UNDERSTANDING THE KEY CHALLENGES AND OPPORTUNITIES IN CREATING CLIMATE TRANSITION PATHWAYS

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ABSTRACT

Climate change poses an interconnected set of risks to the economy, from both the transition to a new mix of renewable energy sources and the physical hazards driven by a warming planet. The complexity of the upcoming transition requires a systems-level approach that leverages the strengths of existing modeling tools, paired with a strategy built on proactively identifying gaps and silos in out-of-the-box analytical solutions. Liberty Mutual brings a unique view from the insurance space on breaking down modeling silos, pairing the physical implications of climate disasters derived from catastrophe and climate modeling along with macroeconomic studies based on research from the Network for Greening the Financial System (NGFS). This paper details the challenges presented by this current climate risk modeling environment and suggests practical strategies for making climate risk actionable as organizations plan their transition to a low-carbon future. We find a clear mismatch between the disparate and path-dependent energy transitions expected across global economies and common climate commitments found in the financial services sector, which risks unintended adverse effects in the speed and equity of the climate transition. Developing a holistic view of climate impacts that ties physical, economic, social, and biodiversity impacts together and places them at the point of decision-making is a strategy that is broadly applicable both within and beyond the insurance sector.

1. INTRODUCTION

In June 2017, at the direction of the Financial Stability Board and following an 18-month consultation, the Taskforce on Climate-related Financial Disclosures (TCFD) published its final report, "Recommendations of the Task Force on Climate-related Financial Disclosures." This report marked one of the first moments that financial services industry leaders and policy leaders came together to publicly and definitively acknowledge that the "warming of the planet caused by greenhouse gas emissions poses serious risks to the global economy and will have an impact across many economic sectors."[1]

Five years later, the financial services sector is increasingly aligned that climate change poses a threat to the global economy and that companies and countries must do their part to mitigate risk. However, the path forward is still unclear. Regulators and standards bodies are moving to require companies to publish comparable climate-related data, but there is not yet global alignment on what should be included in these disclosures. While TCFD has become a commonly leveraged disclosure framework, adopted by both companies and countries as the foundation for climate-related disclosures, European countries are generally pushing for expanded

[1] Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures, June 16, 2017 https://bit.ly/3eqGgG7

disclosures focused on the concept of "double materiality" – covering topics that are significant to a company's bottom line, as well as broader society. Amidst this debate, there is disagreement on how to calculate climate and emissions-related metrics and demonstrate progress. Though reporting and transparency are important components for lowering global emissions, it can also increase climate litigation risk for companies due to the problems with methodologies and models, and may drive maladaptation if that reporting is not grounded in meaningful risk measurements.

With the widespread adoption of TCFD and pressure for companies to commit to "net zero" emissions, companies are also expected to develop and publish climate transition strategies that detail how they intend to address climate as a systemic risk. While TCFD recommends that companies evaluate climate-related financial risk exposure through a climate scenario analysis exercise, TCFD guidance acknowledges that there is a not a single way to conduct this exercise. Consequently, investors and other stakeholders should be cautious when using the information to compare climate risk among peer companies. Today, companies are often only evaluating risks within their own portfolios, without taking into consideration the broader system impacts – or economic forces – that could affect a portfolio.

To address these challenges and better plan for Liberty Mutual's own energy transition, in 2021, Liberty Mutual conducted an enterprise-wide climate transition scenario analysis, combining both a systems-wide assessment and a portfolio-level assessment, to inform our own understanding of climate risk and energy transition strategy. We leveraged climate scenarios from the Network for Greening the Financial System (NGFS), a group of central banks and supervisors committed to sharing best practices, contributing to the development of climate- and environment-related risk management in the financial services sector and mobilizing mainstream finance to support the transition toward a sustainable economy.[2] NGFS, established in 2017, has a dedicated Workstream on Scenario Design and Analysis, which works in partnership with an academic consortium from the Potsdam Institute for Climate Impact Research (PIK), International Institute for Applied Systems Analysis (IIASA), University of Maryland (UMD), Climate Analytics (CA), ETH Zürich (ETHZ), and the National Institute of Economic and Social Research (NIESR) to develop timely and accurate scenarios, to provide a window into different plausible futures, and allow for better future planning.

