BSR Climate Scenarios

A tool to drive resilient business strategy

September 2022

BSR

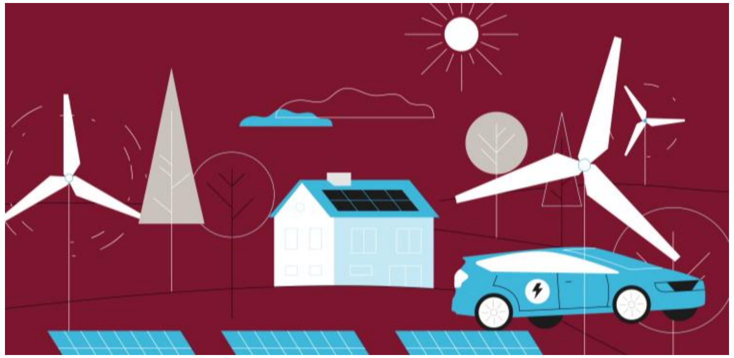
Executive Summary

Businesses are using climate scenario analysis to identify climate-related risks and opportunities, enhance strategic resilience, and respond to burgeoning climate risk disclosure requirements. To support these efforts, BSR has developed three extended climate scenario narratives built on the Network for Greening the Financial System (NGFS) climate scenario framework and corresponding datasets. BSR's scenario set provides expanded and more holistic business-relevant narratives with decade-by-decade accounts of plausible socioeconomic, political, and technological developments, grounded in the NGFS data.

The three scenarios are:

Current Policies

Only currently implemented policies (as of 2020) were preserved. Absent ambitious government or business action, emissions are on track to reach at least 3.3°C of warming by 2100.



Net Zero 2050

The transition to a net-zero economy required drastic and coordinated global action, particularly in the 2020s. The cost of action was high but warming peaks at 1.6°C in 2050 then declines to 1.5°C by 2100.

Delayed Transition

After a decade of inaction, a set of uncoordinated and stringent policies were adopted in the 2030s to rapidly halt greenhouse gas (GHG) emissions. This approach came at high social and economic costs but ultimately held warming to a peak of 1.8C by 2050 and 1.7C by 2100.

While each scenario features increasing physical risks from climate change over the next 15 years, those diverge significantly thereafter—with radically different outcomes over the long term. Ambitious climate action is able to moderate physical risk over time. However, the scenarios also make clear that delayed action significantly increases both physical and transition risks for business and society.

This document provides the extended narratives, along with more information on climate scenarios, their role in sustainability reporting, and how to best use them.

Table of Contents

1. Background Information

    About Climate Scenario Analysis

    NGFS Scenarios Framework

2. Climate Scenario Narratives

    Current Policies

    Net Zero 2050

    Delayed Transition

3. Physical Impact and Transition Data

4. Appendix

    About BSR

01

Background Information

About Climate Scenario Analysis

The Case for Climate Scenario Analysis

Climate scenarios analysis can help organizations:

1

Identify and assess **climate-related risks and opportunities** and stress-test **business strategies** against plausible futures.

2

Enhance **strategic conversations** by challenging business-as-usual assumptions and considering novel, disruptive developments.

3

Promote **collaboration among internal stakeholders** through shared discussion of key drivers reshaping the external operating environment.

4

Create more robust business strategies and financial planning by identifying management actions that are robust across a wide range of plausible climate futures.

5

Improve strategic agility by establishing indicators to monitor the changing business environment and rehearsing responses to disruption in advance.

6

Meet disclosure requirements and requests from investors and other stakeholders for information on climate-related risks and opportunities, and the resilience of its business strategy.

Climate Scenario Analysis in Financial Reporting

The Task Force on Climate-Related Financial Disclosures (TCFD) recommends that companies undertake climate scenario analysis to test and disclose the resilience of their business strategy. Many jurisdictions are developing climate-related disclosure rules and standards, often in line with the TCFD recommendations.

Task Force on Climate-Related Financial Disclosures

The **TCFD recommendations** specify that disclosure of this analysis will assist investors, underwriters, insurers, and other stakeholders to better understand:

- "the degree of robustness of the organization's strategy and financial plans under different plausible future states of the world;
- how the organization may be positioning itself to take advantage of opportunities and plans to mitigate or adapt to climate-related risks; and
- how the organization is challenging itself to think strategically about longer-term climate-related risks and opportunities."

Mandatory Reporting

In their climate-related financial disclosure rule and standard, **the US Securities and Exchange Commission** and the **European Commission** prioritize the use of climate scenario analysis to identify and assess climate-related risks and opportunities and test the resilience of business strategies to climate change.

The Climate-Related Disclosures Standard of the **International Sustainability Standards Board** (ISSB) also includes climate scenario analysis as a key assessment tool.

NGFS Scenarios Framework

Benefits of the NGFS Scenario Framework

A range of third-party climate scenarios are publicly available. Most of these are narrowly focused, explore only transition or physical risks, and are based on assumptions not always relevant for the business community. BSR chose the Network for Greening the Financial System (NGFS) scenarios as the foundation for this set of climate scenarios for several reasons:

NGFS
Central Banks and Supervisors
Network for Greening the Financial System

The scenarios were derived from multiple **reputable climate models** by the Potsdam Institute for Climate Impact Research, the University of Maryland, and the International Institute for Applied System Analysis, among others.

They were developed with reference to the TCFD recommendations and are suitable for all sectors, not just finance, to undertake climate scenario analysis in line with the recommendations.

They integrate **both physical *and* transition risks into the same set**, with shared assumptions and parameters.

They are accompanied by **substantial supporting documentation** and are regularly updated.

The NGFS approach allows for **the exploration of a broad range of temperature pathways as well as different assumptions** that better reflect the uncertainty of future conditions, and guards against model bias.

Scenario analysis results using the NGFS framework represent **aggregate sectors and markets** and can be a guide to assess individual company risks.

NGFS Scenario Framework

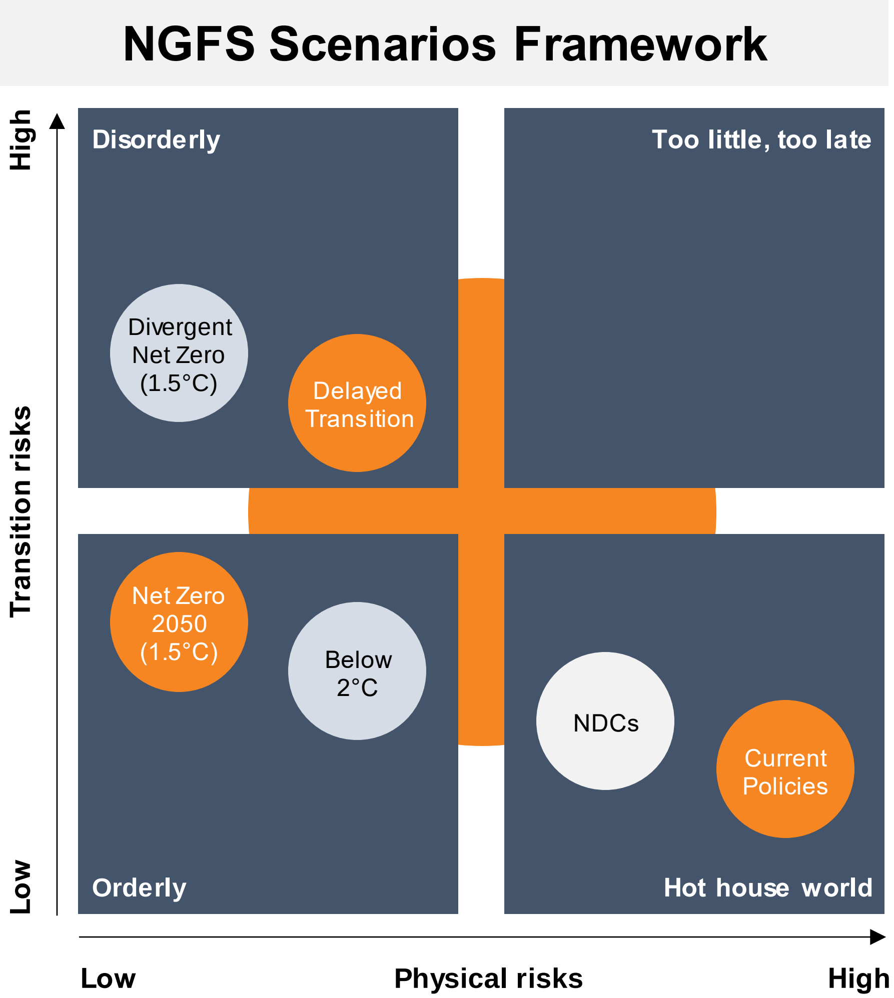
The NGFS scenarios were developed to provide a common starting point for analyzing climate risks to the economy and financial system. They represent a global, harmonized set of transition pathways, physical climate impacts, and economic indicators. The framework describes three types of climate scenarios:

- **Disorderly** scenarios explore higher transition risk due to policies being delayed or divergent across countries and sectors. Carbon prices are typically higher for a given temperature outcome.

- **Orderly** scenarios assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.

- **Hot house world** scenarios assume that some climate policies are implemented in some jurisdictions, but global efforts are insufficient to halt significant global warming. Critical temperature thresholds are exceeded leading to severe physical risks and irreversible impacts like sea-level rise.

BSR has extended the narratives of one of each type of scenario: **Net Zero 2050**, **Delayed Transition**, and **Current Policies.** It has also highlighted **business-relevant data points** from the NGFS datasets that help quantify the physical and transition risks in each scenario.



Source: NGFS Climate Scenarios Database Technical Documentation V2.2 (June 2021)

Building BSR's Climate Scenario Narratives

BSR's extended scenario narratives are holistic, qualitative depictions of plausible futures that explore socioeconomic, technological, and policy considerations. Grounded in the NGFS scenario framework and accompanying data, they were designed to provide companies with a broader view of business-relevant transition and physical risks. BSR developed them using the process below:

In consultation with an interdisciplinary group of internal and external experts, **identified key topics** that would broaden the scope and increase the business relevance of the original NGFS scenarios.

Researched trends that would drive the evolution of these business-relevant topics, and brainstormed plausible pathways for each topic under each scenario, aligned with the parameters established by NGFS data.

Wrote an expanded narrative for each scenario, supplementing it with content that was drawn from NGFS supplemental documents.

Extracted data from the NGFS IIASA Scenario Explorer and NGFS CA Climate Impact Explorer, with a particular focus on the most relevant variables for each scenario (e.g., include information on risk from high carbon pricing in scenarios where carbon price is expected to be higher).

Note: All qualitative content in this scenario set was added by BSR, while all quantitative content is derived from the NGFS datasets. Qualitative content is BSR's interpretation of how key topics might plausibly evolve across each scenario, grounded in the NGFS data and assumptions.

Considerations When Using These Scenarios

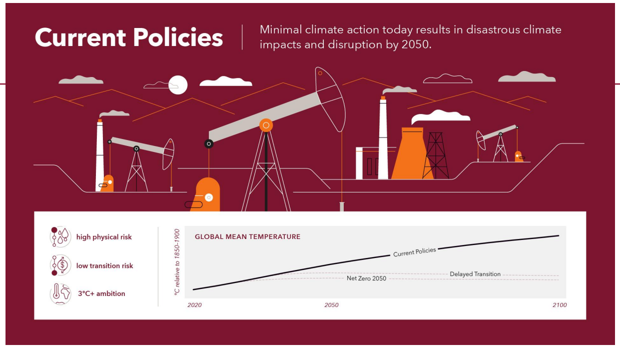
Scenarios are an important strategic tool that enable the **exploration of how multiple drivers of change may interact and converge to shape the future in different and unpredictable ways**.

