
The results produced by the system include:

- Changes, by scenario, in borrower risk ratings
- Implied spreads, by loan, needed to make up borrower credit deterioration under each scenario
- Increases in economic capital, broken into expected and unexpected losses
- Analytics, targets and limits by industrial sector, geography or rating

GC main screen (retail - US latest)



GC scenario screens (US latest)



GreenCap is designed to fill the gap in risk frameworks that need deterministic climate stress tests in a way that can be transparently used by the risk governance committee to properly manage risks that climate change will create, both physical and transitional.

Visit GreenCap.live for more insights and resources, curated for use by banks aiming to add climate risk to their existing risk frameworks.

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 500 employees with a global footprint. Our production and management teams are in the US, 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 Nord, GreenPoint rigorously complies with ISO 9001:2015, ISO 27001:2013, and ISO 27701:2019 standards.

Marcus Cree

MANAGING DIRECTOR AND
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 studying 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 provides strategic and tactical guidance to GreenPoint senior management and serves as client ombudsman. His career in the financial services industry spans three decades during which he has held investment banking and C-level risk management positions at Royal Bank of Canada (RBC) 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" (Risk Books, 2018).

Sanjay was the Founding Director of the RBC/Hass Fellowship Program at the University of California at Berkeley and has served as an advisor and a member of the Board of Directors of UPS Capital (a Division of UPS). He has also served on the Global Board of Directors for Professional Risk International Association (PRMIA).

Sanjay 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. As well as being a regular speaker at conferences, Sanjay actively teaches postgraduate level courses in business and quantitative finance at EDHEC (NICE, France), Fordham, and Columbia Universities.