Through Liberty Mutual's analysis of the NGFS scenarios and additional data, we found that given the assumption that a global common policy scenario is unlikely, regional policy coordination is the most viable path forward for reducing the financial cost of transition risks. This means that different economies will proceed through their energy transition from different starting points and may take different amounts of time along their respective paths.

As we have seen through Liberty Mutual's own research, working with clients on their respective transition strategies, and analyzing publicly available climate data and research, the reality is that there is no pragmatic path to "net zero" by 2050 for the global economy – yet. The steps required to transition to a low-carbon economy are complex. Existing climate data, research, and modeling can help companies develop science-based and proactive strategies for the next five to ten years with some certainty, but beyond that transition plans rely on technological breakthroughs, scalability, and behavioral changes. In order to better understand the future and develop more realistic strategies, we need to look beyond individual company commitments and analysis of individual portfolios and focus on implementing systems-level thinking and pragmatic policies that support the economy through the transition.

This paper unpacks the challenges with existing climate data and modeling, outlines recommendations for how business leaders should approach thinking about climate transition risk for their organizations, and through climate mitigation and adaptation strategies, ultimately create a realistic transition pathway.

2. THE PROBLEM: UNIFORM, SIMPLISTIC TOOLS ARE A POOR MATCH FOR COMPLEX AND INTERCONNECTED CLIMATE RISKS

2.1 No single tool captures system-level risks of climate change to the economy

With over a century of experience in underwriting global property and casualty risk, at Liberty Mutual, we rely heavily on data and modeling to help inform our understanding of risk. While climate scenarios and modeling are a good place to start to explore future weather patterns and physical catastrophes, existing technology anticipates future environmental and economic conditions with incomplete models.

[2] https://bit.ly/3EyqCmM

Climate modeling for the kind of extreme physical hazards that are most material to the insurance industry is still in the early development stage, and the reliability of climate data differs by peril, geography, and time horizon. While Liberty Mutual continues to invest in technology and academic research to improve modeling capabilities, we also think it is imperative to understand the strengths and limitations of the tools in place today.

The insurance industry uses three families of models to assess climate-related risks: 1) catastrophe models, 2) physical climate models, and 3) integrated assessment models (IAMs) – explained in further detail below.

- Catastrophe models, used by the insurance sector for decades to help price physical risks, are useful tools to measure the impacts or financial losses from catastrophic events. Catastrophe models are built primarily using historical statistical distributions that describe physical hazards, and, therefore, generally do not explicitly consider future climate considerations. Their strength lies in providing probabilities of extreme event occurrence assuming current climate conditions. Catastrophe models are only well developed for geographic areas and hazards where a large percentage of the population is insured against that hazard and are less developed in geographies with low amounts of insurance coverage. This limitation affects parts of the world that may be vulnerable to climate-driven catastrophes but have limited insurance availability and uptake.
- Climate models are largely physical models that represent the Earth system and help to understand the evolution of the system over different time scales (past, present, and future). Climate models do not measure the financial or economic impact of climate events. The efficacy of data from climate models is dependent on the projected time scale of interest (e.g., from present time to 2050) and the spatial resolution of the model's data (e.g., results from a specific model may be on a ~100-kilometer grid). More model uncertainty is introduced at shorter time horizons, where the overprint of natural variability is comparatively