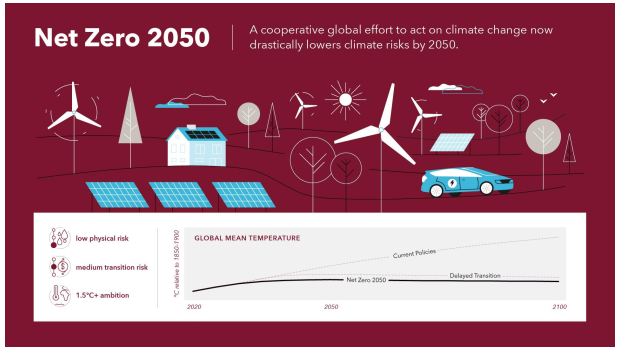
When using these scenarios, it is important to remember:

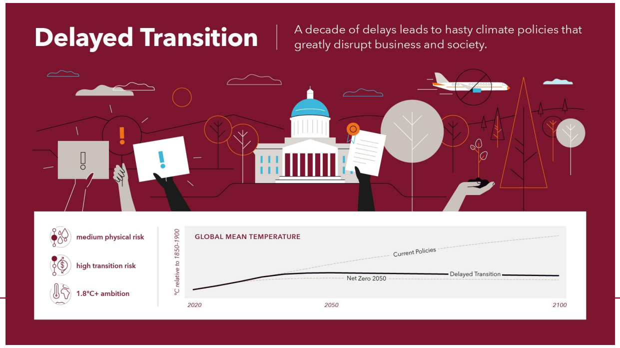
The scenarios are hypothetical constructs that depict a set of different plausible climate-related futures that will impact the operating context of business.

Although grounded in NGFS data, **the scenarios are not intended to predict** a single "most likely" future. Rather, they offer a complementary approach to forecasting, one that enables the exploration of highly uncertain future possibilities.

These scenarios use **broad descriptions to holistically describe plausible futures** based on the available climate data. **Not all topics are included in each decade** of each scenario. Instead, the scenarios highlight the defining topics and developments in each decade.







How to use these scenarios

Use the scenario set to test your strategy, challenge assumptions, uncover blind spots, and identify additional actions to address climate-related risks and opportunities. Resilient strategic ideas are those that work across most or all scenarios.

Taking each scenario in turn, ask:

- If this scenario were to transpire, **what would be the impacts on our business?**
- **What new challenges and opportunities would be created**, and are we prepared for these?
- **Are there any strategic moves** that we can make that would position the business to thrive across all the scenarios?

Be sure to **give equal consideration** to all three scenarios rather than trying to choose “the most likely” scenario. History is full of unlikely scenarios causing great disruption. Scenario analysis provides an important opportunity to ask “what if” questions.

Discuss the scenarios among a diverse group of internal stakeholders because no individual expert has a complete view of the emerging future.

Consider drawing from the NGFS datasets to add additional data and further contextualize and tailor the scenario narratives to your organization and industry.

Given that the scenarios take a global view, **consider the specific policy changes in your region** that may impact your operating context, and explore the regional data available in the NGFS datasets.

BSR can help your organization use these scenarios in a variety of ways, including informing strategy processes; conducting a TCFD-aligned scenario analysis; stress-testing plans, assessments, and targets; and designing more transformative and foresightful industry collaborations. For more information, please contact Ameer Azim (aazim@bsr.org)

02

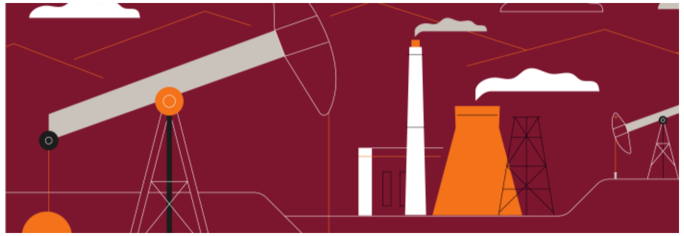
Climate Scenario Narratives

NGFS Assumptions Table

	Current Policies	Net Zero 2050	Delayed Transition
Physical Risk	High physical risks	Low physical risks	Medium physical risks
Transition Risk	Low transition risks	Medium transition risks	High transition risks
Policy Ambition	3°C+	1.5°C	1.8°C
Policy Reaction	None–continuation of 2020 policies	Immediate and smooth	Delayed
Technology Change	Slow	Fast	Slow then fast
Carbon Dioxide Removal	Low use	Medium use	Low use
Regional Policy Variation	Low	Medium	High

Scenario descriptions based on the NGFS scenarios framework as well as data from NGFS Climate Impact Explorer and NGFS IIASA Scenario Explorer.

Overview of the 3 Scenario Narratives



Current Policies

Only currently implemented policies (as of 2020) were preserved. Absent ambitious government or business action, emissions grew rapidly. Warming reached 2°C by 2050 and as a result, physical climate impacts increased in severity and frequency. The world was on track to see at least 3.3°C of warming by 2100. Large-scale and increasingly persistent physical changes became more disruptive, including sea-level rise, desertification, and ecosystem collapse. With society facing chronic disasters, global attention turned to adaptation. Competition over resources and destabilizing inequality compounded global tensions.

Net Zero 2050

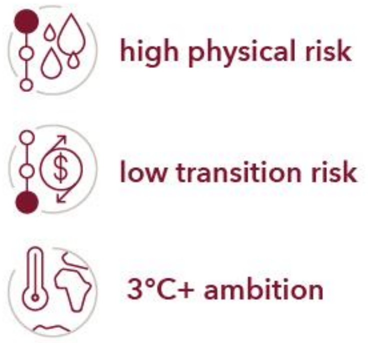
The transition to a net-zero economy by 2050 required drastic and coordinated global action, particularly in the 2020s. The cost of this action was high because many industries were severely disrupted and the job market shifted. Changing consumer preferences and policy action was backed by a wave of green tech, including high use of carbon capture and storage, high levels of transparency (and even surveillance), and changes in global regulatory institutions. Warming peaked at 1.6°C in 2050. With the debate on when and how to act over, climate justice, reskilling programs, and international climate reparations rose to the top of the agenda.

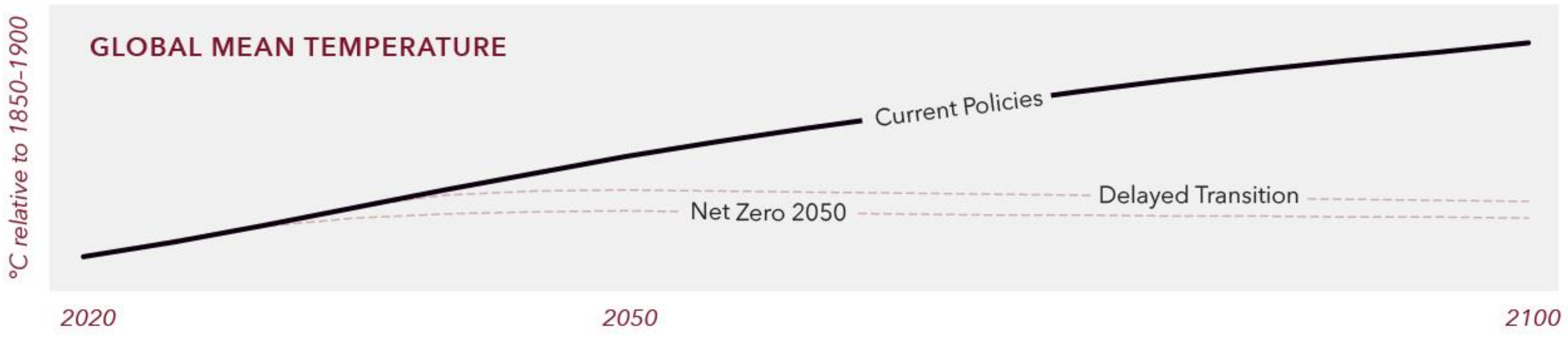
Delayed Transition

A decade of inaction in the 2020s drove mounting pressure for climate action. What followed was a set of hasty and reactionary government policies in the 2030s that sought to rapidly halt GHG emissions and make up for lost time. Businesses faced significant transition risks, including mandates to rapidly reduce emissions. The disorderly approach came with high social and economic costs but ultimately led to a halving of emissions by 2040 and peak warming at 1.8°C by 2050. By mid-century, the cost of the energy transition began to have a lessened impact on economies, and governments were able to shift attention to investing in social programs and revitalizing sectors affected by climate policies.

Current Policies

Minimal climate action today results in disastrous climate impacts and disruption by 2050.





Current Policies

Minimal climate action today results in disastrous climate impacts and disruption by 2050.

The View from 2050

Only currently implemented policies (as of 2020) were preserved. Absent ambitious government or business action, emissions grew rapidly. Warming reached 2°C by 2050 and as a result, physical climate impacts also increased in severity and frequency. The world was on track to see at least 3.3°C of warming by 2100. Despite this, investment in decarbonizing the global energy system remained slow, with limited investments in energy efficiency and continued exploitation of fossil fuels.

Large-scale and increasingly persistent physical changes became more disruptive, including sea-level rise, desertification, extreme weather patterns, and ecosystem collapse. Competition over resources and destabilizing inequality compounded global tensions. With society facing continuous climate disasters, global attention turned to adaptation. In many cases, the wealthy were able to invest in adaptation and related technologies, while most of the world endured challenges.

- 3°C+ policy ambition
- None—continuation of 2020 policies
- Slow technology change
- Low use of CO_2 removal
- Low regional policy variation

The 2020s: What Defined the Decade

Geopolitical tensions undermine climate action | Paris Agreement collapses | Energy system largely unchanged

- **Climate action stalled out** in the 2020s. Many commitments in place failed to be met, especially reductions of Scope 3 emissions, and new commitments lacked sufficient ambition and implementation.
- The absence of meaningful policy measures **slowed investment in renewables,** contributing to fuel poverty and growing energy costs**.** Progress on reducing emissions of hard-to-abate sectors slowed.
- In the first half of the decade, the priority was containing COVID-19, Russia's invasion of Ukraine, and the economic fallout from these events. The public and governments were largely preoccupied with **volatile oil and gas prices, broken supply chains, and inflation**.
- These years also saw an **intensification of nationalism, trade wars, and geopolitical fracturing**.
- Tensions between China and Russia and the West undermined cooperation on climate action, making it nearly impossible to increase ambition or hold the largest emitters to account.
- Geopolitical instability led governments to prioritize **energy security through domestic production** and was used to justify continued use of fossil fuels.
- Landscape initiatives for managing climate and nature risks at the subnational political level were deprioritized. Multinationals acquired more production area with minimal oversight or respect of Indigenous land rights.
- **Climate disasters hit much of the global population;** however, this did not lead to action but, rather, **finger-pointing and competition.** Governments provided **band-aid approaches** rather than investing in systemic solutions. Companies tried to stabilize their operating context with industry collaborations.
- Toward the end of the decade, there was a flurry of disruptive activism targeted at fossil fuel projects, political leaders, and the finance sector.
- By the end of the decade, **the Paris Agreement had effectively collapsed,** with no means to increase ambition or hold countries to account on previous commitments. **Pledges to halt deforestation and protect biodiversity also collapsed**.

