BSR Climate Scenarios

A tool to drive resilient business strategy

Updated 2025 with NGFS Phase V Scenarios

BSR®

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01 | Introduction

Executive Summary

Businesses are using climate scenario analysis to assess risks, build resilience, and meet disclosure requirements.

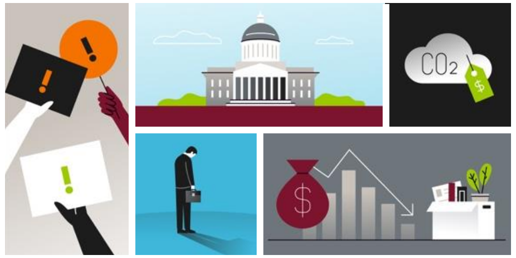
To support this, BSR developed four scenarios based on the NGFS data framework, offering decade-by-decade insights into plausible socioeconomic, political, and technological developments.

Climate Scenarios

Current Policies

Only currently implemented policies (as of 2023) were preserved. Absent ambitious government or business action, greenhouse gas (GHG) emissions put the world on track to reach 3.0°C of warming by 2100.

Maps to RCP 4.5



Delayed Transition

After a decade of inaction, a set of uncoordinated and stringent policies adopted in the 2030s rapidly halt GHG emissions. This came with high social and economic costs but ultimately curbed warming to 1.7°C by 2100.

Maps to RCP 2.6

Net Zero 2050

The transition to a net-zero economy required drastic and coordinated global action beginning in the 2020s. The cost of action was initially high but warming peaks at 1.6°C in 2040 and then declines to 1.4°C by 2100.

Maps to RCP 1.9

Fragmented World

A divergent and uncoordinated policy landscape emerges where some countries adopt aggressive policies, while others do not. This leads to both high physical and transition risks and by 2100, the world reaches 2.4°C of warming.

Maps to RCP 3.4

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 can 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.

Default Variable List

The following variables are always included in BSR climate scenario analyses. The variables are for global data, unless stated otherwise. It is recommended that these variables be reviewed, as needed, for regions or countries of interest. This list does not include the sector slides.

Variable	Current Policies	Net Zero 2050	Delayed Transition	Fragmented World
Global Mean Temperature	x	x	x	x
Greenhouse Gas Emissions	x	x	x	x
Primary Energy Mix	x	x	x	x
Carbon Price	x	x	x	x
Fossil vs. Low-Carbon Energy Investments	x	x	x	x
Energy Demand vs. Efficiency Investments	x			
GDP Loss from Chronic Physical Damages	x	x	x	x
GDP Loss from Transition Damages		x	x	x
Change in Pasture, Crop, and Forest Land		x	x	x
Change in Consumption, Disposable Income, Investment, & Equity Price (US & China)	x			
Greenhouse Gas Emissions by Sector	x	x	x	x
Policy Cost (GDP Change)				x
Physical Climate Damage (GDP) by Region				x
Acute Climate Damage (GDP) by Type	x	x	x	
Carbon Capture and Storage (CCS) Investments		x	x	
Carbon Sequestration		x	x	
Land Use for Carbon Sequestration		x	x	

02 | Background Information

About Climate Scenario Analysis

The Case for Climate Scenario Analysis

Climate scenarios analysis can help organizations:

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

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

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

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

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

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

Climate Scenario Analysis in Financial Reporting

TCFD

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.

TCFD Recommendations for Disclosure Rules and Standards

- 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
- How the organization is challenging itself to think strategically about longer-term climate-related risks and opportunities

Mandatory Reporting

- The EU's **Corporate Sustainability Reporting Directive** (CSRD) and **California's Climate Related Financial Risk Act** both 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), which has been adopted by jurisdictions around the world, also includes climate scenario analysis as a key assessment tool.

CSRD

CALIFORNIA REPUBLIC

ISSB

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.

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 (Phase V) and **NGFS Climate Analytics 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.

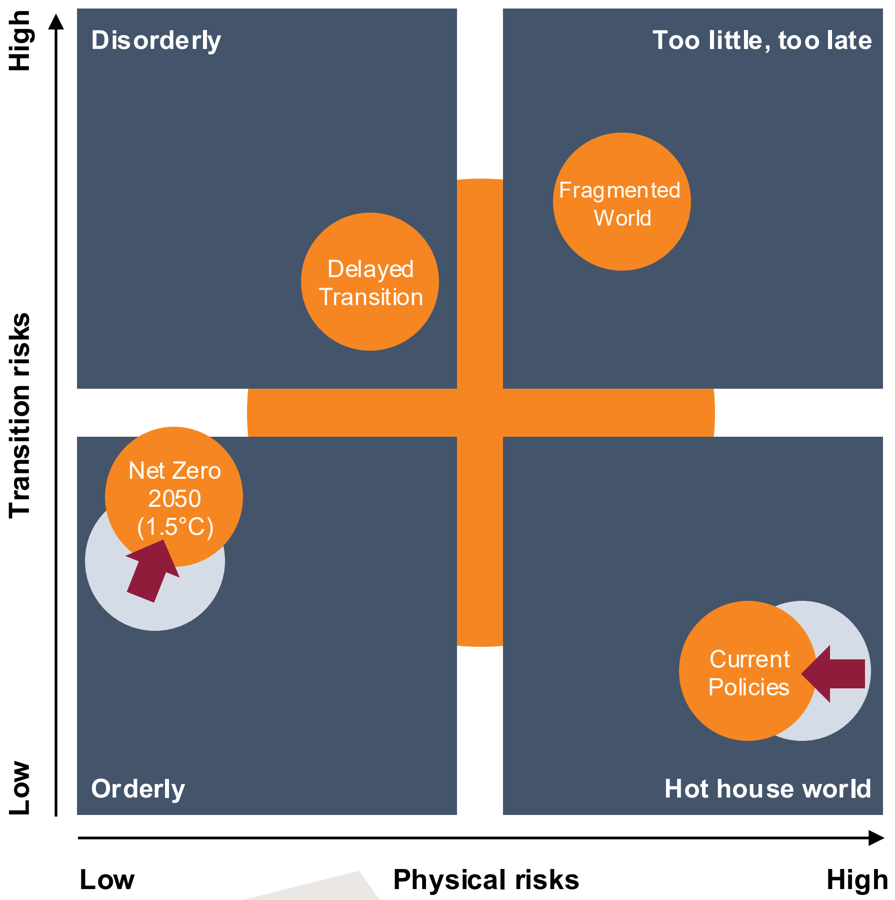
Benefits of the NGFS Scenario Framework

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 four 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.
- **Too little, too late** scenarios assume that a late and uncoordinated transition fails to limit physical risks.
- **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 created narratives for each type of scenario: **Net Zero 2050**, **Delayed Transition**, **Current Policies**, and **Fragmented World.** It has also highlighted **business-relevant data points** from the NGFS datasets that help quantify the physical and transition risks in each scenario.

NGFS Scenarios Framework Phase V



In Phase V, NGFS updated the scenarios to account for the latest data and policy commitments up to March 2024. The arrows show how the scenarios have shifted to reflect these updates.

Source: NGFS Climate Scenarios Database Technical Documentation V5 (2024)

NGFS Phase V Updates

BSR's previous Climate Scenarios Analysis was based on the NGFS Phase IV data. **BSR has updated its Climate Scenario Analysis with the latest NGFS 2024 (Phase V) scenario data** to maximize the scenarios' utility in supporting companies to conduct credible and streamlined climate scenario analysis. While the NGFS Scenarios will continue to evolve and become more precise, **key updates** to the latest NGFS 2024 (Phase IV & V) scenarios include:

Latest Policies & Global Developments

- The NGFS scenarios have been brought up to date with latest policies, such as the U.S. Inflation Reduction Act (IRA), the EU Fit for 55, and other **policies and country-level commitments enacted through March 2024.** The scenarios also reflect the impact of global developments, such as the war in Ukraine and its impact on energy markets.

Technology Trends

- The new scenarios also reflect the **latest trends in renewable energy technologies** (e.g., decreased capital costs for solar and wind), and key **mitigation technologies**.

Lower Carbon Capture Projections

- To reflect the latest science, all scenarios now have lower projections for **carbon capture and storage**, and **direct air carbon capture has been removed** from all scenarios.

New Calculations for Physical Damages

- **Heatwaves and droughts**, as well as their economic impacts, have been added to physical impact models and a **new damage function** now assesses that GDP losses due to physical risks could be 2-4x higher than previously estimated.