Figure 1: Understanding climate data and models

	CATASTROPHE MODELS	CLIMATE MODELS	TRANSITION RISK MODELS
USE	To measure the impact or financial loss from physical risks and catastrophic events.	To understand the evolution of the system over different time scales (past, present and future).	To inform economic risks arising from the transition to a zero carbon economy.
INPUTS	Historical statistical distributions that describe physical hazards; do not explicitly consider future climate considerations.	Physical models that represent the Earth system and help to understand the evolution of the system over different time scales (past, present and future); do not measure the financial or economic impact of climate events.	Incorporates two different types of information: climate data that don't measure the financial and economic impacts of climate events, and economic data that leverage historical patterns to predict a future that will look different due to intensifying climate change impacts.
BENEFITS	Provides probabilities of extreme event occurrence assuming current climate conditions.	Can produce realistic future climate conditions.	Portrays plausible scenarios or pathways to transition the economy from a predominantly fossil fuel energy perspective to one incorporating new types of fuel sources.
LIMITATIONS	Only well developed for geographic areas and hazards where a large percentage of the population is insured against that hazard. They are less developed in geographies with a low amount of insurance coverage that could be susceptible to climate change.	Struggles to predict many of the extreme events that most impact the insurance industry (such as hurricanes and wildfires). These events occur on spatial scales that are too small to be "seen" in most climate models.	Risk of misinterpreting the output of the models when making portfolio-level decisions due to the highly simplified and backward looking representation of physical hazard impacts on the economy.

Note: Here integrated assessment models is referred to as transition risk models

more important, or smaller spatial scales, below the resolution of the model. Unlike catastrophe models, climate models can produce realistic future climate conditions, but they struggle to capture many of the extreme events that most impact the insurance industry (such as hurricanes and wildfires). These events occur on spatial scales that are too small to be "seen" in most climate models. To leverage climate models effectively, the insurance industry must approach these models with a sophisticated understanding of the uncertainty represented at the shorter time horizons and smaller spatial scales where our sector operates.

- Integrated assessment models (IAMs) are tools that can inform economic risks arising from the transition to a zero-carbon economy. IAMs incorporate two different types of information: climate data that do not measure the financial and economic impacts of climate events and economic data that leverage historical patterns to predict a future we know will look different due to intensifying climate change impacts. Their strength lies in portraying plausible scenarios or pathways to transition the economy from a predominantly fossil fuel-energy perspective to one incorporating new types of fuel sources. Integrated assessment models (IAMs) include simple representations of the climate system, which could potentially result in misunderstandings or misinterpretations of the relative risk between transition and physical climate risks. Due to the highly simplified and backward-looking representation of physical hazard impacts on the economy, interpreting integrated assessment models at face value potentially risks underweighting the potential impact of physical risks on the economy. In the absence of sufficient expertise to evaluate these complex families of models, financial institutions run the risk of misinterpreting the output of the models when making portfolio-level decisions. If used in isolation, depending on these models to predict what the world will look like in 15+ years may lead to results that cannot be fully relied upon for business and supervisory decision making.

In the longer term, effective climate risk management requires incorporating the strengths of each model – extreme events modeling from catastrophe models, the forward-looking perspective gained from physical climate models, and the economic risk modeling predicted by IAMs.

In the short term, however, the strengths and limitations of each tool must be respected to ensure data created by each model are not misunderstood or misinterpreted. Likewise, when allocating capital or making financial investment decisions, caution should be exercised when evaluating quantitative risk models based on current climate science and climate models. The data can be used to evaluate probable impacts on a range of financial outcomes, to inform appetites and thresholds for climate-related risks, and to build risk management frameworks based on exposure to and probability of different climate events. Climate risk management is most effective on the organizational level when it is integrated directly into the decision-making process. Enterprises should ask themselves, "at what point would a changing climate or economy affect our risk appetite or change a decision?" This method of reverse stress testing allows for a probabilistic approach to climate impacts that respects uncertainty while incorporating the best available science.

In comparison, the financial services industry's existing approach to long-term stress testing includes static models that only represent a specific moment in time – which is equivalent to implementing 1970 models to measure 2000- and 2020-time horizons. Traditionally, models have focused on stress testing individual portfolios over five-, 10-, and 15-year periods. Yet, for many financial companies this is not reflective of how we manage our business and is difficult to integrate directly in the decision-making and risk appetite process.

At Liberty Mutual, we are taking this all into consideration in our day-to-day risk management analysis and are actively working to improve data modeling in partnership with other academic and industry partners. Understanding what models can and cannot provide is crucial for developing realistic and comprehensive transition strategies.