Current Policies

Roughly 55 million hectares of forests were lost in the 2020s.

The 2030s: What Defined the Decade

Shift to adaptation | Rising nationalism | Climate impacts accelerate (from mid-decade)

- As climate damage increased, developed economies shifted attention to ad hoc, **region-specific adaptation measures** leading to growth of the "adaptation economy." Low-income communities received little investment and faced worsening climate and economic shocks, exacerbating existing inequities and driving financial strain.
- The international **debate on the responsibility to finance adaptation in developing countries** hit a wall. Prior commitments from developed countries to do so were largely abandoned.
- **Corporate investment in natural capital focused on continuity of supply**, with limited regard to approaches that focused on creating co-benefits for communities and nature.
- In the absence of a carbon price or meaningful climate finance, **emerging markets forged ahead with high emitting projects**, fueling further warming.
- Technological approaches and human-engineered infrastructure was the primary means of adaptation. **Adaptation technologies become a key economic advantage** and were not openly shared.
- The **overreliance on technology for adaptation, without structural changes** such as the greening of the grid, led to increased emissions, exacerbating the challenge.
- Increasingly severe climate shocks and impacts to livelihoods drove the movement of **climate refugees.** Nations shunned responsibility and nationalistic sentiments increased.
- Climate impacts on ports and trade routes, especially coastal commercial hubs in China and Southeast Asia, led to **ongoing supply chain disruptions, loss of redundancy, trade wars, and overall increased cost of goods**.
- Biodiversity and topsoil loss, and the decline of watersheds contributed to a decline in crop quality and yield, driving food insecurity. Agricultural innovation and automation increased rapidly, including **genome modification, lab-grown food, and controlled-environment agriculture**.
- By the end of the decade, heat stress begun to significantly impact worker productivity, especially outdoors. Automation was used to maintain productivity levels, leading to increased worker displacement.

Current Policies

- Yearly GDP loss from climate damage increased from US$1.1 trillion in 2030 to US$2.3 trillion by 2040.
- Damage from hurricanes in the US increased 13% by 2040, compared to 2020 levels.

The 2040s: What Defined the Decade

Destabilizing inequality | Mass migration | Compounding global tensions | Systems on the brink of collapse

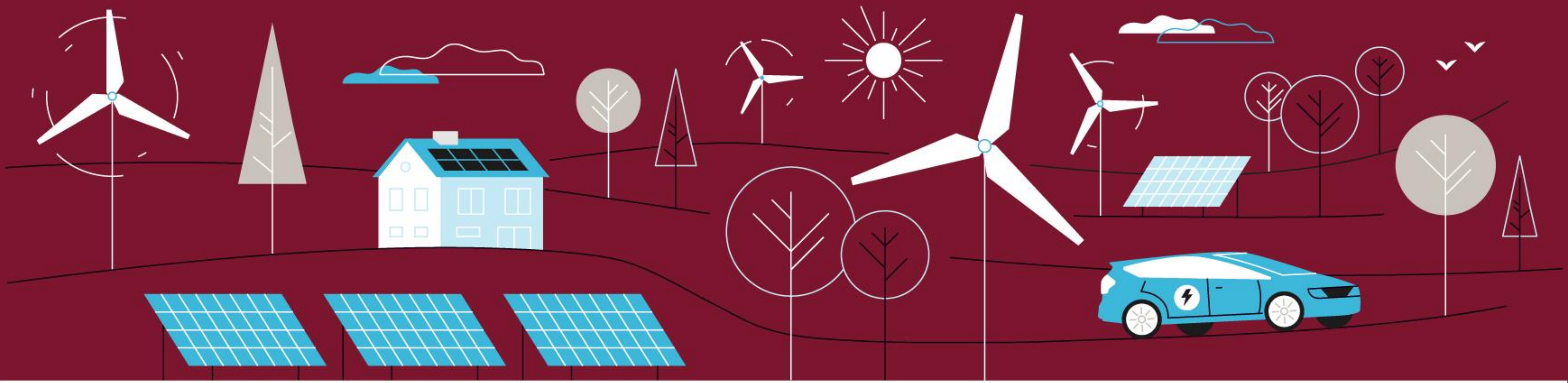
- Mitigation was all but abandoned and climate disasters became routine. **Adapting to climate disruptions** became a normalized part of everyday life.
- The biodiversity crisis became so severe that many **actions to protect natural ecosystems for climate mitigation were no longer possible.**
- The decade saw dramatically **increasing international and national inequality**. Well-governed, wealthier regions invested in adaptation while **low-income regions bore the brunt of economic and physical climate impacts**.
- A **"climate-adapted" class emerged** that could afford privatized services and build its own adaptation measures. This lead to a further **deterioration of the social contract** and a widening class divide.
- **Health impacts were disproportionately felt by under-resourced communities**, placing strain on public health.
- **Social safety nets began to collapse** against the pressure of rising inequality from mass migration, displaced workers, poverty, and the rising cost of goods. In response, mutual aid networks gained strength out of necessity.
- Climate impacts also **eroded progress on social inclusion and human rights**. Women, the elderly, those with disabilities, Indigenous, people of color, and low-income communities were impacted the most.
- **Many areas were deemed uninsurable** and payouts on climate events were capped or eliminated.
- **Competition for economic resources escalated**, compounding global tensions and driving inflation, social unrest, and conflict. Some nations adopted authoritarian rule in an attempt to secure order.
- Worsening resource scarcity and changing food production led to **new growing regions and shifts in trade**. Countries with access to technology and productive land gained significant access to the global marketplace.
- Almost everyone, except the wealthy, **could no longer afford luxury goods or nonessential products**.
- Both **work and recreation gravitated further online**, as physical climate impacts made in-person activities increasingly difficult. Employees sought adaptation benefits such as housing insurance and early warning systems.

Current Policies

- By 2040, India saw a 15% increase in the population exposed to heat waves.
- In the Philippines, the damage from river floods increased by 38% by 2050, compared to 2020 levels.
- GDP loss from climate damage reached US$4.1 trillion per year by the end of the decade.

Net Zero 2050

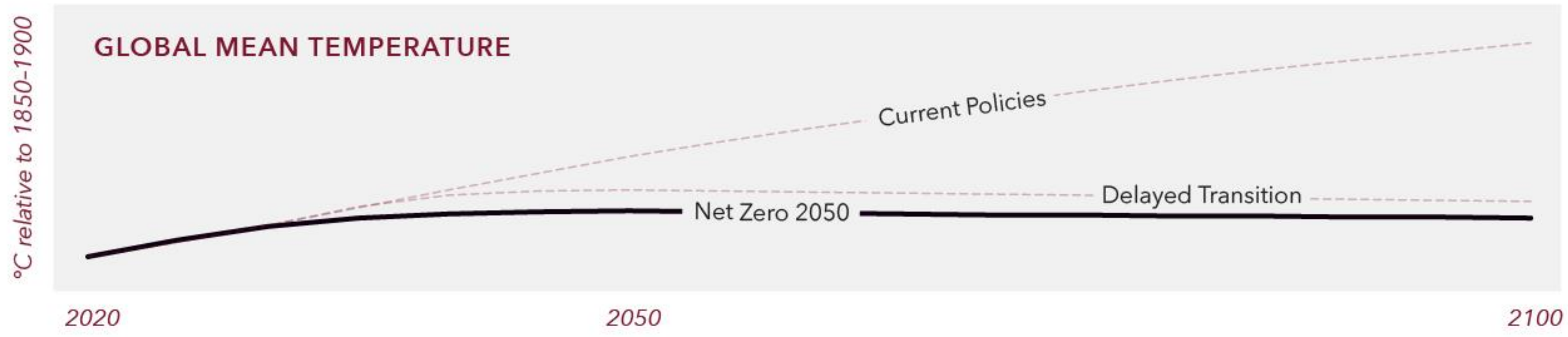
A cooperative global effort to act on climate change now drastically lowers climate risks by 2050.



low physical risk

medium transition risk

1.5°C+ ambition



Net Zero 2050

A cooperative global effort to act on climate change now drastically lowers climate risks by 2050.

The View from 2050

The transition to a net-zero economy by 2050 required drastic and coordinated global action from government, business, and civil society, particularly in the 2020s. Climate impacts already felt across the globe, and expected to increase, made clear the risks of inaction. But the cost of action were high because many industries were severely disrupted and the job market shifted.

Action was backed by a wave of green tech, including high use of carbon capture and storage, high levels of transparency (and even surveillance), and changes in global regulatory institutions. Although global temperature continued to rise in the previous three decades, swift action resulted in warming peaking at 1.6°C in 2050. With the debate on when and how to act over, climate justice, including responsibility for refugees, reskilling programs, and international climate reparations rose to the top of the agenda.

- 1.5°C policy ambition
- Immediate and smooth policy reaction
- Fast technology change
- Medium use of carbon dioxide removal
- Medium regional policy variation

The 2020s: What Defined the Decade

Collaborative and coordinated climate action | High-tech transparency | Unequal distribution of costs and benefits

- **Collaborative global climate action** radically accelerated**,** with strong US-China cooperation on the issue.
- **Developing economies, Indigenous communities, women, and youth gained more prominence** in climate negotiations.
- Alongside carbon pricing, many countries introduced legally mandated climate targets and carbon budgets, mandates or subsidies for zero- or low-carbon technologies, and financial and trade disincentives for high-carbon activities or products. A strong climate policy framework became a competitive advantage for manufacturing regions.
- International **climate finance increased** for developing and emerging economies, which accelerated their decarbonization and investments in natural capital.
- A **realignment of capital markets and a boom in venture capital** investments redirected capital toward climate technologies, decarbonization of industries, and natural ecosystem protection.
- **Climate tech innovations,** including in battery storage and low-carbon energy supplies, increased dramatically. By the mid-2020s, the use of carbon capture technology, such as Direct Air Capture and some small-scale Carbon Capture and Storage, began to increase.
- To solve the **challenges around transition minerals**, **domestic exploration and new mining technologies and territories** became key competition areas for countries and major industrial organizations.
- There was an increased focus on the **links between biodiversity, risk, and climate.** Nature-related disclosures became mandated in many countries. There was an increase in forest protection, attention to Indigenous land management practices, and the uptake of regenerative agriculture practices, often enhanced with ag-tech approaches.
- Satellites and autonomous systems **increased monitoring and reporting of emissions,** particularly in supply chains, while also enabling increased monitoring of other impacts, including biodiversity and human rights.
- **Upskilling and reskilling programs were inconsistent across and within countries,** leading to high levels of job loss in certain regions or for underserved groups, which resulted in instability, social unrest, and increased migration. Conversely, new opportunities emerged for those with new skills, particularly younger workers.

Net Zero 2050

- The policy cost of additional energy systems rose drastically in the 2020s, reaching US$1 trillion by 2030.
- By 2030, investments in energy efficiency increased 71% to reach US$385 billion per year, while investments in low-carbon energy supply increased fivefold to US$2.6 trillion per year.