Source: NGFS Scenarios Phase V

Considerations When Using These Scenarios

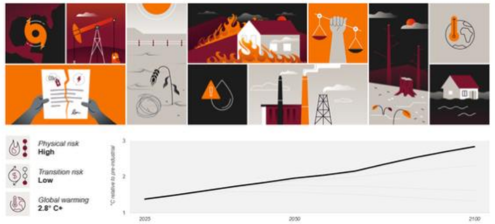
Scenarios are an important strategic tool that enable the **exploration of how multiple drivers of change may interact and converge to shape the future in different and unpredictable ways**.

When using these scenarios, it is important to remember:

1. The **scenarios are hypothetical constructs** that depict a set of different plausible climate-related futures that will impact the operating context of business.
2. 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.
3. 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.

Current Policies

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

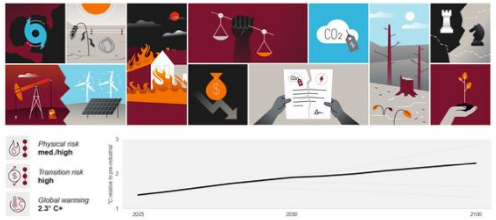


Delayed Transition

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

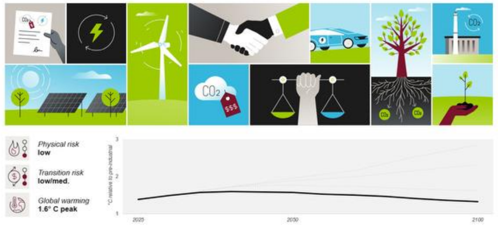
Fragmented World

A delayed and fragmented policy response leads to both high physical and transition risks.



Net Zero 2050

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



How to Use Climate 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 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).

03 | Climate Scenario Narratives & Data

Climate Scenarios Narrative Overview

NGFS Scenario Assumptions & Characteristics

Overall NGFS Assumptions: The four NGFS Scenarios have a 2050 horizon year and are differentiated by key design choices relating to long-term policy, short-term policy, and technology availability.

Individual Scenario Assumptions

SCENARIO	CURRENT POLICIES Only currently (2023) implemented policies are preserved, leading to high physical risks.	NET ZERO 2050 Stringent climate policies are immediately adopted to reach global net zero GHG emissions around 2050.	DELAYED TRANSITION Climate policies are delayed, which forces a very aggressive policy response starting in 2030.	FRAGMENTED WORLD Climate policies are delayed and globally fragmented, leading to high physical and transition risks.
Physical risks	**High physical risks**	**Low physical risks**	**Low–med. physical risks**	**Med.–high physical risks**
Impact of transition	**Low transition risks**	**Low–med. transition risks**	**Med.–high transition risks**	**High transition risks**
Global temperature rise*	3.0°C+ by 2100 (RCP 4.5)***	1.4°C, peak: 1.6°C (RCP 1.9)***	1.7°C, peak: 1.8°C (RCP 2.6)***	2.4°C+ by 2100 (RCP 3.4)***
Policy reaction	No additional**	Immediate and smooth**	Delayed**	Delayed and fragmented**
Technology change	Slow	Fast	Slow then fast	Slow then fragmented
Carbon dioxide removal use	Low	Medium/high	Low/medium	Low/medium
Regional policy reaction	Low regional variation	Medium regional variation	High regional variation	High regional variation

** above pre-industrial levels by 2100*
*** because NGFS's phase 5 data set was developed in 2024, this does not include any recent policy developments which may have strengthened or weakened ambition.*
**** IPCC's Representation Concentration Pathways*
Scenario descriptions based on the NGFS Phase V Documentation as well as data from NGFS Climate Impact Explorer and NGFS IIASA Scenario Explorer.

Overview of the Four Scenario Narratives

Current Policies

2020s

- Climate policy stalled
- Limited investment was directed to the energy transition
- Physical impacts brought disruption

2030s

- Low carbon prices failed to reduce emissions
- Climate impacts continued to accelerate
- Assets became uninsurable

2040s

- Adaptation became the focus of climate action
- Inequality was exacerbated
- Climate impacts caused exponential economic losses

Overview of the Four Scenario Narratives

Net Zero 2050

2020s

- Swift and forceful action was taken to reduce emissions
- Economies adapted, but not without struggle
- Climate impacts continued to accelerate due to inertia

2030s

- Emissions reduction efforts continued
- Economies began to show signs of recovery
- Attention switched towards harder-to-abate sectors

2040s

- Policy efforts were successful at helping the world reach net zero
- Some manageable climate impacts remained
- Climate reparations facilitated increased equity

Overview of the Four Scenario Narratives

Delayed Transition

2020s

- Policymakers implemented limited additional climate action
- Reliance on fossil fuels continued
- Physical impacts became more severe and apparent

2030s

- An abrupt crisis response began
- Businesses and citizens faced high compliance costs during the transition
- Emissions reduction was ultimately successful but turbulent

2040s

- A new low-carbon economy emerged
- Decarbonization efforts switched to harder-to-abate sectors
- Temperatures and physical impacts stabilized

Overview of the Four Scenario Narratives

Fragmented World

2020s

- Climate policy progress stalled
- Energy systems remained reliant on fossil fuels
- Physical impacts became more severe and apparent

2030s

- The global policy response diverged
- Policy fragmentation led to geopolitical tension and economic tension
- Climate justice issues intensified as climate risks amplified inequalities

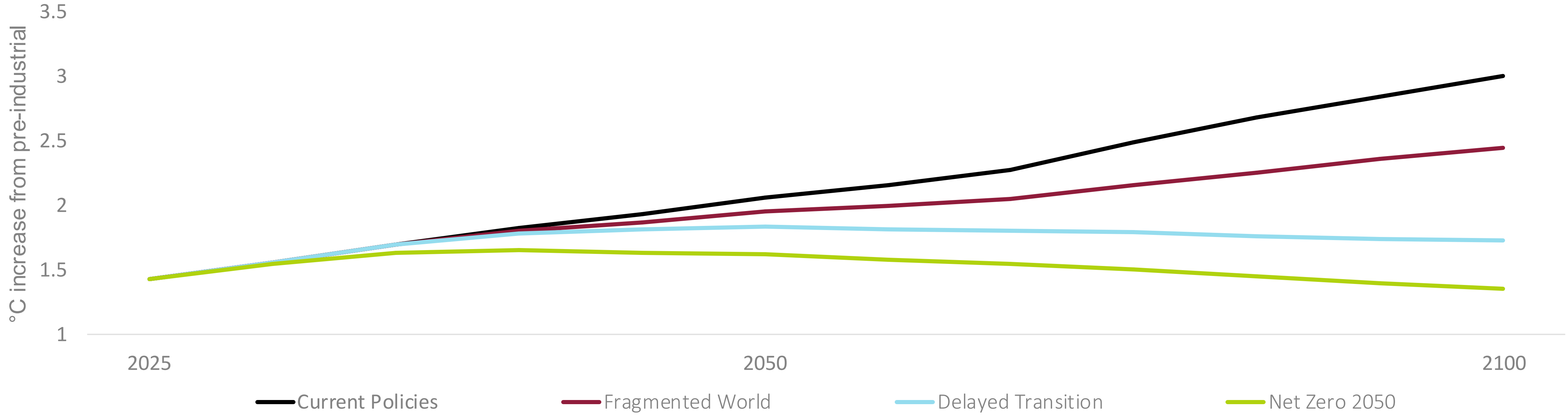
2040s

- Global economic networks became increasingly complex
- Progress from Net Zero-aligned countries alone was too-little, too-late
- Physical impacts from climate change worsened

Climate Scenarios Data Overview

Global Mean Temperature

By 2100, emissions trajectories resulted in 1.4°C warming in the **Net Zero 2050** scenario, 1.7°C in **Delayed Transition**, 2.4°C in **Fragmented World**, and 3.0°C in **Current Policies**. In all four scenarios, society continued to experience physical risks caused by GHG emissions emitted prior to 2023.



Under the four scenarios, warming continued to increase until the mid-2040s. Early climate action in Net Zero 2050 meant global temperatures stabilized sooner, resulting in comparatively less severe physical climate impacts from the mid-2040s onward.

Source: NGFS Phase 5 Scenario Explorer; Variable: AR6 climate diagnostics|Surface Temperature (GSAT)|MAGICCv7.5.3|50.0th Percentile; Model: REMIND-MAgPIE 3.3-4.8

*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.