2.2 Climate transition plans must account for varying realities

We understand that we need to build a dynamic approach to address climate change that considers tough trade-offs across a multitude of objectives (e.g., environmental, economic, and political). However, while the technology and data improve by the day, we are beginning to understand variables beyond just emissions mitigation that need to be included in climate strategies. One of these priorities is ensuring that the climate transition is just, not significantly and negatively impacting one population while improving another. Historically, this factor has not been a large part of the conversation because, as earlier

described, the models and tools used only offer a partial view of what will be required for an equitable transition to a low carbon future.[3] Existing models do not measure the true societal or community impacts of climate change, failing to account for the trade-off of pursuing emissions reductions, the social impacts of climate change, and the challenges entities face when operating across jurisdictions with different laws and behaviors.

Furthermore, the financial services industry is just beginning to understand the interrelated nature of climate change and environmental and social impacts – recognizing that climate change impacts more than energy use and carbon emissions – and is closely connected to biodiversity, oceans, land use, and the depletion of natural resources. In fact, until recently, biodiversity and nature-related risks had been largely overlooked in climate risk calculations and solutions. For example, the increase in the use of solar panels is an overwhelmingly positive example of renewable energy, but the mining for panel materials and land use of solar farms presents dangers to biodiversity that many did not anticipate.[4] As such, we will have to consider the benefits of increasing solar energy output compared to the costs of biodiversity loss – and how to account for this in emission taxonomies.

The transition to electric vehicles (EVs) is another example of how a transition to a lower carbon economy can potentially promote exclusionary behaviors. Without policy action to lower the cost of EVs and to ensure affordable and accessible EV charging solutions, an abrupt move to EVs would impact lower income and financially vulnerable communities who do not have the means to take on these additional costs.

Figure 2: Selecting scenarios from the Central Banks and Supervisors Network for Greening the Financial System

Informed by existing tools and methodologies, we opted to develop our own approach to climate scenario analysis, leveraging the scenarios published by the Central Banks and Supervisors Network for Greening the Financial System (NGFS).

NGFS comprises leaders within the financial sector working to establish industry standard practice for climate risk stress testing and more broadly on transition risks overall. NGFS's climate scenarios provide a common reference point for understanding how climate change, climate policy, and technology trends could evolve.

Liberty Mutual opted to move forward with this framework for several reasons:

INDUSTRY RELEVANCE

As of February 2022, NGFS is a group of 108 members and 17 observers, including a number of central banks, committed to sharing best practices, contributing to the development of climate- and environment-related risk management in the financial sector and mobilizing mainstream finance to support the transition towards a sustainable economy.

TIMELINESS OF INSIGHTS

NGFS scenarios are updated in a timely manner. The first dataset was released June 2020 (v1.0) and has been updated twice since then in June of 2021 (v2.0) and September of 2022 (v3.0). Information in this analysis is based off data from v1.0 and v2.0.

ACADEMIC BACKING

NGFS is supported by an academic consortium from the Potsdam Institute for Climate Impact Research (PIK), International Institute for Applied Systems Analysis (IIASA), University of Maryland, Climate Analytics and Swiss Federal Institute of Technology in Zurich.

USED BY REGULATORS

The NGFS Framework provides a common reference point for prudential regulators and informs oversight of climate-related risks in different markets.