The 2030s: What Defined the Decade

Tech solutionism and bias | Some transition costs linger | New commitments to the socioeconomic transition

- Technologies including AI and new means of data storage, such as synthetic DNA, drastically reduced the energy needed for data storage and processing and helped spur tech solutionism. AI and remote sensing also underpinned GHG efficiency, natural resource allocation, and impact monitoring.
- National carbon budgets combined with new levels of carbon monitoring led to **increased carbon surveillance** that was resisted by those who saw it as restricting citizens' freedoms and privacy. **Carbon-related cybercrimes,** focused on manipulating emissions data, also emerged.
- The **pace of technological developments** led to **unforeseen socioeconomic and environmental impacts,** including site selection for new technologies and the use of algorithmic decision-making for emissions reductions that had built-in biases toward underserved communities or prioritized emission reduction over other environmental impacts.
- Carbon sequestration from land use and forest cover peaked in 2030 and began to plateau thereafter, while carbon capture technology expanded drastically. In 2030, carbon emissions from agriculture, forestry, and other land uses crossed into negative emissions.
- Following a decrease in the 2020s, **production of cement and steel began to slowly increase** again, but with much lower emissions.
- By the mid-2030s, **worker displacement and reskilling gained prominence as a sustainability issue.**
- **Consumer preferences and awareness** continued to drive changes in the business environment, with many companies making commitments to net positive impacts.
- **Climate impacts continued to escalate** and unequal impacts on certain regions continued to **hamper economic development.** Attribution emerged as a key concern to address **reparations for loss and damages** to countries and vulnerable groups.

Net Zero 2050

- By 2040, total CO_2 emissions decreased by 76% compared to 2020.
- The rate of carbon capture and storage increased by roughly 350% in the 2030s.

The 2040s: What Defines the Decade

Reconciliation and reparations on climate | Long-term technological breakthroughs | Climate positive goals

- With 1.5°C in sight, the expected **level of ambition rose. Climate and nature positive commitments** became the new norm for governments and corporations as planetary well-being and the interconnectedness of socioeconomics, nature, and climate were enshrined in policy frameworks.
- Despite limiting the total rise in global warming, **climate impacts were still felt across the globe and serious disturbances remained common.** However, these **began to stabilize** at a new normal in terms of frequency and intensity.
- Unavoidable climate impacts led to some change in crops and growing regions and the use of ag tech to overcome these.
- The **international dialogue on historical climate justice increased**. In a series of climate talks that harkened back to the post-World War II era, international leaders came together to explore historical climate justice concerns and to re-examine and redesign the international legal and market frameworks that allowed for such an escalation.
- New international legal frameworks, supported by sophisticated techniques to scientifically attribute responsibility for climate change, enabled **legally mandated climate reparations** from wealthy countries to low-income countries for historical damages incurred, including loss of life, land, culture, and community.
- There were also growing **calls to remove all historical carbon emissions**, restore ecosystems, and reverse biodiversity loss **attributed to a specific company or country**.
- Previous technological investments began to spur new innovations beyond green tech, and the long-term investments in innovative approaches to some of the most difficult-to-decarbonize products and services began to pay off

Net Zero 2050

The price of carbon has more than doubled since 2020 and is roughly US$500 per ton of CO_2 by 2050.

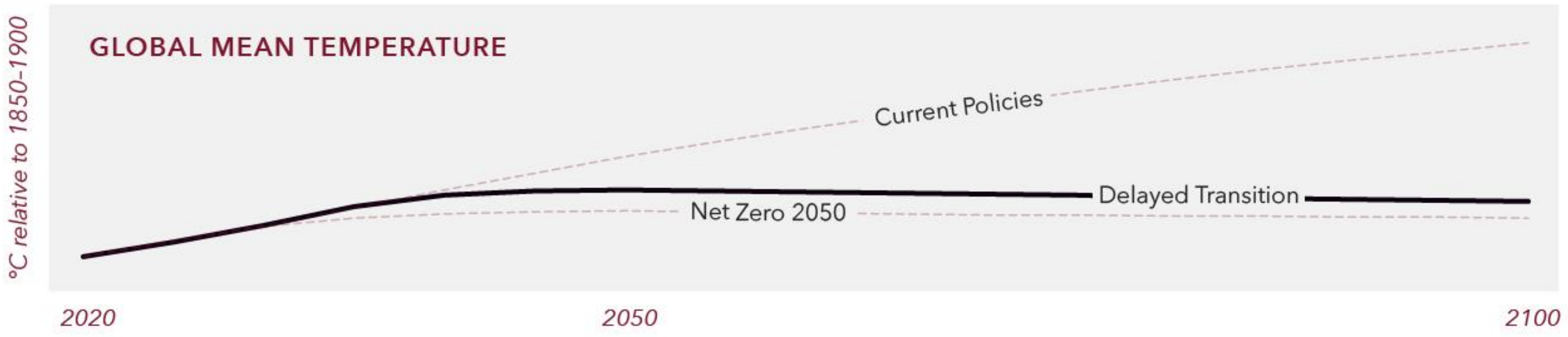
Delayed Transition

A decade of delays leads to hasty climate policies that greatly disrupt business and society.

medium physical risk

high transition risk

1.8°C+ ambition



Delayed Transition

A decade of delays leads to hasty climate policies that greatly disrupt business and society.

The View from 2050

A decade of inaction in the 2020s drove mounting pressure for climate action. What followed was a set of hasty and reactionary policies in the 2030s that sought to rapidly halt GHG emissions and make up for lost time. The disorderly approach came with high social and economic costs but ultimately led to a halving of emissions by 2040 and peak warming at 1.8°C by 2050. By mid-century, the cost of the energy transition began to have less impact on economies, and governments were able to shift attention to investing in social programs and revitalizing sectors affected by climate policies.

The physical impacts of rising temperature led to disrupted supply chains, food insecurity, mass migration and displacement, reduced economic activity and trade, and social unrest. Companies, which had leaned heavily on voluntary commitments to climate action, were faced with legal mandates to rapidly reduce emissions within short time frames.

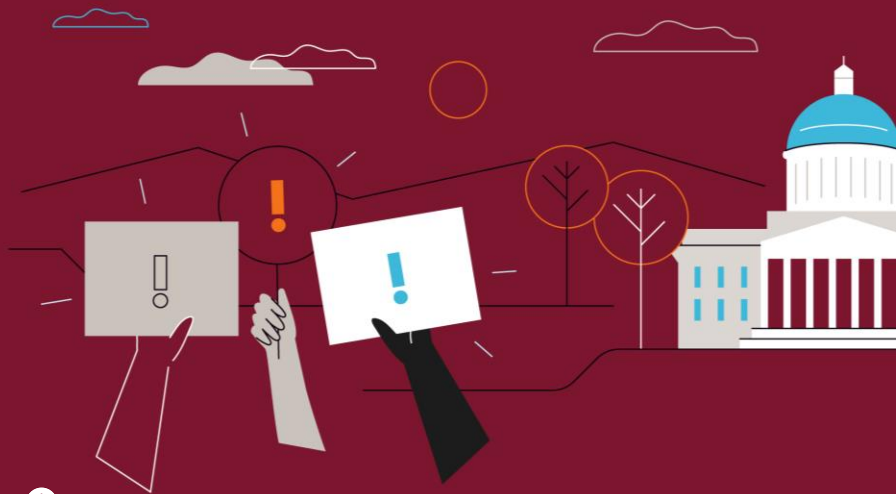
- 1.8°C policy ambition
- Delayed policy reaction
- Slow, then fast, technology change
- Low use of CO_2 removal
- High variation in regional policies

The 2020s: What Defined the Decade

COVID-induced distraction and inaction | Escalating weather events drive disruption and rising activism

- There was **limited action from governments and businesses** to reduce GHG emissions, as they focused their attention instead on the global economic crisis precipitated by the COVID-19 pandemic, compounded by Russia's invasion of Ukraine, inflation, and US-China tensions.
- "Green" recovery policies of the West **were not implemented in an effective way**. Europe slowed down timelines for phasing out coal, which was considered a substitute for Russian natural gas.
- International congresses to advance climate action continued to take place with limited impact. **National Determined Contributions (NDCs) did not align with a 1.5°C future** and most national targets were missed.
- **Companies continued to set voluntary commitments**. Enforcement mechanisms to ensure accountability against those commitments were not widely implemented.
- Misinformation around appropriate climate policy responses proliferated through social media platforms **without effective means to control it**, leading to distrust of efforts intended to reduce emissions.
- In the mid-2020s, **physical impacts from climate change became increasingly common**. Businesses experienced frequent supply shortages, increasing and volatile prices, and greater competition for resources.
- Companies focused on increasing supplier redundancy but **failed to make significant investments** in building supply chain resilience and reducing Scope 3 emissions.
- Several extremely high-risk regions globally were **declared uninsurable due to climate risk**, stranding assets for homeowners and businesses in these areas and prompting national intervention in certain countries.
- By the turn of the decade, the impacts of climate change on global physical and mental well-being, income and wealth, and business operations began to **galvanize business and popular support for climate action**.

Delayed Transition



- Increased seasonal droughts and floods impacted agricultural production and led to severe food insecurity in Central America, Sub-Saharan Africa, and India.
- In Asia, heat stress drove a 3% decrease in labor productivity compared to 1986-2006, impacting global supply chains and resource availability.

The 2030s: What Defined the Decade

Abrupt crisis response | Desperate and expensive scramble to action | Fragmented global approach

- With growing physical impacts and increasing social unrest, **governments were under great pressure** to act. To maintain their license to operate, **businesses responded to public expectations** to reduce emissions.
- In the early 2030s, **the climate crisis was declared an emergency** in many countries. Governments adopted abrupt and highly disruptive policies to reduce emissions, including stringent carbon taxes and even bans.
- Where action was still delayed, **civil society led targeted disruptions** of industry and climate litigation against heavy emitters, those who financed fossil fuels, and increasingly, governments.
- **Disruptions led to political instability**, reduced governance and adaptation capacity, an increase in stranded assets, large-scale socioeconomic disruption, and rising inequality.
- Divergent climate policies between ambitious countries and laggards led to strained relationships and **geopolitical instability**. This affected trade and drove shortages of fuel and other key commodities.
- Fossil fuel consumption began to decline significantly from the start of the decade. By 2035, the **development of new coal power plants ended** at a global level.
- Most sectors were impacted by **legal mandates to halve emissions** by 2040 and fully decarbonize by 2050. This led to rushed deployment of renewable energy by businesses and rapid emissions reduction programs at a greater cost. Hasty electrification brought reliability issues and was limited by a lack of supply of critical minerals.
- Regulatory action and demand from clients and customers meant businesses had to **rapidly reduce Scope 3 emissions**. Supply chain disruptions led to greater automation, and reshoring and nearshoring of operations.
- The rapid push for decarbonization meant that **local contexts were often overlooked**. Initiatives led by local communities and grassroots organizations became fragmented and focused on community resilience.
- To offset emissions, companies invested heavily in **carbon removal programs**, with a focus on land-based approaches (e.g., reforestation) because scaling technological approaches for carbon sequestration remained financially unfeasible.

Delayed Transition

- New solar power developments reached nearly 900 GW per year by 2035.
- Carbon pricing mechanisms were widely instituted, and carbon prices rose, reaching US$650 per ton of CO_2 by 2040.
- Energy efficiency investments accelerated, reaching US$400 billion per year by the end of the decade.