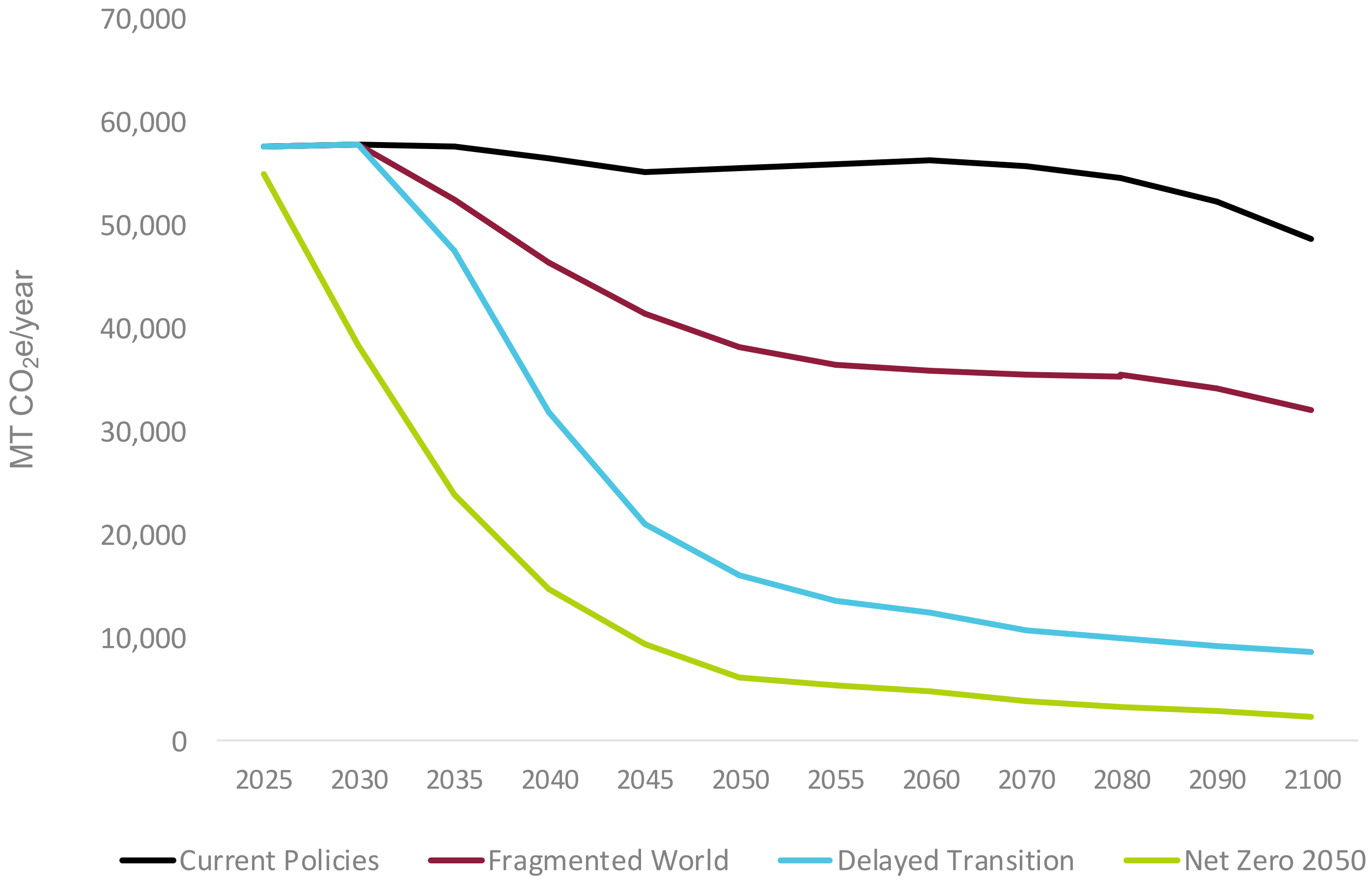
GHG Emissions (Kyoto Gases)

The four 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 followed a similar, but slightly steeper emissions trajectory compared to **Net Zero 2050,** but on a five-year delay.

Fragmented World begins its emissions reduction at a similar time to Delayed Transition, but on a less aggressive trajectory that stabilizes at higher emissions levels.

Current Policies fails to substantially reduce emissions through 2060.



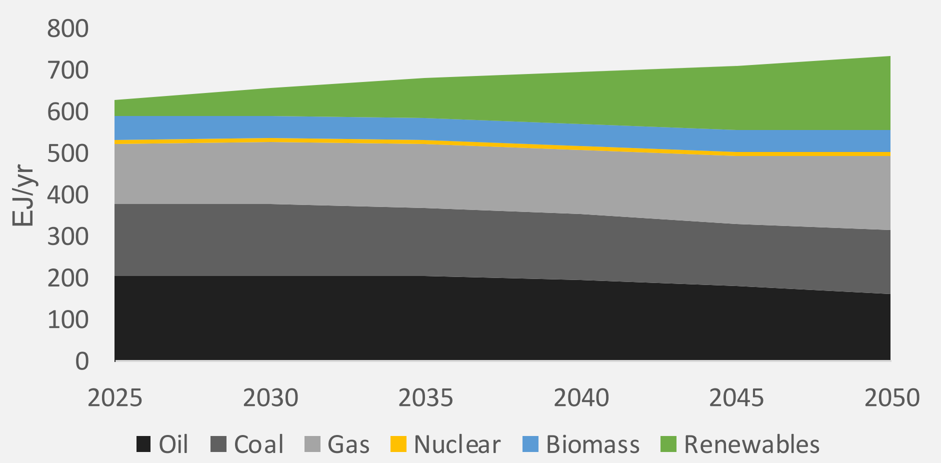
Source: [NGFS Phase 5 Scenario Explorer](); Variable: Emissions | Kyoto Gases; Model: REMIND-MAgPIE 3.3-4.8

Primary Energy Mix

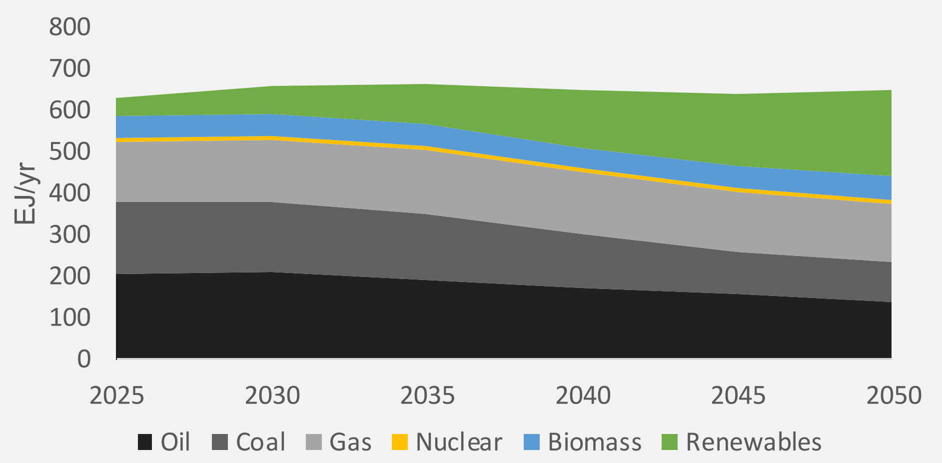
In 2050, renewables and biomass delivered 53% of global primary energy needs in **Fragmented World**, more than 69% of global primary energy needs under **Delayed Transition** and nearly 83% in **Net Zero 2050**.

This is in contrast with **Current Policies**, where fossil fuels continued to be the overwhelmingly dominant source of primary energy.