SUPPORT FROM NGOs

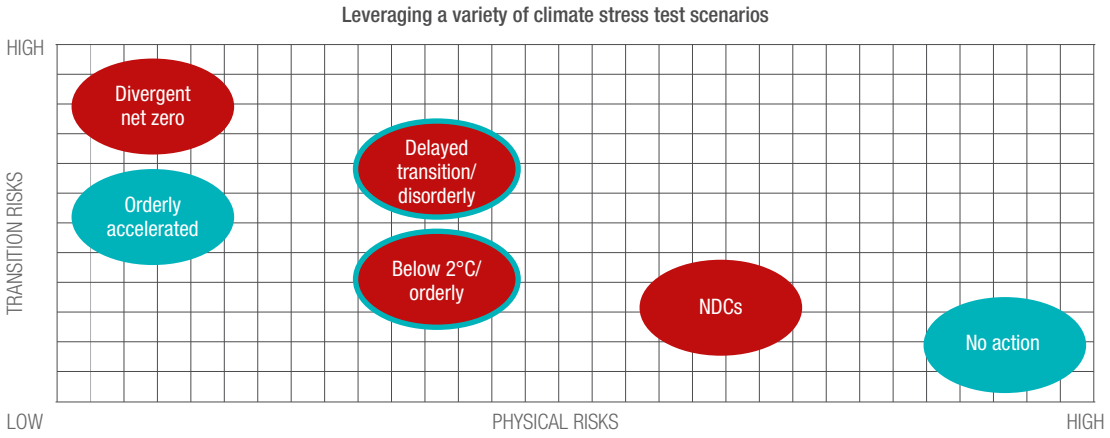
It is backed by Bloomberg Philanthropies and other organizations with a track record for helping establish industry standards and developing innovative tools to advance climate action across the financial sector.

[3] Liberty Mutual TCFD Report, 2021

[4] Dunnett, S., 2022, "Does renewable energy efforts threaten efforts to conserve biodiversity on land?" Carbon Brief, 2022, March 2, https://bit.ly/3rN2RQ5

Strategies need to consider how communities may be alienated by transition efforts. Risks to socioeconomic factors[5] like food security, livelihood security, water security, environmental health, and cultural identity are compounded by climate change. Globally, some of the most vulnerable communities are currently facing disruptions in agriculture that greatly affect their food supply as well as disruptions and damage to water quality due to contamination after heavy rain. Communities face these challenges while simultaneously dealing with extreme weather events. If we continue to ignore geopolitical risk and social impacts of climate change, we will not achieve real progress or synchroneity in the climate transition.

Figure 3: Leveraging a variety of climate stress test scenarios



Graph adapted from NGFS scenario framework[6]

Systems-level analysis scenarios

BELOW 2°C

- Assumes net zero CO_2 emissions by 2070 and limits warming to 1.7°C.
- Assumes that globally coordinated climate policies are introduced immediately, resulting in relatively low physical and transition risks.

DIVERGENT NET ZERO

- Assumes net zero CO_2 emissions by 2050 and limits warming to 1.5°C.
- Assumes considerably high transition risks, due to quickened energy transition pace and policy variation, but overall results in the lowest physical risks.

DELAYED TRANSITION

- Assumes global annual emissions do not decrease until 2030 with strong policies needed to limit warming to below 2°C.
- Assumes new climate policies are not introduced until 2030 and the level of policy action differs across countries and regions.

NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)

- Assumes continued progress towards a moderate climate ambition resulting in a steady decline in emissions and warming of ~2.5° to 3°C.
- Assumes moderate to severe physical risks.

Portfolio-level analysis scenarios

ORDERLY

- Assumes climate policies are introduced early and become gradually more stringent. Net zero CO_2 emissions are achieved before 2070, giving a 67% chance of limiting global warning to below 2°C.
- Low transition and physical risk as a result.
- Significant investment is needed to transition to a carbon neutral economy.

ORDERLY ACCELERATED

- CO_2 emissions need to reach net zero around 2050 to limit global warming to 1.5°C with a 67% chance.
- This emissions reduction is much more rapid than the Orderly scenario, leading to higher transition risks.

DISORDERLY

- Assumes climate policies are not introduced until 2030.
- Since actions are taken relatively late and limited by available technologies, emissions reductions need to be sharper than in the Orderly scenario to limit the warming to the same target.

NO ACTION

- Assumes only currently implemented policies are preserved.
- Nationally determined contributions are not met; emissions grow until 2080 leading to 3°C warming.
- Severe physical risks (e.g., irreversible sea level increase).