The 2040s: What Defined the Decade

Lingering economic impacts | Rising hope for the future | Beginning of a new low-carbon economy

- Rapid action led to a **halving of yearly emissions by 2040**, compared to 2020 levels. Increased public pressure and stringent regulations to maintain a downward trend in emissions resulted in a heightened degree of monitoring and demand for accountability of polluting governments and industries.
- Sectors that struggled to decarbonize (e.g., heavy industry, steel, cement, aviation, shipping, mining) **gained greater attention, driving investment in innovation** to develop low-carbon production technologies. The development of new, lower-carbon forms of production, combined with the use of carbon dioxide removal (CDR) technologies, led to a **recovery in steel and cement production**, which was significantly impacted in the 2030s.
- Although CDR technologies were still costly, companies must invest in them **to address residual emissions and meet their climate targets.**
- **Carbon dioxide sequestered through land-based sinks grew** to roughly 1,200 metric tons of CO_2 per year. Global forest cover grew from the 2020s, with more than 150 million hectares of forests recovered by the 2040s.
- Land-based decarbonization led to **acute competition for land** between energy, food, and housing.
- **Investment in low-carbon energy supply peaked in 2040**. The cost of the energy transition began to have less impact on economies, and governments were able to shift attention to **investing in social programs and revitalizing sectors affected by climate policies**.
- Physical impacts became less severe by mid-century. Localized adaptation responses allowed some populations and industries to gradually **build resilience to acute and chronic weather events.**
- Achieving a **just transition** (i.e., an economic transition that is fair, inclusive, and equitable to those that it concerns) **became the focus of economic recovery programs**. Public incentives drove investment among growing "green" industries into regions that experienced greater job loss, creating new economic opportunities and worker reskilling programs.

Delayed Transition

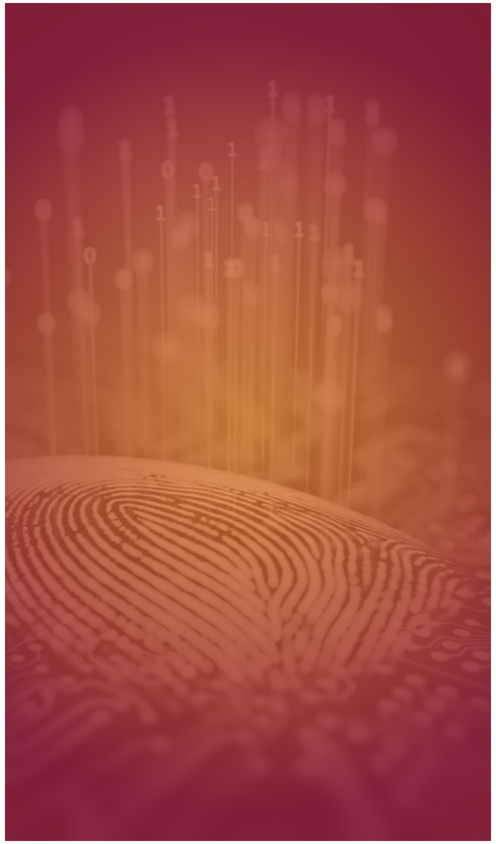
- At a global level, investments in low-carbon energy supply increased, reaching roughly US$3 trillion per year by 2040
- Investments in energy efficiency have also continued to increase, reaching nearly US$600 billion per year by 2050.
- By 2050, damage from hurricanes in the US increased 16% compared to 2020 and Thailand experienced a 27% increase in the share of the population annually exposed to heat waves, compared to the 1986-2006 period

03

Physical Impact and Transition Data

Physical Impact and Transition Data | Sources

The data in the following slides have been extracted from the NGFS IIASA Scenario Explorer and NGFS CA Climate Impact Explorer and present a subset of business-relevant data, which can further contextualize and quantify the BSR scenario narratives.



The NGFS has produced publicly available resources, including data, technical resources, and analysis tools.

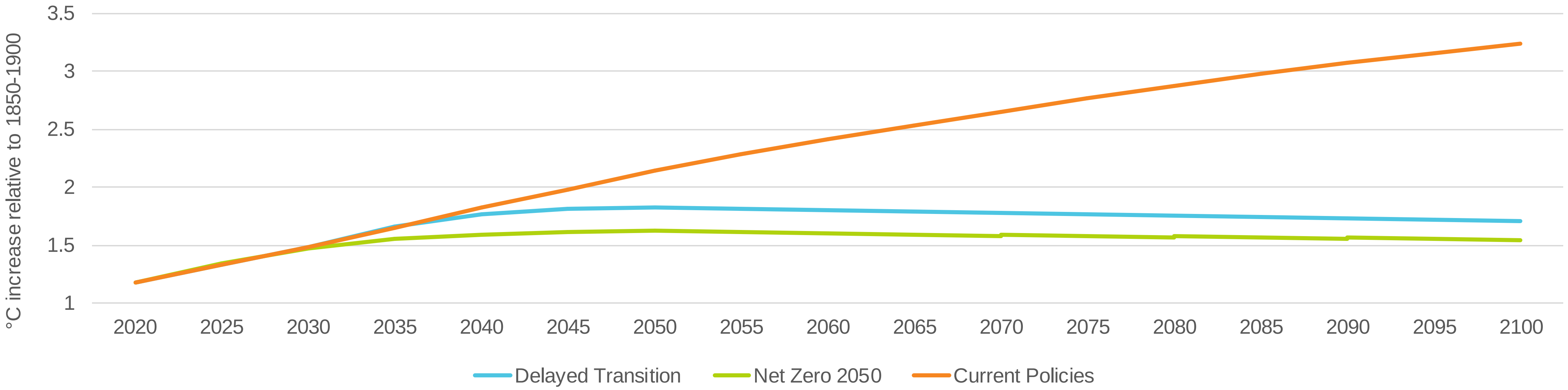
One of those resources, the NGFS IIASA Scenario Explorer, is a web-based platform that provides visualizations and display of the **transition** scenarios time series data.

In addition, the NGFS CA Climate Impact Explorer provides visualizations and display of the **physical** scenarios time series data.

Both platforms include additional data variables that provide greater detail on the three scenarios featured in this document.

Global Mean Temperature

Emissions trajectories would mean an expected 1.5°C warming under the Net Zero 2050 scenario, 1.8°C under Delayed Transition, and more than 3°C by 2100 under Current Policies. In all three scenarios, society will continue to experience climate-related risks caused by GHG emissions emitted prior to 2020.



Under the three scenarios, warming continues to increase until the mid-2030s. Early climate action in Net Zero 2050 means global temperatures stabilize sooner, resulting in less physical climate impacts from the mid-2030s onward.

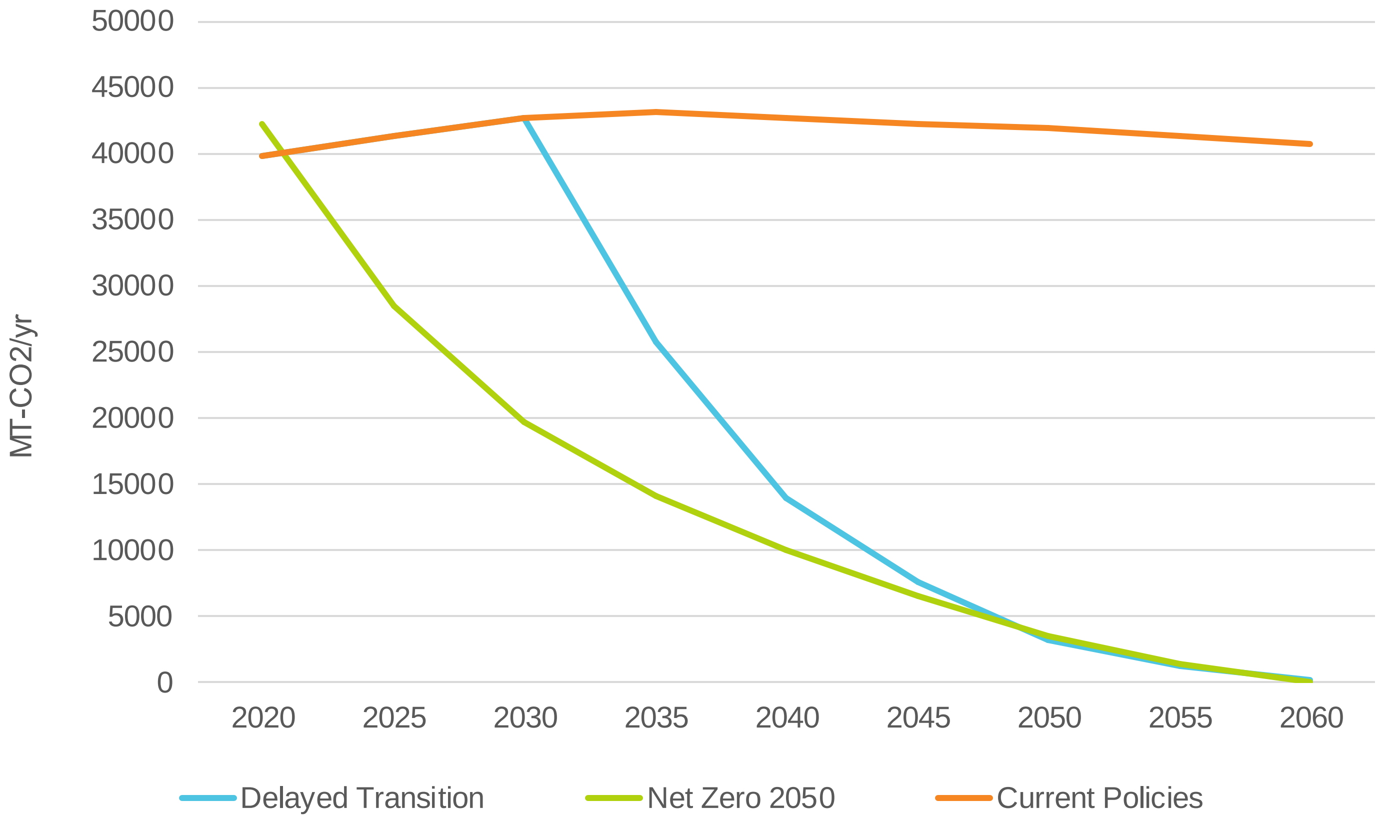
Note: The graph depicts the expected temperature increase under each scenario; it does not include ranges of uncertainty. To view the full dataset, please visit the NGFS IIASA Scenario Explorer.

Carbon Dioxide Emissions

The three scenarios present different emissions trajectories, which define their warming potential and associated physical impact risk. The graph below does not include negative emissions from carbon capture and storage.

Delayed Transition presents a continuous decline in carbon dioxide emissions, following a similar trajectory as that of **Net Zero 2050** but with a 10-year delay.