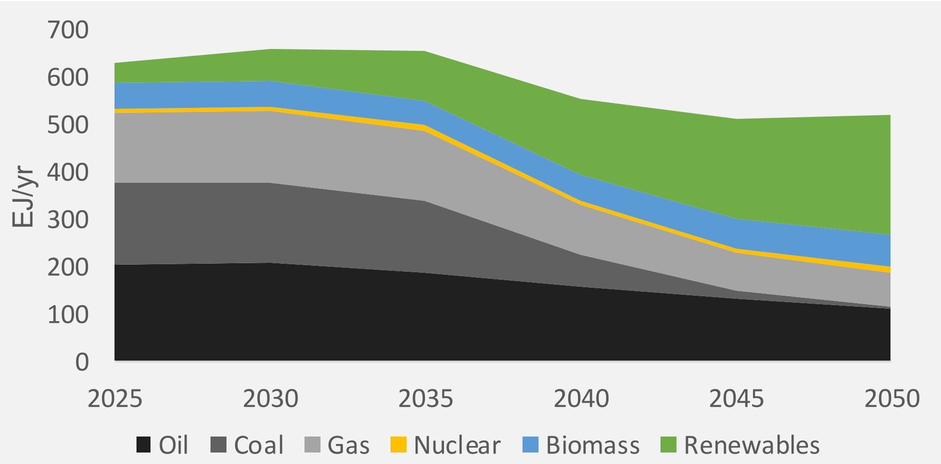
Current Policies



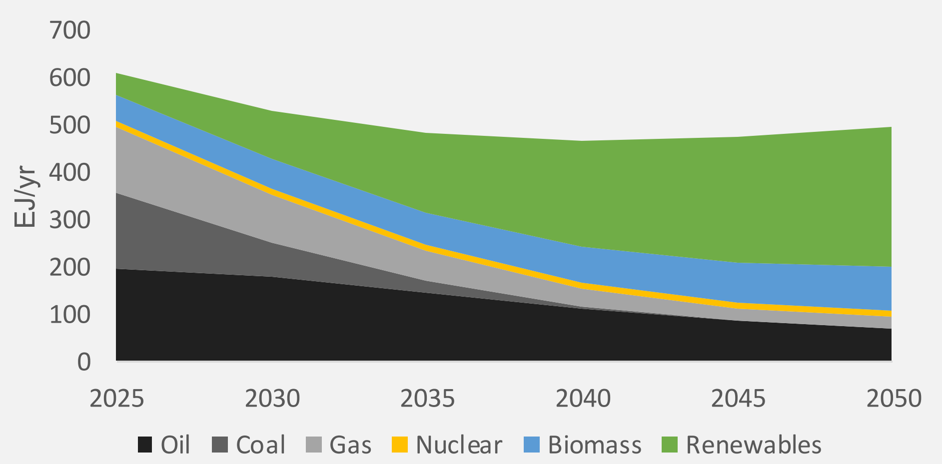
Fragmented World



Delayed Transition



Net Zero 2050



Source: NGFS Phase 5 Scenario Explorer; Variables: Primary Energy | Biomass; Coal; Gas; Non-Biomass Renewables; Nuclear; Oil; Model: REMIND-MAgPIE 3.3-4.8

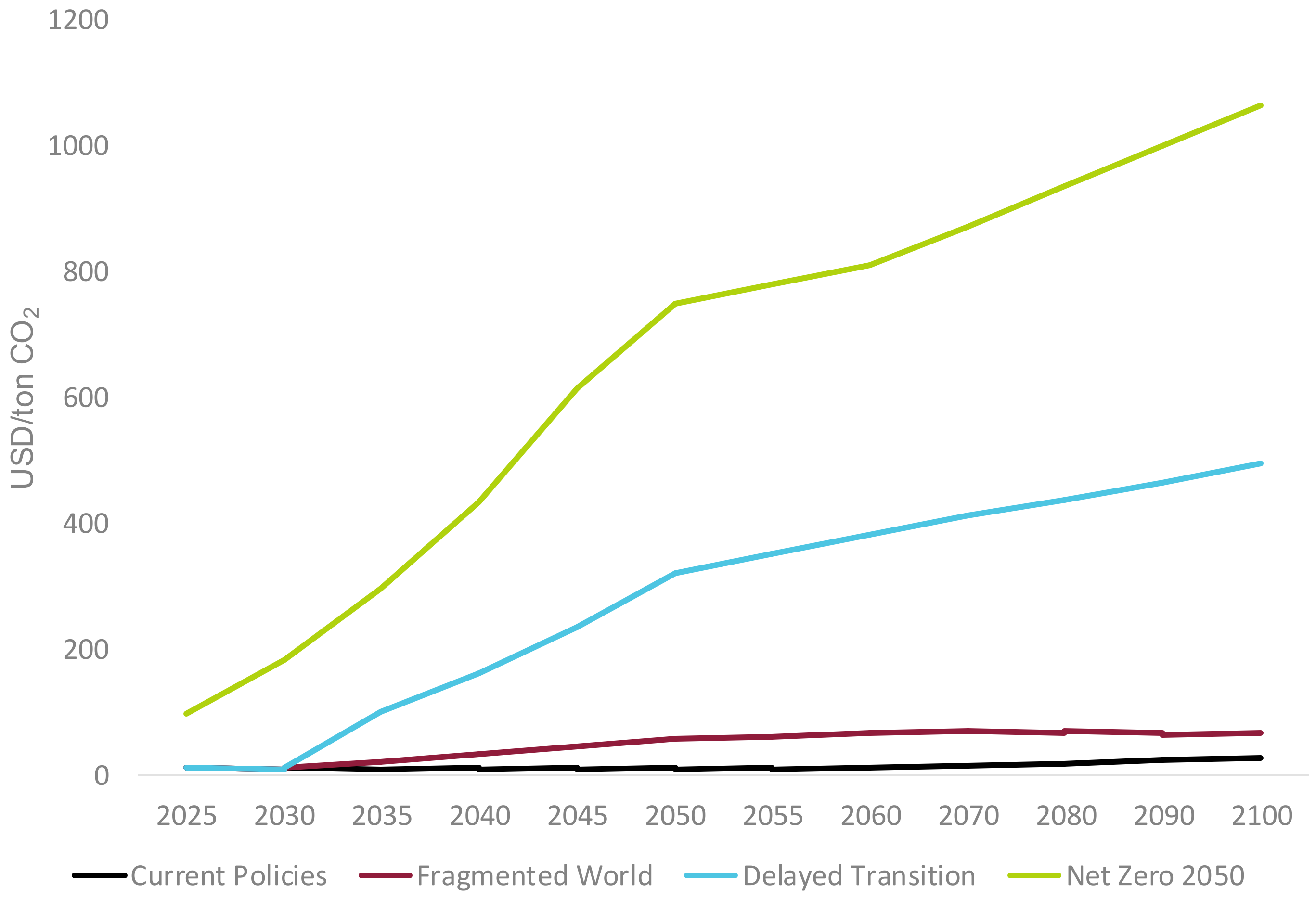
Carbon Price

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.

A variety of factors can contribute to higher carbon prices, including greater ambition to mitigate climate change, a delay in action that requires a rapid response, a diversity of policy measures across sectors and regions, and the limited availability of technology, such as carbon dioxide removal.

The late response in **Delayed Transition** creates the conditions for **the most rapid increase in carbon price** in the early 2030s.

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.



Source: NGFS Phase 5 Scenario Explorer; Variable: Price | Carbon; Model: REMIND-MAgPIE 3.3-4.8

Climate Scenarios Full Narratives

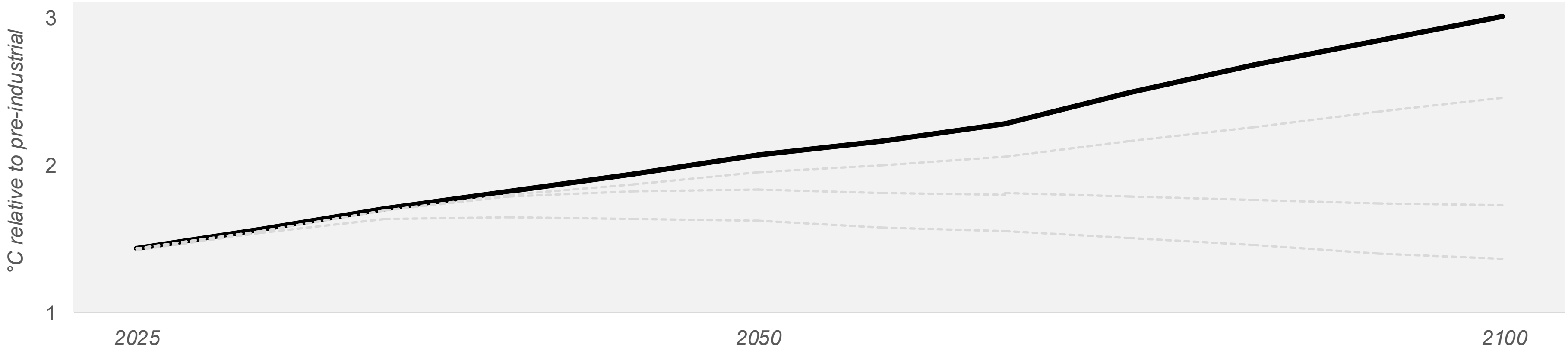
Current Policies

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

Physical risk
High

Transition risk
Low

Global warming
3.0°C+



Current Policies

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

Key Scenario Characteristics

- Carbon prices remain below 11 USD/ton CO_2 through 2050
- By 2050, chronic climate impacts leave GDP around 36% lower in Africa and Asia, 32% lower in Latin America, 20% lower in North America, and 10% lower in Europe compared with a climate-neutral baseline
- Europe and Asia experience the greatest economic damages from heatwaves, while Africa, Latin America, the Middle East, and North America are most exposed to drought
- By 2050, fossil fuels still account for over 70% of the world's total energy needs.