[5] World Bank, "Social dimensions of climate change," https://bit.ly/3Cmsyfr
[6] The NGFS Climate Scenarios, https://www.ngfs.net/ngfs-scenarios-portal/

2.3 Climate planning must include a clear understanding of systems-level climate action

While many companies are turning to private sector solutions for climate scenario analysis, Liberty Mutual found that the NGFS scenarios portal[7] provided a clearer and more customizable insight into what a plausible future might look like.

NGFS uses a collection of data (economic, climate, energy, agricultural) to design a set of transition scenarios in partnership with climate experts and economists. The scenarios provide reference points for understanding climate change with consideration of upcoming policy and technology trends – as well as the various ways these trends could evolve in the future. This type of analysis is critical for helping diagnose the climate challenge and develop solutions that are fit for purpose. Businesses can leverage scenarios published by NGFS to help inform their climate strategies. These scenarios outline a range of high and low physical and transition risk outcomes.

Ultimately, analysis of the scenarios reveals that a common approach to global policy action is unlikely.

Transition goals and timelines already differ by country, meaning we can expect varying policy goals to arise at different time horizons. The pace and shape of policy development is informed by the energy and carbon intensity of the corresponding sector and region, as well as the current energy mix. This sets up different economic realities by region, as some areas rely more heavily on carbon-intensive fuels today, or may choose to skip intermediary steps in the energy transition, moving from coal or oil directly to renewables, perhaps bypassing gas. Divergent, regional energy transition pathways will impact the type of preferred renewable investments and strategy, further challenging a one-size-fits-all approach to decarbonization. Coordination, not commonality, of policy action will reduce negative economic impact.

Through Liberty Mutual's analysis of the NGFS scenarios and related research, it is clear that different countries and regions are on unique climate transition journeys. Efforts like the Inflation Reduction Act (IRA) – a move by the U.S. to invest in clean energy[8] to help meet Paris Agreement goals – represents a glimmer of hope in unifying climate change action. Although the IRA will have positive effects beyond the U.S., more action is still needed to drive synchronized climate action globally.

However, we anticipate the lack of coordinated policy approaches to continue. This will challenge companies, who will need to design their own transition pathways to meet differing economic realities, resulting in increased reputational risk from stakeholders who prefer commonality over a coordinated approach.

3. IMPLICATIONS AND PATH FORWARD

3.1 Climate commitments could potentially lead to unintended consequences absent a more fulsome understanding of system-level impacts

In today's environment, where climate science is urging the need for action, outside of the macro policy decisions that are needed to change systemic risk, companies are announcing individual steps in reducing emissions for their businesses. However, the commitments are being made at a time of significant uncertainty in terms of the path forward and when tools are not fully developed.

As society's understanding of climate and environmental impacts is still in its infancy and will continue to evolve, there are real dangers in labeling economic activities in a binary manner of being "green", which are considered low-carbon and resilient activities, or "brown", which are activities traditionally reliant on fossil fuels and other harmful materials. We should be wary of claims of zero emissions activities or products, particularly when those net zero targets are achieved through carbon emissions offsets with a decidedly mixed track record of efficacy. All economic activities have shades of brown and green. It is dangerous for us to start classifying economic activities without first fully evaluating the activities and products from the perspective of the activity's full lifecycle.

[7] https://bit.ly/3TfUVm2
[8] PBS News Hour, "What the Inflation Reduction Act does for green energy," August 2022

Differing time horizons present an ongoing challenge for companies as they attempt to define commitments and launch transition pathways. Regions are at varying stages of the energy transition, with countries making climate decisions based on the needs of their own economies and regulatory environments. Attempting to apply globally what may work in one region could undermine other jurisdictions' approaches to the energy transition and potentially lead to legal and regulatory concerns.

Despite these challenges, many of the world's most powerful businesses and governments have set climate targets and produced strategies to decrease their emissions. The consequences of this disjointed approach are already emerging. This past spring, the Net Zero Asset Owner Alliance,[9] a U.N.-convened member-led initiative of institutional investors committed to transitioning their investment portfolios to net zero GHG emissions by 2050, consistent with a maximum temperature rise of 1.5°C., asked that a slight lag be tolerated when it comes to members' decarbonization goals, given the widening gap between climate science and realistic economic pathways.