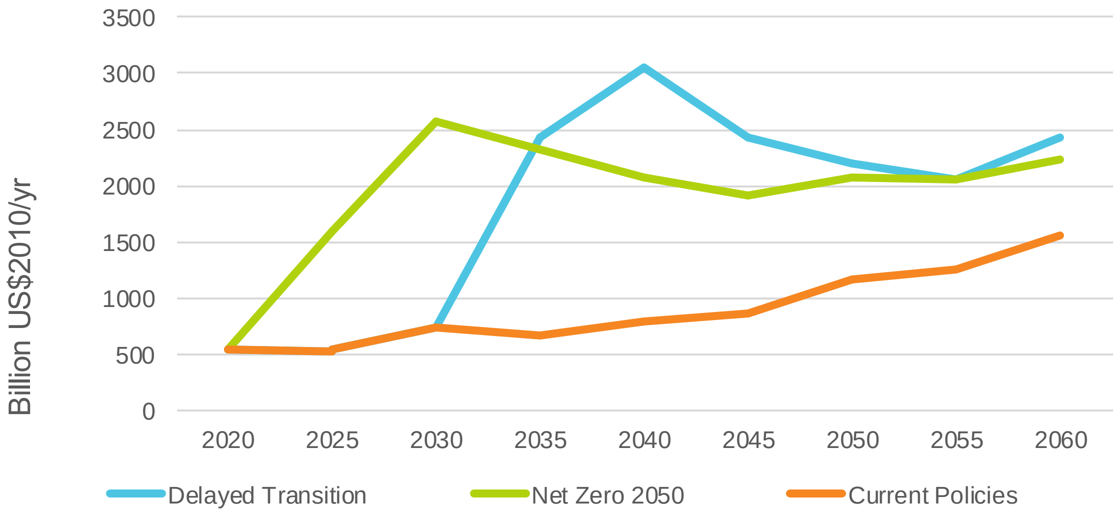
Current Policies shows a limited decline in emissions following 2035. Annual emissions are higher in 2060 than they were in 2020.



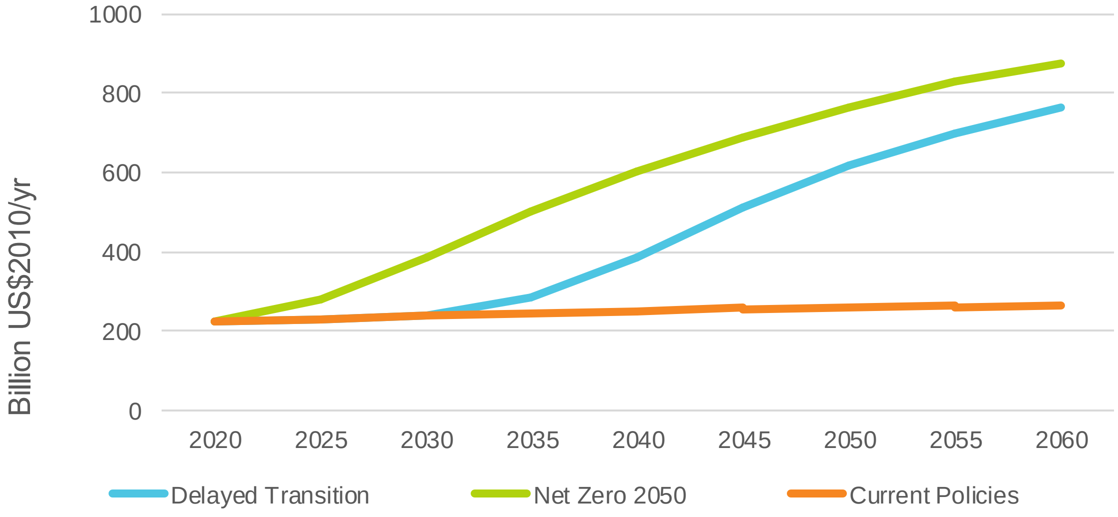
Investment in the Energy Transition

Transitioning to a net zero economy would require investment flows be geared toward mass deployment of green electricity, electricity storage, and energy efficiency.

Investment in Low-Carbon Energy Supply



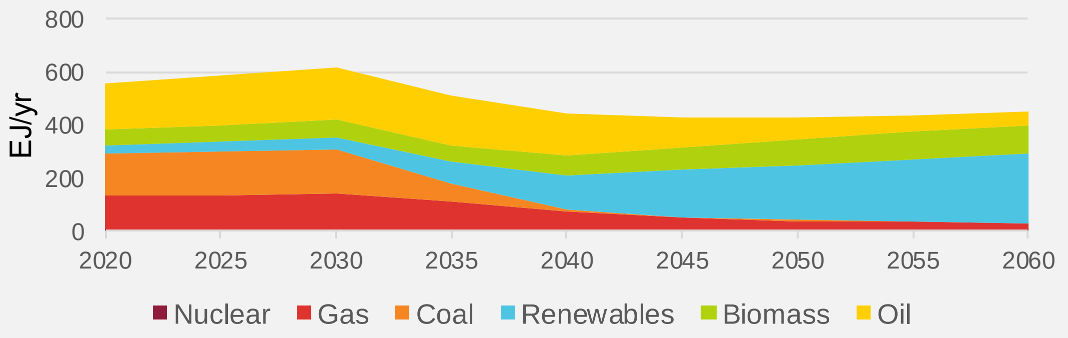
Investment in Energy Efficiency



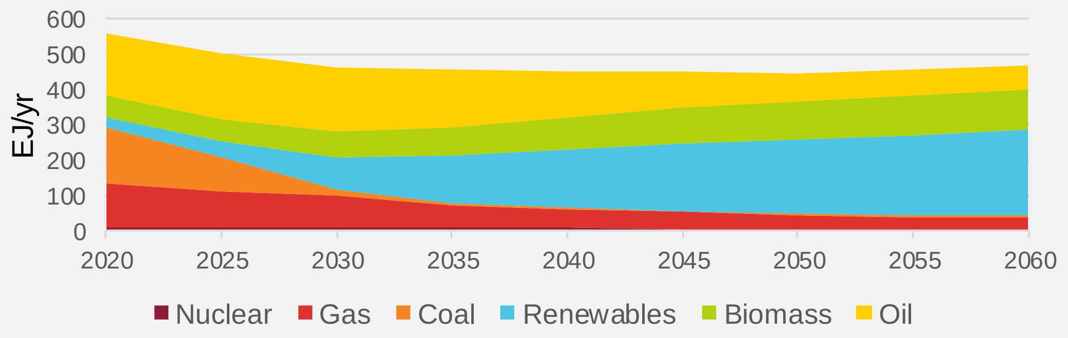
Investment in low-carbon energy supply and energy efficiency is significantly higher under the Delayed Transition and Net Zero 2050 scenarios. In Delayed Transition, late mass deployment of renewable energy capacity additions in the 2020s means greater and rapid investment needed in the 2030s and 2040s.

Energy Mix

Delayed Transition

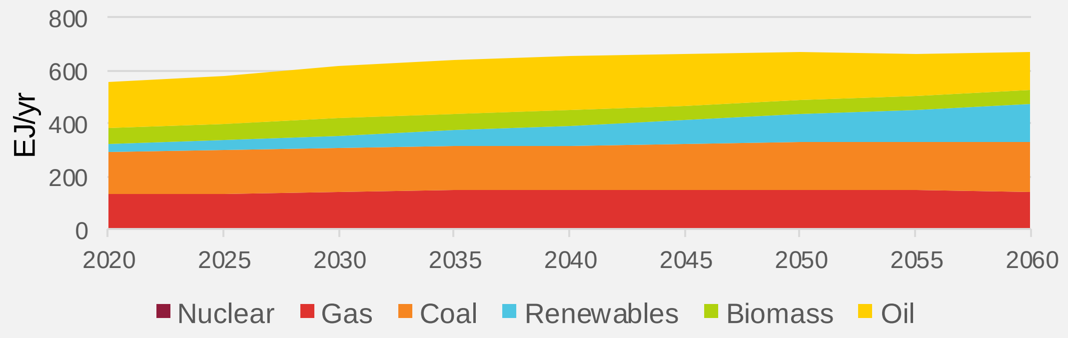


Net Zero 2050



By 2050, renewables and biomass would deliver more than 65% of global primary energy needs under Delayed Transition and Net Zero 2050. This is in contrast with Current Policies, where fossil fuels continue to be the dominant source of primary energy, even after accounting for current technology trends.

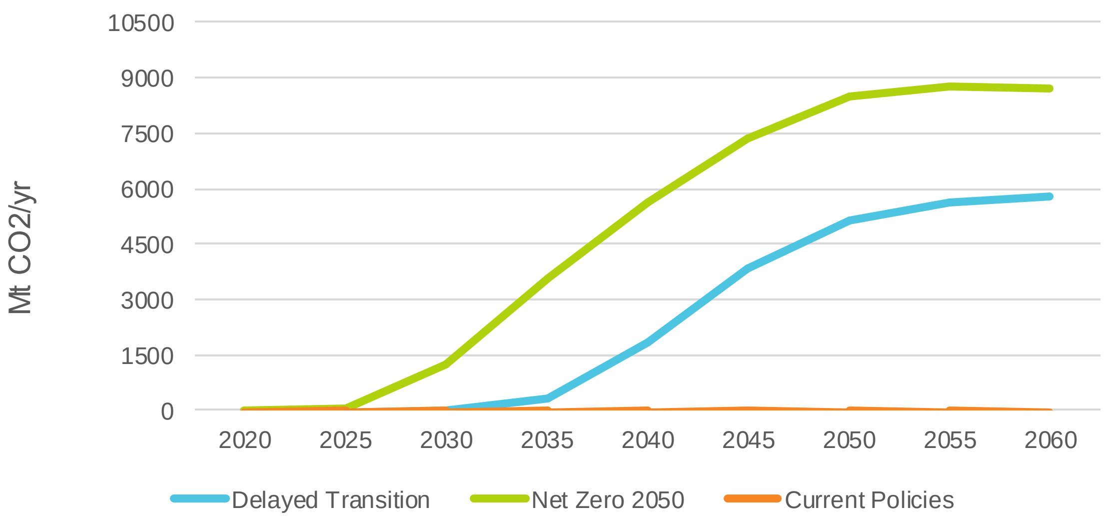
Current Policies



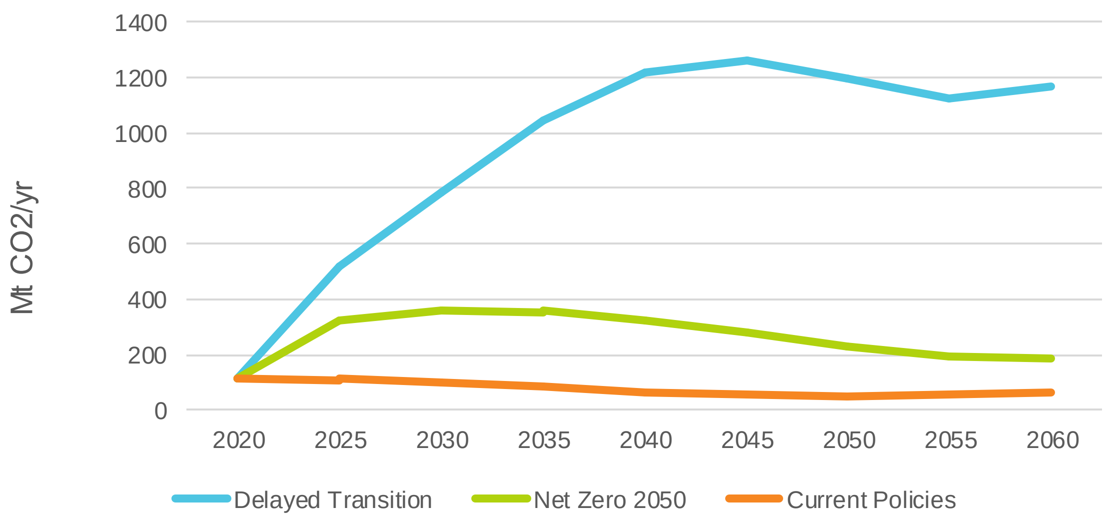
Carbon Dioxide Removal

Carbon removal can come from changes in land use (e.g., reforestation and afforestation) or from technologies to capture and store carbon dioxide.