Key Scenario Assumptions

- 3.0°C+ warming by 2100
- No policy changes—continuation of policies as of 2023
- Slow technology change
- Low use of CO_2 removal
- Low regional policy variation

Current Policies

The 2020s

CLIMATE POLICY STALLED

After promising developments in the early 2020s (e.g., United States' IRA), climate policy stalled in the latter half of the decade due to political gridlock and economic concerns. The world fell well short of achieving 50% emissions reduction by 2030 to stay on a 1.5ºC trajectory.

LIMITED INVESTMENT IN THE ENERGY SYSTEM

With **geopolitical instability and high energy prices**, most governments prioritized energy security and continued to rely on fossil fuels as an energy source for more than 80% of total primary energy needs.

PHYSICAL IMPACTS BROUGHT DISRUPTION

Extreme weather events affected a growing share of the global population, leading to an uptick in climate refugees and significantly disrupting agricultural yields, manufacturing, and transportation.

The 2030s

LOW CARBON PRICES FAILED TO REDUCE EMISSIONS

Worsening **physical impacts did not result in increased government action** to curve emissions and carbon prices remained below 11 USD/ton. The **global temperature reached 1.7ºC** above pre-industrial levels by 2035.

CLIMATE IMPACTS CONTINUED TO ACCELERATE

Chronic and acute weather events became more severe and frequent across regions. Climate **impacts on ports and trade routes** led to ongoing supply chain disruptions, loss of supplier redundancy, and overall increased cost of goods.

ASSETS BECAME UNINSURABLE

With worsening weather patterns, **assets in high-risk locations were deemed uninsurable** and insurance companies restricted coverage. For businesses, this led to **significant loss in asset value**, higher rates of self-insurance, and a shift towards onshoring production in lower risk regions.

The 2040s

ADAPTATION BECAME THE FOCUS OF CLIMATE ACTION

Climate **negotiations shifted from mitigation towards adaptation**, with historically high-emitting countries failing to assume financial responsibility for climate impacts. Most investment in adaptation took place in high- income countries, leaving the middle- and low-income countries most exposed.

INEQUALITY WAS EXACERBATED

Vulnerable populations felt the growing pressure of **lower agricultural productivity**, extreme weather events, and **the rising cost of goods**. These impacts led to a growing refugee crisis in heavily impacted regions like SE Asia and Africa, and **reversed decades of progress on human rights**.

CLIMATE IMPACTS LED TO ECONOMIC LOSS

With global GDP losses from chronic impacts reaching nearly **15% annually by 2050**, operating under uncertainty was the new norm. Businesses were faced **with increasing costs of goods and** had to **invest heavily in resilience** to withstand the exponential impacts.

View from 2050

Policies implemented as of 2024 were preserved and **limited additional policy action** was taken.

↓

Without government or business action, **emissions failed to decline.**

↓

Physical climate impacts increased in severity and frequency, causing exponential economic loss, ecosystem damage, and human rights issues.

The 2020s: What Defined the Decade

CLIMATE POLICY STALLED

- After promising developments in the early 2020s (e.g., United States' Inflation Reduction Act, EU's Fit for 55 package), **climate policy stalled in the latter half of the decade** due to political gridlock, economic concerns, and the ascendancy of nationalist parties that de-prioritized climate action. While initial investments of the 2020s successfully reduced emissions roughly 10% in regions like the EU and countries in the OECD, **they fell short of significantly impacting global emissions**, which remained stable through the end of the decade.
- As a result, the **world did not achieve the 50% emissions reduction required by 2030 to stay on a 1.5ºC** warming trajectory, and many companies missed their near-term targets. The limited government action that was taken, which largely focused on climate-related disclosures, resulted in relatively low compliance costs for business.

LIMITED INVESTMENT WAS DIRECTED TO THE ENERGY TRANSITION

- Due to political inertia and a desire to keep energy prices low, most governments **continued to rely on fossil fuels as their primary energy source**. Global investment in fossil fuels continued to increase, reaching nearly 1 trillion USD per year by 2030 and continuing to outweigh investments in low-carbon energy.
- The absence of substantial climate policy measures meant investment in renewables was not significant enough to propel a low-carbon energy transition, and by 2030 **renewables** (including wind, solar, and hydro) **accounted for only about 10% of the world's total energy needs** and supplied less than 50% of the world's electricity. Because of the limited progress on decarbonizing the energy supply, many corporations struggled to decarbonize their energy consumption, and scope 2 emissions remained high.

PHYSICAL IMPACTS BROUGHT DISRUPTION

- By 2030, the **chronic impacts from climate change cost the global economy 5.3% annually** to the tune of roughly 5 trillion dollars, and acute extreme weather events were quickly increasing in prevalence across the world, particularly in the developing world. In Africa, droughts caused the most significant damage, inflicting annual GDP losses of 7.6%. In Asia, heatwaves were the most notable impact, inflicting annual GDP losses of 5.1% in the continent. Although acute physical impacts in regions like the U.S. and EU were relatively minimal compared to the developing world, chronic climate impacts still led to annual damages of 8.3% and 3.8%, respectively. The cumulative weight of these climate impacts globally led to an **increase in climate refugees**, and **disrupted agricultural production, manufacturing, and transportation**.
- These disruptions were exacerbated by a rise of nationalism and a retreat from globalization which further threatened the stability of global supply chains. Despite the growing physical impacts, **government action on climate remained limited**. Without significant climate regulation, companies focused on building resilience to recurring environmental shocks and relocated parts of their supply chains away from the most affected regions.

Current policies

- From 2025 to 2030, global emissions increased by 0.4% as many nations and companies missed or weakened their climate targets.
- Global investment in fossil fuel extraction continued to increase, reaching 1 trillion USD/year by 2030.
- In 2030, heatwaves inflicted annual GDP losses of 5% in Asia, and droughts inflicted annual GDP losses of 7.6% across Africa.

The 2030s: What Defined the Decade

LOW CARBON PRICES FAIL TO REDUCE EMISSIONS

- Despite worsening physical impacts, governments failed to implement significant emissions-reduction measures. The **global average carbon price remained below 11 USD/ton throughout the 2030s**, and in the absence of significant financial incentives**, markets forged ahead with high-emissions projects**. Throughout the decade, the world added an average of 66GW, roughly 54 billion USD, of natural gas power plants every year, with roughly 60% of the capacity being constructed in Asia, the Middle East, and Africa.
- By the end of the decade, **fossil fuels still accounted for 73% of the world's total primary energy needs** and without meaningful progress in the energy sector, nearly every other sector--including transportation, industry, and tech--, also struggled to decarbonize. **By 2040, the world had already reached 1.8C of warming** and was on track to surpass 2C by 2050.

CLIMATE IMPACTS CONTINUED TO ACCELERATE

- Throughout the 2030s, **physical impacts from climate change accelerated globally**, causing ongoing supply chain disruptions, and increased costs for critical goods and services. In the United States, annual hurricane damage rose by up to 30% over 2015 baseline levels by 2040. In central Europe, river flood damage increased by over 80% over baseline levels.
- **Crop failures became increasingly common** in key agricultural regions such as the Midwestern United States, rising an additional 1% over baseline. Although some crops saw local increases in yield (e.g., U.S. wheat), U.S. maize yields decreased between 4-20% by 2040, and India wheat declined as much as 6-38%. These escalating impacts led **to food supply chain collapses**, exacerbated inequality, and prompted some countries to impose stricter export controls to preserve their food supply.
- **Offshore manufacturing hubs also became a major point of vulnerability** as ports and shipping routes faced increasing threats, leading many companies to reconsider their sourcing strategies. Faced with these challenges, most businesses chose to invest their waning resources in adaptation over emissions reduction.