3.2 Now is also the time to invest in climate adaptation for our communities

As noted in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report,[10] even with drastic emissions reductions, we are already seeing an increase in the frequency of extreme weather events, and there are unavoidable impacts of our warming planet affecting our risk today and in the future. According to the National Oceanic and Atmospheric Administration (NOAA),[11] the 2021 Atlantic hurricane season was the third most active in history with 21 named storms, including several that produced economic losses that exceeded U.S.$1 billion. Alongside the need for increased disaster funding, we must also take critical steps today to build more resilient communities and invest in climate adaptation.

Like climate mitigation, climate resiliency and adaptation will take a mix of public policy and private investment, and innovative collaboration across sectors and industries. From local elected officials to store managers, teachers to insurance agents, everyone has a responsibility to contribute to climate resiliency. This can mean leading the charge on stricter building codes and ensuring that all infrastructure is designed to better withstand extreme weather – and in turn making sure that our families and communities are safer and more resilient. For those debating the high costs of disasters, we know that investments in communities now prevent bigger bills later, after disaster strikes. The National Institute of Building Sciences notes that adopting the latest building code requirements can save $11 for each dollar invested and add only 1 percent to construction costs.[12]

3.3 Coordination across the public and private sectors is key for meaningful climate action

The global financial sector's current approach to addressing climate change will not meaningfully solve systemic climate risk. Today, companies look at climate impacts at the company portfolio level, but we need to recognize that reducing climate risk at the individual company level does not address climate impacts at the system level – particularly when it comes to physical damage and threats.

Widescale change will require radical collaboration across industries and sectors. At Liberty Mutual, we continue to see the importance of public-private collaboration and discussion. In late 2021, we engaged public sector and private sector leaders for a half-day workshop, in partnership with NOAA. These discussions reiterated the potential for public-private collaboration across a number of issues: including better data and modeling, a better understanding of climate hazards, and continuing to educate communities on the importance of climate resiliency. Following the workshop, we continue to invest in our relationship with policymakers, researchers, and the public sector.

As there is not a common policy approach to reducing carbon emissions across the globe, it will be important for corporate leaders to engage with government leaders across local jurisdictions – and to work towards industry transformation, not just individual business goals. For many, this will be a diversion from traditional business strategy, but it is the only way to achieve true global coordination toward a low-carbon economy.

[9] Marsh, A., 2021, "Net zero asset managers fall short of targets set by scientists," Bloomberg, November 10, https://bloom.bg/3Mr7Xva
[10] IPCC, 2022: Climate change 2022: impacts, adaptation, and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)], Cambridge University Press
[11] NOAA 2021 Atlantic Hurricane Season Summary Table, 2022, https://bit.ly/3g2IGwl
[12] NIBS, 2019, "Natural hazard mitigation saves," https://bit.ly/3MCSUP7

4. CONCLUSION

There are many actions that will aid in the transition to a low-carbon economy – from promoting resiliency and adopting behaviors that reduce systemic climate risk to building products that support them. Yet, we must recognize that progress will not happen in a linear manner.

We need to implement systems-level thinking and pragmatic policies that support the economy through the transition. As we have seen, oversimplifying the issue has led to a binary way of thinking that fosters backlash. We must instead acknowledge the complexity and nuance that the transition will require. We also need to develop and learn from models that recognize this complexity, coordinate across sectors and geographies, and allow for varying pathways and shifting realities.

True progress will be patchy – at times moving at warp speed due to technological revolution, and at other times moving more slowly. Moreover, as much as one might like to pick winners and losers today, we do not know if the "winners" of today will make it through the finish line in 2050 and beyond.

As with any great change, we must assess new information, challenge our strategy, and be open to new possibilities. While the road to climate transition will not be easy, with strong coordination and alignment on the macro insights we can implement over long-term periods, there is a real opportunity for us to better drive sustainable change.