Carbon Capture and Storage (CCS)



Land Use

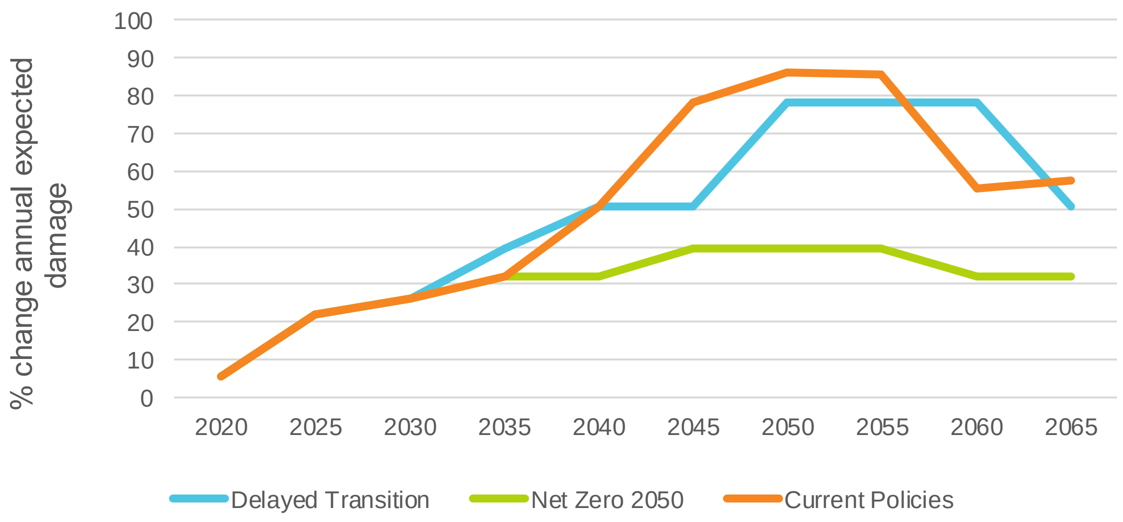


The potential for scaling of carbon capture and storage technologies needed to remove residual emissions and achieve net zero will depend on the availability of viable technologies and on policies and financing to support their deployment.

Damage from Physical Impacts

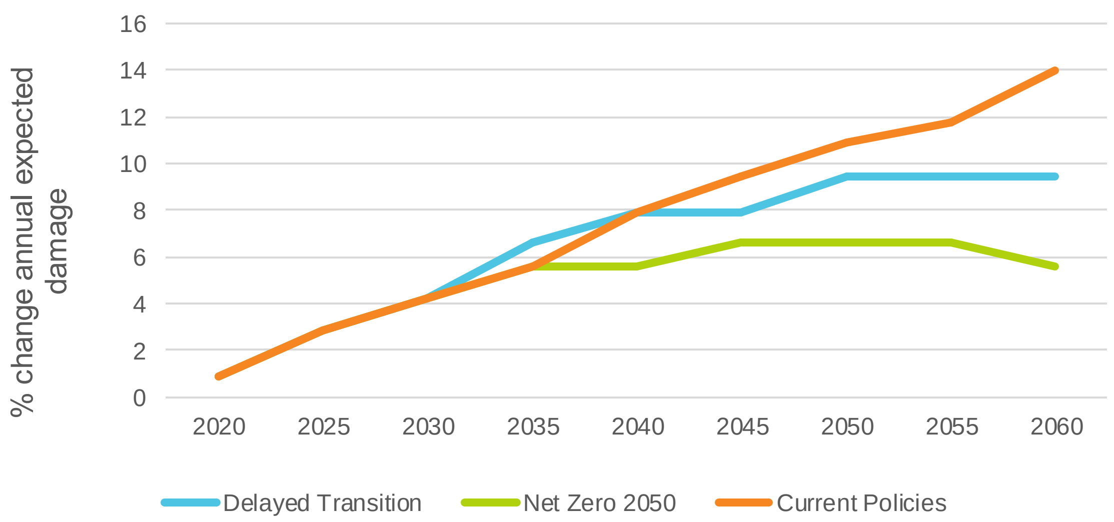
Greater warming is linked to an increase in extreme weather across the globe, with variation across geographies, as illustrated by the two examples below.

River Floods in Germany



Compared to 2015, the expected damage from river floods in Germany may increase by roughly 86% by 2050 under the Current Policies scenario.

Tropical Cyclones in China

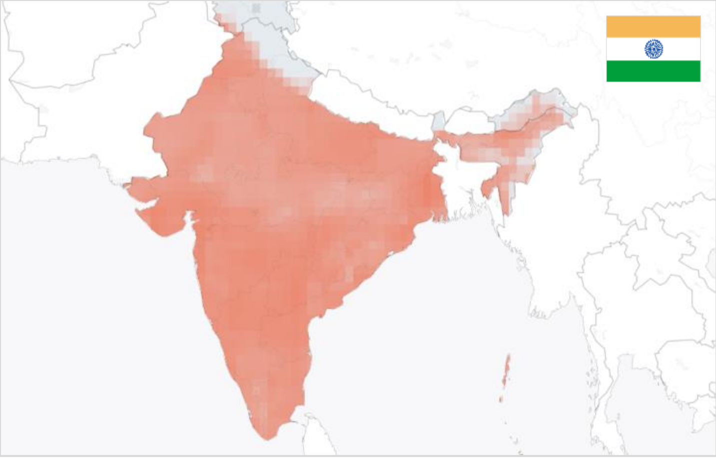


Compared to 2015, damage from tropical cyclones may increase by roughly 11% in China by 2050 under the Current Policies scenario. A large proportion of the total damage is caused by singular but very severe events (i.e., 1-in-100 years events).

Loss of Labor Productivity

Labor productivity is expected to decrease with rising temperatures, leading to material impacts on the economy and society. India and the United States are examples of countries that would be heavily impacted.

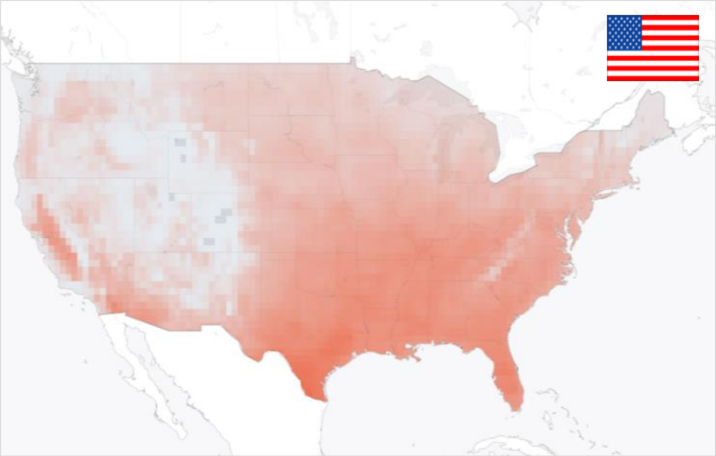
India in 2050 under Current Policies



Change in Labor Productivity due to Heat Stress in %

below -15.3% | -15 | -10 | -5 | above -0%

US in 2050 under Current Policies



Change in Labor Productivity due to Heat Stress in %

below -11% | -10 | -8 | -6 | -4 | -2 | 0 | above -0%

Current Policies is linked with the greatest degree of physical impacts, particularly toward mid- and late-century. Under this scenario, the world may experience a temperature increase of 2°C by 2050, leading India to experience a 6% loss of labor productivity and the US a 2.5% loss on average, compared to the reference period of 1986-2006. In a Net Zero 2050 scenario, productivity loss is limited to 5% in India and 1.9% in the US (Image source: NGFS CA Climate Impact Explorer).

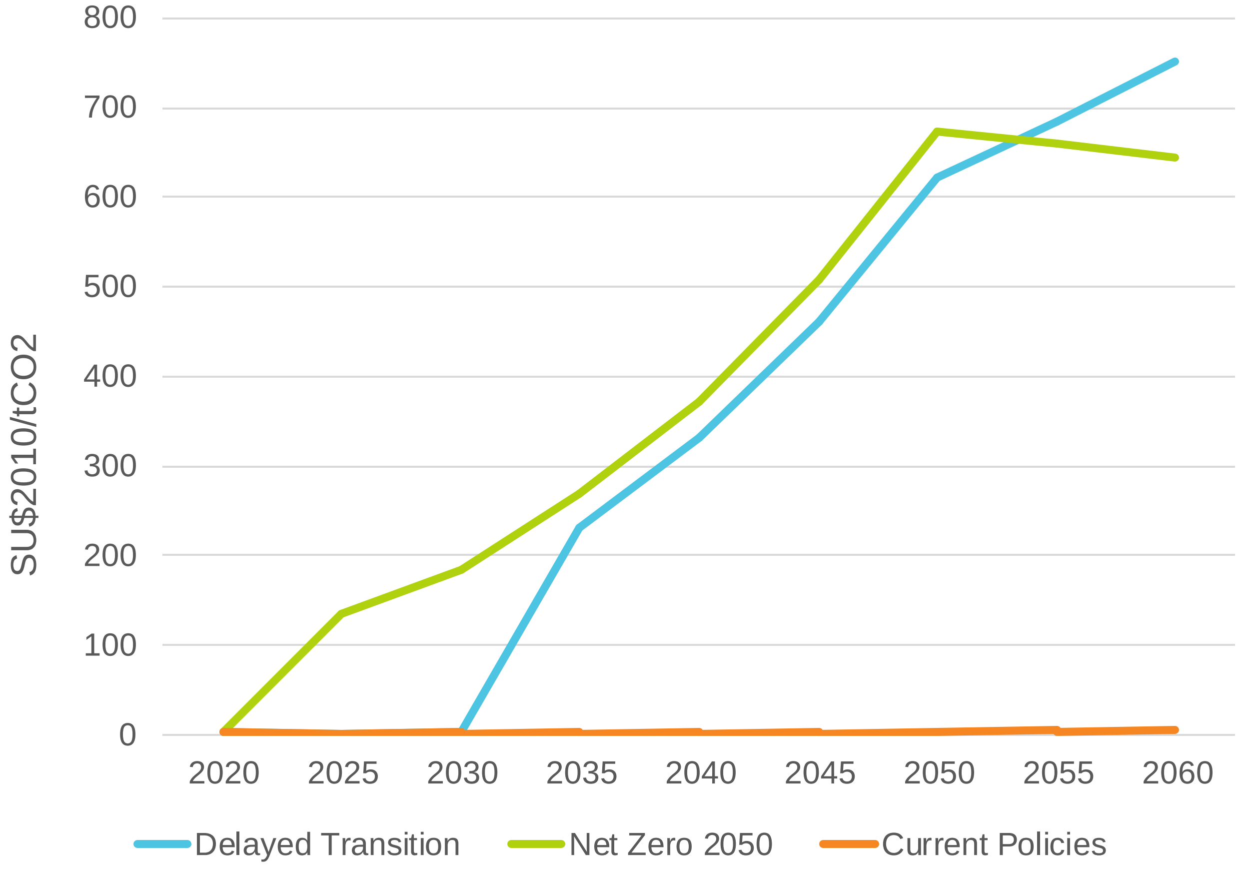
Carbon Price

Carbon price is a useful indicator of transition risk. It serves as a proxy for the intensity of government policies and changes in technology and consumer preferences.