ASSETS BECAME UNINSURABLE

- As acute weather events grew more frequent and intense and the chronic impacts from climate change cost the global economy 10.5% annually by 2040, assets at high risk of physical impacts became uninsurable. Facing underwriting losses, **insurance companies increased rates dramatically, restricted coverage, and exited some regions**—such as SE Asia and coastal regions of the U.S.--, altogether. This led to significant asset value losses for corporations, as well as higher rates of self-insurance, and greater reliance on disaster relief from the already strained public sector.
- **Nearshoring or relocating operations to less impacted regions**, such as parts of the EU and North America became more common but costly due to increasing real estate prices.

Current policies

- Carbon prices stayed below 11 USD per ton and businesses, including fossil fuel reliant ones, continued to operate business as usual.
- Annual hurricane damage increased by 30% in the U.S. by 2040, and river flood damage increased 50% in Eastern Europe.
- Insurance companies dropped their coverage of many at-risk assets as physical impacts worsened.

The 2040s: What Defined the Decade

ADAPTATION BECAME THE FOCUS OF CLIMATE ACTION

- Without hope of meaningfully curbing global emissions, many countries and businesses **shifted focus to adaptation**. Although at great cost, wealthier countries were able to make the necessary investments to adapt to climate change. However, the **lack of global cooperation resulted in limited technology transfer** (e.g., drought-resistant crops, early detection systems) to middle- and low-income countries and as a result, they struggled to adapt to the exponential rate of climate change.
- Businesses responded by **heavily investing in adaptation**, including upgrading and relocating critical infrastructure, increasing supply chain redundancy, and adopting technological solutions such as climate-resilient crops and energy systems.

INEQUALITY WAS EXACERBATED

- The inequity of climate change's physical impacts coupled with an unequal adaptation response fueled **a dramatic increase in global social inequality**. Vulnerable populations were hit with a crippling mix of physical and economic impacts, including lower agricultural productivity, **increasingly severe weather events** that destroyed homes and livelihoods, and **rising costs** for essential goods and services. The combined weight of these impacts led to the death of millions every year, disproportionately impacting the elderly, those with disabilities, and low-income communities.
- Climate change's physical impacts also triggered a wave of climate refugees, escalating geopolitical tensions and sparking reactionary, nationalist movements. **Progress that had been made on social inclusion and human rights was largely reversed**. Meanwhile, companies felt a growing pressure to invest in their communities to mitigate climate change's worsening social impacts.

CLIMATE IMPACTS CAUSED EXPONENTIAL ECONOMIC LOSSES

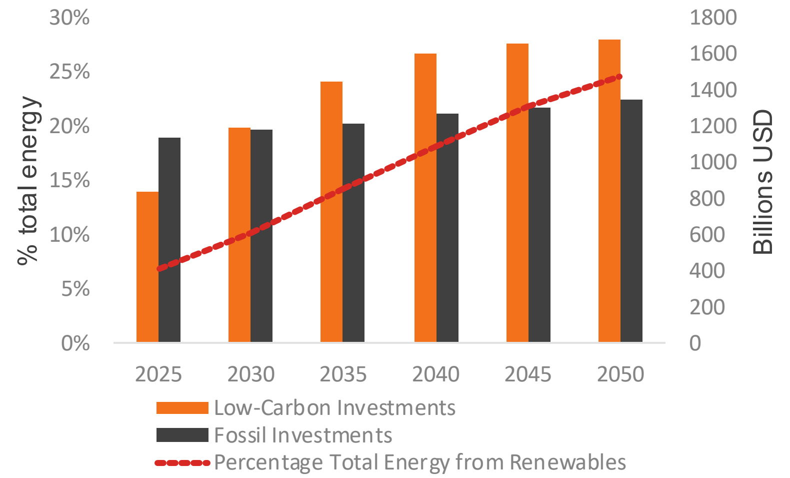
- By 2050, the exponential nature of climate change became increasingly apparent. In 2050, the **chronic physical impacts from climate change cost the global economy nearly 15% annually**, and led to GDP losses of 18% in Africa, 18% in Asia, and 16% in Latin America. Regions like the EU and US faired slightly better but still experienced annual chronic damages of 5% and 11%, respectively.
- Acute impacts also continued to increase in severity. Droughts inflicted the most damage in in Africa, causing annual GDP losses of 12.6%, and heatwaves shaved off 12% of GDP in Asian countries. Despite the severity of the crisis, limited action was taken to curb emissions and the **world remained on a trajectory to exceed 3°C of warming** by the end of the century.

Current policies

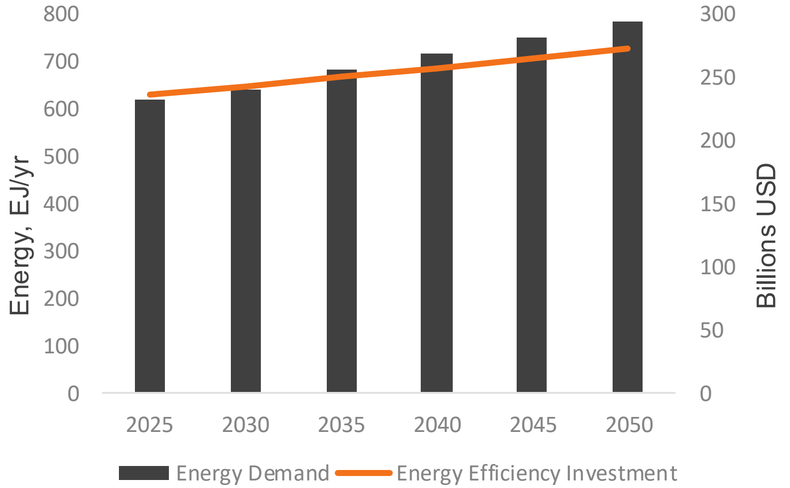
- With 3°C of warming appearing likely, businesses and communities were forced to focus on adaptation
- Global inequality accelerated due to extreme weather events, rising prices, and a growing climate refugee crisis. Human rights progress stalled or unraveled in many regions hit the hardest.
- Annual GDP losses from heatwaves rose to 12% in Asia, and annual losses from droughts reached 12% across Africa and 16% in India.

Current Policies

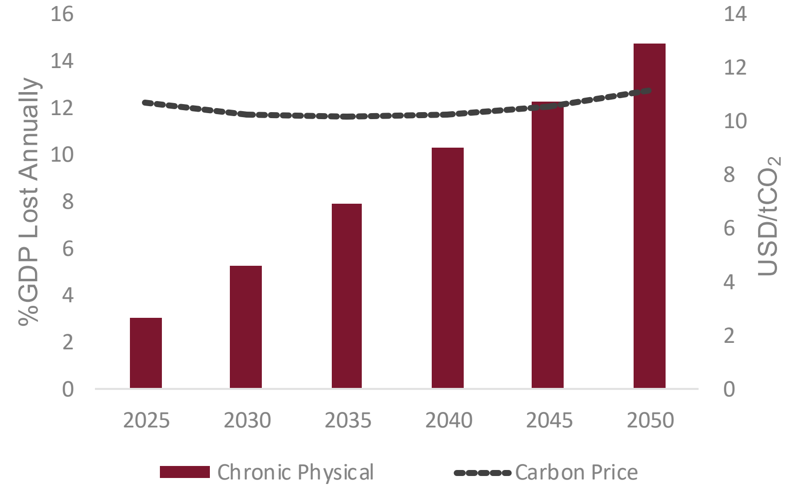
Renewables maintained a smaller share of primary energy output as fossil investment sustained



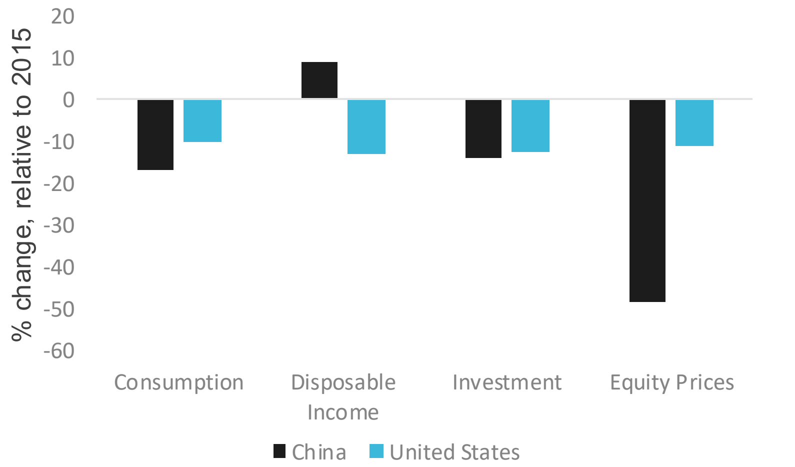
Global energy demand grew ~27% by 2050 due to lack of energy efficiency investment



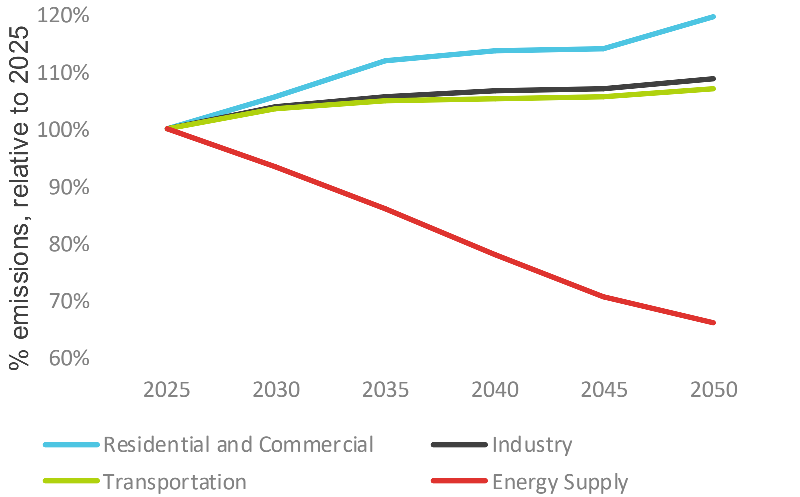
Lack of climate policy & carbon pricing led to exponential GDP loss from climate damage



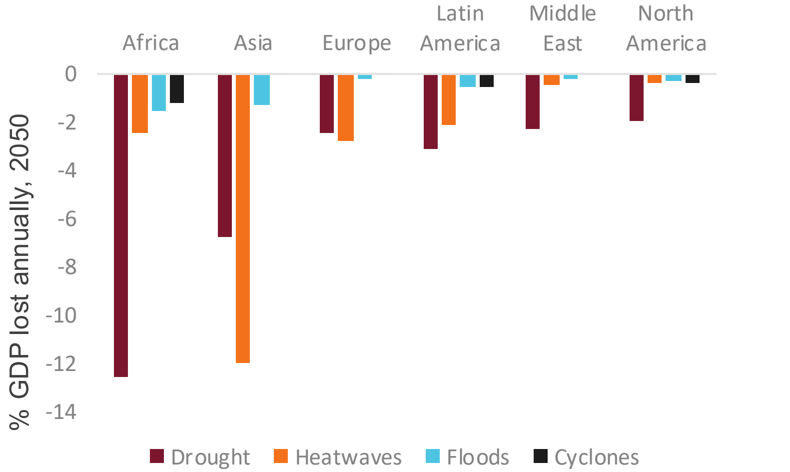
By 2050, climate impacts had notable impacts on consumers and market behavior



Energy supply was the only major sector to achieve emissions reduction through 2050



Inequitable climate impacts caused 3-7X greater acute physical damages in Asia/Africa than EU/NA



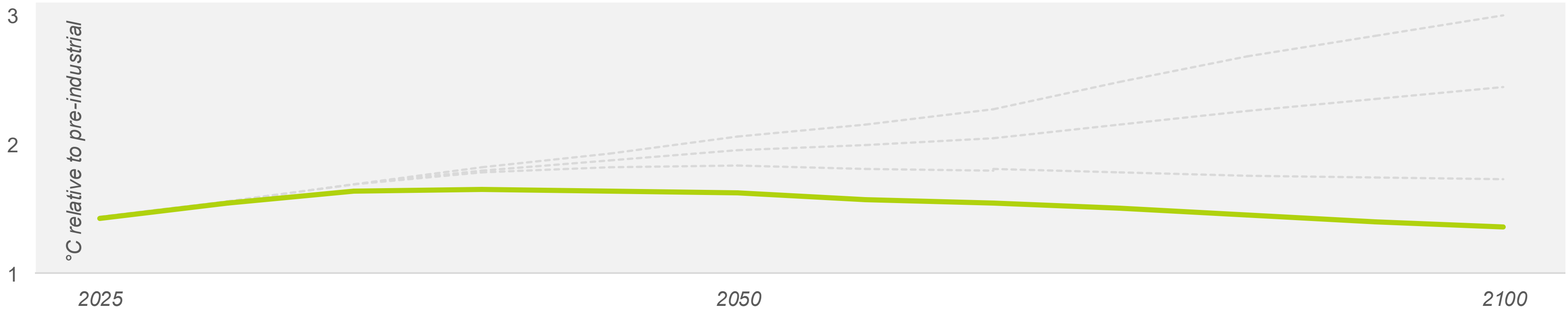
Net Zero 2050

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

Physical risk
low

Transition risk
low/med.

Global warming
1.6°C peak



Net Zero 2050

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

Key Scenario Characteristics

- Carbon prices spike to 183 USD/ton CO_2 by 2030, and 748 USD/ton CO_2 by 2050
- High inflation rates in 2020s due to climate policies, reaching 1% over baseline levels globally, and as high as 3-7% in some regions
- Annual investments in low-carbon solutions total nearly 3% of global GDP, or about 2.8 trillion USD, by 2030
- Renewables account for around 90% of global electricity production by late 2030s
- Global temperatures begin decreasing by 2040, and helping to limit annual GDP losses due to chronic physical impacts to 7%

Key Scenario Assumptions

- 1.6°C peak warming
- Immediate and smooth policy reaction
- Fast technology change
- Medium/high use of carbon dioxide removal
- Medium regional policy variation

Net Zero 2050

The 2020s

SWIFT AND FORCEFUL ACTION WAS TAKEN TO REDUCE EMISSIONS

In line with climate experts, **policymakers acted swiftly to curb carbon emissions**, raising carbon prices to 183 USD/ton by 2030, and adopting mandatory reduction targets for sectors. The strong policies reduced global Kyoto emissions by 30% in the decade.

ECONOMIES ADAPTED, BUT NOT WITHOUT STRUGGLE

The cost of the world's aggressive climate policies resulted in annual transition costs of 1% global GDP by 2030. Global **inflation rates rose** 1% over baseline levels, and **unemployment spiked** in emissions intensive industries.

EARLY CLIMATE IMPACTS CONTINUED TO ESCALATE

Despite efforts to reduce emissions, **the frequency of extreme weather events still increased** incrementally due to past emissions, with annual global GDP losses due to chronic physical impacts increasing from 2.9% in 2025 to 5.1% in 2030.

The 2030s

EMISSIONS REDUCTION EFFORTS CONTINUED

Policy momentum continued into the 2030s, with carbon prices jumping another 136% to 433 USD/ton by 2040, and emissions reducing another 62% in the decade. However, the extreme growth of renewables and energy storage had **negative side effects**, such as **environmental and human rights impacts** from rare earth mineral mining.

ECONOMIES STABILIZED

Economies began to stabilize in the 2030s, with inflation and interest rates returning to baseline. Prices for critical goods and services followed suit, therefore removing pressure on consumer disposable income.

ATTENTION SWITCHED TOWARDS HARDER-TO-ABATE SECTORS

The intensive low-carbon investments resulted in **renewables accounting for over 90% of global electricity** production. With the electricity sector largely decarbonized, **investments switched to harder-to-abate sectors** such as cement and steel. By 2040, industrial sector emissions had fallen 62% relative to 2030.

The 2040s

POLICY EFFORTS WERE SUCCESSFUL AT HELPING THE WORLD REACH NET ZERO

By 2050, **global emissions were a mere 11.3% of 2025** levels, and natural and technological removals helped mitigate nearly 90% of the remaining emissions. The global price on carbon reached 749 USD/ton in 2050, and in response, **businesses phased out** much of their remaining use of **fossil fuels.**

MANAGEABLE CLIMATE IMPACTS REMAINED

Although the world's efforts to reduce emissions **limited the severity of climate change**, losses due to chronic physical impacts still amounted to 7.3% of global GDP. Fortunately, investment into **adaptation efforts** were able to mitigate most of the risk for businesses.