Higher carbon prices indicate greater ambition to mitigate climate change, a delay in action that requires a rapid response, diversity of policy measures across sectors and regions, and limited availability of technology, such as carbon dioxide removal.

Given the late response under Delayed Transition, this scenario is **linked to the highest carbon prices** in mid- to late-century.

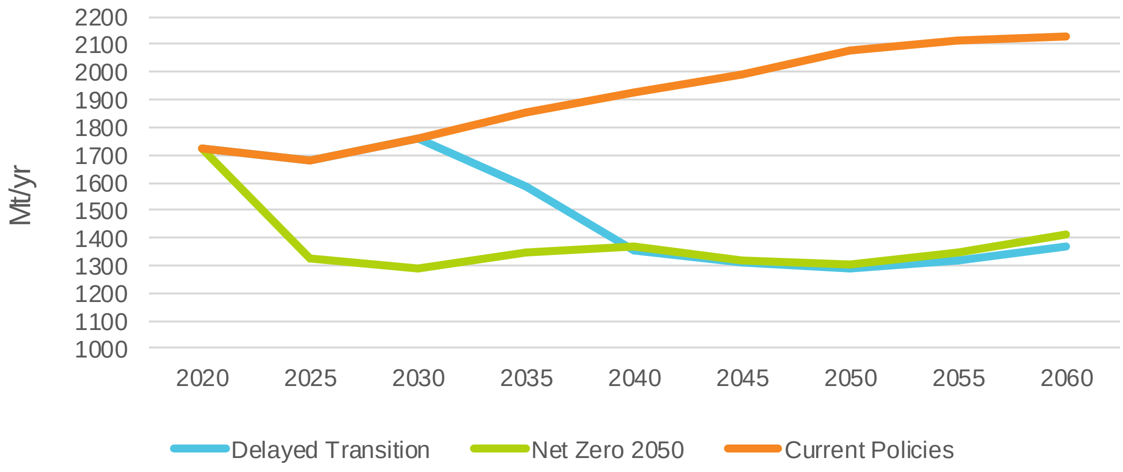
Carbon prices tend to be lower in low- and middle-income economies, which reduces the efficiency of pricing mechanisms but may align with equity considerations.



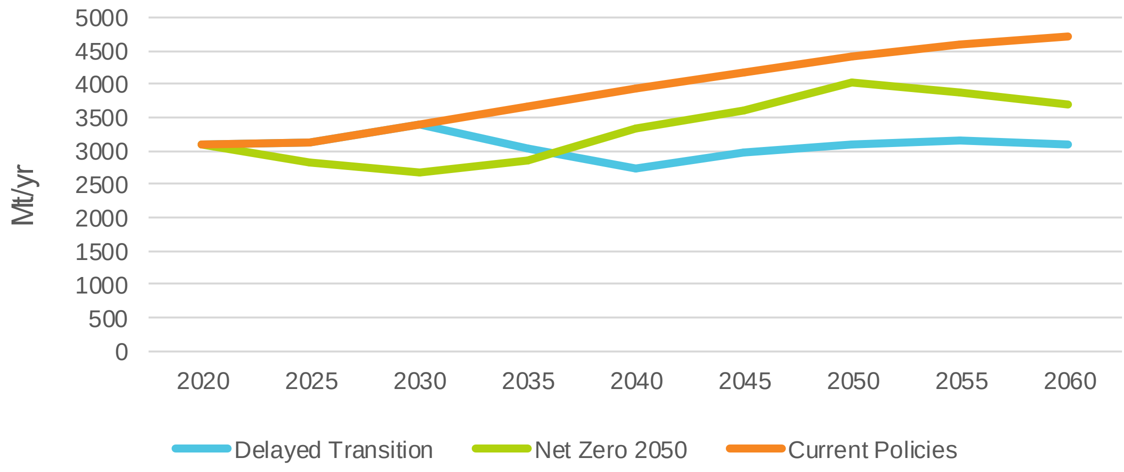
Steel and Cement Production

Transitioning away from carbon-intensive production and consumption may be induced by policy mechanisms, such as emissions pricing. As it takes time to decarbonize “hard-to-abate” sectors and develop and deploy alternative technologies, climate policies may lead to higher costs in the interim.

Steel Production



Cement Production



Cement and steel production is linked to a high intensity of GHG emissions and is difficult to decarbonize. Efforts to reduce emissions may impact the production of key industrial inputs.

04

Appendix

Acknowledgements

The BSR climate scenarios were developed by Margot Brent, Chelsea Matthews, Jacob Park, and Maria Troya.

We thank all external and internal reviewers who contributed to the development of the BSR climate scenarios:

At BSR, Dunstan Allison-Hope, Ameer Azim, Giulio Berruti, Hugh Brown, Ouida Chichester, Cliodhnagh Conlon, Jessica Custer, Christine Diamente, Laura Donnelly, Hannah Ellis, Eileen Gallagher, Paul Holdredge, Anna Iles, Todd Jones, David Korngold, Erin Leitheiser, Ariela Levy, Olivia Li, Asako Nagai, Pinal Patel, Thuy Phung, Jeremy Prepscius, Beth Richmond, Mariana Riquelme, Michael Rohwer, Berkley Rothmeier, Cameron Steagall, Lale Tekisalp, Annelise Thim, Jenny Vaughn, Simone Washington, and David Wei.

External reviewers include Bill Adams (Mercer International), Alberto Carrillo Pineda (SBTi), Rohitesh Dhawan (ICMM), Trevor Dhu (Microsoft), Claire Fyson (Climate Analytics), Kimberly Gladman (UN PRI), Quentin Lejeune (Climate Analytics), Doree Marentette (ECF), Romain Pardo (CISL), Christian Spano (ICMM), Elizabeth Sturcken (EDF), Celine Suarez (Morgan Stanley), Charlotte Vailles (I4CE), Sissel Waage, the Research and Development Team at The Climate Service, and the members of the Value Chain Risk to Resilience collaborative initiative.

We also thank the NGFS Secretariat, Climate Analytics, and others involved in the development of NGFS climate scenarios.

The BSR climate scenarios were made possible with funding from Bloomberg Philanthropies.

BSR and NGFS Resources

BSR

- Additional information on BSR's work can be found on the Climate Scenarios dedicated **website.**
- For more information on climate scenario analysis, see BSR's blog **here.**
- If you would like BSR to support your organization in conducting climate scenario analysis, please contact Ameer Azim (aazim@bsr.org)

BSR's work on Climate Change and Futures Thinking

- BSR catalyzes business action on Climate Change by helping companies to reduce their **GHG** emissions and build resilience to climate impacts.
- Through the Sustainable Futures Lab, BSR explores emerging issues at the nexus of business and sustainability.

Network for Greening the Financial System (NGFS)

- The NGFS Climate Scenarios Portal hosts information on the six scenarios developed by the Network.
- A full list of relevant NGFS Climate Scenario documentation and resources can be found at the Data & Resources subsite.

Data Portals

- The NGFS IIASA Scenario Explorer is a web-based user interface that provides visualizations and display of the transition scenarios time series data.
- The NGFS CA Climate Impact Explorer is a web-based user interface that provides visualizations and display of the physical scenarios time series data.

Licensed Use of NGFS Scenario Data

The climate scenario narratives in this document are Adapted Material based on the Licensed Material (Climate Scenarios and respective transition and physical data) developed by the Network for Greening the Financial System (NGFS).

The narratives in this document are based on the second set of NGFS climate scenarios, released in June 2021.

BSR has modified the Licensed Material developed by the NGFS to produce the climate scenarios narratives in this document.

All quantitative information (i.e., data) included in this document are part of the NGFS Scenarios. Transition data is part of the NGFS IIASA Scenario Explorer (release 2.2). Unless indicated, all other material, including the climate scenario narratives, were adapted by BSR.

NGFS materials are licensed under the Public License of the Network for Greening the Financial System. The NGFS has not endorsed the climate scenarios developed by BSR or their use.

Physical Impact Data

Physical impact data included in this document belongs to the NGFS CA Climate Impact Explorer, developed by Climate Analytics, with data from ISIMIP and CLIMADA.

About BSR

Global Team of Sustainability Experts

BSR™ is a sustainable business network and consultancy focused on creating a world in which all people can thrive on a healthy planet. With offices in Asia, Europe, and North America, BSR provides its 300+ member companies with insight, advice, and collaborative initiatives to help them see a changing world more clearly, create long-term value, and scale impact.

- Copenhagen
- Guangzhou
- Hong Kong
- New York
- Paris
- San Francisco
- Shanghai
- Singapore
- Tokyo

1 Mission

We work with business to create a just and sustainable world.

185+ Global Staff

75+ Project Locations

300+ Member Companies

9 Offices

20+ Collaborative Initiatives

7 Areas of Expertise

30 Years of Experience

Why BSR

Mission-Driven

BSR's mission is to work with business to create a just and sustainable world. We envision a world in which everyone can lead a prosperous and dignified life within the boundaries of the Earth's natural resources.

Sustainable Business Expertise

We are experienced working across the full range of company operations, enabling us to connect points across the value chain.

Industry Focus

Organized by industry, our consulting teams will keep you up-to-date on important trends and help you to achieve your sustainability ambitions, or resolve specific challenges, with expert advice across multiple regions and issue areas.

Diverse Backgrounds

Our global staff have diverse backgrounds, with deep experience in specific business sectors, civil society, consulting, investment, government, law, and policy, bringing innovative and dynamic perspectives to evolving sustainability challenges.

Collaboration

We collaborate with peers and partners to address systemic and sector-specific challenges, share best practices, and scale impact.

Areas of Expertise

We work across seven core areas

- Climate Change and Nature
- Diversity, Equity, and Inclusion (DEI)
- Human Rights
- Nature
- Supply Chain Sustainability
- Sustainability Management
- Women's Empowerment

Disclaimer

The conclusions presented in this document represent BSR's best professional judgment, based upon the information available and conditions existing as of the date of the review. In performing its assignment, BSR relies upon publicly available information, information provided by member companies, and information provided by third parties. Accordingly, the conclusions in this document are valid only to the extent that the information provided or available to BSR was accurate and complete, and the strength and accuracy of the conclusions may be impacted by facts, data, and context to which BSR was not privy. As such, the facts or conclusions referenced in this document should not be considered an audit, certification, or any form of qualification. This document does not constitute and cannot be relied upon as legal advice of any sort and cannot be considered an exhaustive review of legal or regulatory compliance. BSR makes no representations or warranties, express or implied, about the business or its operations. BSR maintains a policy of not acting as a representative of its membership, nor does it endorse specific policies or standards. The views expressed in this document do not reflect those of BSR member companies.

Thank You

BSR™ is a sustainable business network and consultancy focused on creating a world in which all people can thrive on a healthy planet. With offices in Asia, Europe, and North America, BSR provides its 300+ member companies with insight, advice, and collaborative initiatives to help them see a changing world more clearly, create long-term value, and scale impact.

www.bsr.org

BSR