CLIMATE REPARATIONS FACILITATED INCREASED EQUITY

After **emissions and global temperature stabilized**, the economic development of previously vulnerable areas was promoted through **reparation programs and international legal frameworks** that held emitters responsible for the damages caused by climate change.

View from 2050

The transition to a net-zero economy required **drastic and coordinated global action** from government, business, and civil society.

↓

The **cost of action was initially high**, but most economies and sectors recovered by the mid to late 2030s.

↓

Swift action resulted in **warming peaking at 1.6°C** in 2040, minimizing climate change's physical impacts.

The 2020s: What Defined the Decade

SWIFT AND FORCEFUL ACTION WAS TAKEN TO REDUCE EMISSIONS

- Following recommendations from climate experts, policymakers across the globe acted swiftly to curb emissions and reduce the long-term impacts of climate change. By 2030, **global average carbon prices reached 183 USD/ton** of CO2, and many countries implemented legally mandated emissions reduction targets and sector-specific carbon budgets.
- **Decarbonizing the energy system became the top priority**, and global investments in low-carbon solutions totaled nearly 3% of global GDP, or 2.8 trillion USD, annually by 2030. As a result, renewables share of global primary energy surged from 7.9% in 2025 to 19.5% in 2030, and the percentage of the global grid powered by renewables grew from 36% to 48% over the same period. Although the policies were successful at reducing global emissions by 30% in the decade, they also resulted in **global GDP losses of nearly 1% by 2030**.

ECONOMIES ADAPTED, BUT NOT WITHOUT STRUGGLE

- In response to rising carbon prices and government regulation, corporations were forced to take on significant costs to adapt their operations and reduce emissions. By 2025, **global inflation rates increased by an additional 1%** over background inflation rates, with rates as much as 3-4% higher across Asia, the Middle East, and Latin America. This led to higher prices for everything from electricity--which spiked 50% globally from 2020-2030--, to food and **low-income consumers struggled** in this early transitional period.
- While **unemployment rates increased** in certain countries as climate policies took their toll on the fossil fuel industry and manufacturing sector, the increased demand for energy efficiency measures and low-carbon solutions spurred job retraining programs that mitigated some of the employment losses. In some countries, such as China, these initiatives even helped contribute to overall job growth in the latter half of the decade.

CLIMATE IMPACTS CONTINUED TO ACCELERATE DUE TO INERTIA OF PAST EMISSIONS

- Despite the success of global emissions reduction efforts, **climate change's physical impacts continued to intensify** due to the inertia of past emissions. From 2025 to 2030, economic damages from chronic physical impacts increased from 2.9% to 5.1%, costing the global economy roughly 5 trillion USD. Acute physical impacts also became dramatically more pronounced by the decade's end. In Asia, annual GDP losses due to heatwaves reached 3.6% by 2030 and in Africa, droughts cost nearly 3.8% of the continent's GDP annually by 2030.
- As a result, businesses faced worsening **supply chain disruptions**, **volatile prices for critical commodities**, and **increased competition for resources**. In response to these increased physical damages, governments felt emboldened to forge ahead with the transition as the costs of inaction clearly outweighed the transition costs, which remained below 1% of global GDP in 2030.

Net Zero 2050

- Global average carbon prices rose to 183 USD/ton by 2030.
- Global investments in low-carbon energy totaled nearly 3% of GDP, or roughly 2.8 trillion USD, in 2030 and brought the percentage of the world's total energy needs met by renewables up from 8% in 2025 to 20% by 2030.
- Inflation rates spiked an additional 1% over baseline levels in the decade.

The 2030s: What Defined the Decade

EMISSIONS REDUCTION EFFORTS CONTINUED

- As climate impacts worsened, the strong momentum of the 2020s carried into the 2030s. **Carbon prices rose by another 136%** to reach 433 USD/ton CO_2 by the end of the decade, and aggressive policy mandates maintained pressure on businesses to further reduce their emissions. These measures kept the world on track to reach net zero, and by 2040 **global emissions had decreased 73%** relative to 2025.
- To accomplish these reductions, the world's total electricity capacity increased more than 50% in the decade, and the world continued to pour money into low-carbon investments, which reached a high of 3.5 trillion USD per year in 2035. However, this **explosive growth in low-carbon energy systems** also necessitated the increased mining of transition minerals, such as lithium and cobalt. This increased mining activity in mineral-rich regions such as Australia, Chile, and the Congo **endangered ecosystems and created new environmental justice concerns for vulnerable groups**, including Indigenous populations and low-wage workers. As the large volume of batteries and solar panels reached the end of their life cycles, their disposal also posed challenges for both local communities and the environment.

ECONOMIES BEGAN TO SHOW SIGNS OF RECOVERY

- After the economic struggles of the 2020s, economies began to recover as the **costs for critical technologies dropped** and businesses adapted to higher carbon prices by lowering embodied emissions. Following a peak in global inflation of around 1% above baseline levels in the mid-2020s, it steadily declined back down to baseline levels by the mid-2030s. As inflation stabilized, central banks felt comfortable **lowering long-term interest rates** and by 2035, U.S. long-term interest rates were nearly 1% lower than they had been a decade earlier.
- These lower rates, combined with reduced costs for transition technologies, **allowed businesses to stabilize prices** and led to increased household disposable income. For example, the global electricity price index decreased to 1.07 by 2040, down from its high of 1.51 in 2030. As economies stabilized, political attention was able to shift toward **addressing climate inequities**, and low- and middle-income nations, indigenous communities, women, and youth gained more influence in climate negotiations.

ATTENTION SWITCHED TOWARDS HARDER-TO-ABATE SECTORS

- After two decades of aggressive and productive low-carbon energy investments, renewables and biomass combined to supply 64.2% of the world's total primary energy needs. In the electricity sector, renewables and nuclear combined to account for 97% of the world's total demand. This progress allowed annual renewable investments to drop 20% in the 2030s and opened **new investment opportunities to reduce emissions in harder-to-abate sectors** such as cement, steel, and chemicals production.
- By the decade's end, **industrial sector emissions were 62% lower than in 2030**, driven in part by a 430% increase in hydrogen capacity. Additionally, the increased use of satellites and autonomous systems to monitor and report emissions helped companies tackle residual emissions across their complex supply chains, and improved tracking of broader impacts, such as related to biodiversity and human rights.

Net Zero 2050

- Carbon prices rose another 136% by 2040 to reach 433 USD/ton by 2040, and helped the world reduce emissions another 62% in the decade.
- Inflation rates returned to baseline levels, and costs for basic goods, such as electricity, stabilized in the decade.
- After continued aggressive investments, renewables and nuclear combined to supply over 97% of the world's total electricity demand.

The 2040s: What Defined the Decade

POLICY EFFORTS WERE SUCCESSFUL AT HELPING THE WORLD REACH NET ZERO

- Because of collaborative global efforts, **emissions continued to decrease throughout the 2040s**, and by 2050 global emissions were a mere 11.3% of 2025 levels. Businesses and policymakers made further progress on offsetting remaining emissions through natural and technological removals, and by 2050, **nearly 90% of the world's remaining emissions were captured or offset**.
- As a result of the world's persistent climate policies, **carbon prices continued their steady rise**, hitting 749 USD/ton CO_2 by 2050. In response, businesses phased out most of the remaining fossil fuel use in their value chains, with fossil fuels only accounting for 19% of global primary energy use by 2050, down from 81.3% in 2025. By 2040, the transportation sector accounted for nearly 50% of global emissions, the largest share of any sector, and therefore became the new priority for investments. As a result of these **investments and technological advancements**, such as into sustainable aviation fuels, the transportation sector saw its emissions reduce another 43% from 2040-2050.

SOME MANAGEABLE CLIMATE IMPACTS REMAINED

- Although global emissions reductions efforts limited the severity of climate change and even helped temperatures to decrease slightly in the 2040s, **its physical impacts were still felt to some extent across much of the world** due to locked in emissions from earlier decades. For example, heatwaves in Africa and Asia were roughly twice as frequent as they were in 2020, but they also had not increased substantially since 2035. In the United States and across western Europe, annual economic damage from river floods stabilized at levels about 35% above 2020 and had also not increased substantially since 2035. By 2050, chronic physical impacts from climate change resulted in annual GDP losses of 7.3% globally, a slight increase from 6.8% in 2035.
- This **global stabilization of physical impacts** also made them more predictable, therefore allowing countries and corporations to more readily **mitigate them through investment in adaptation**.

CLIMATE REPARATIONS FACILITATED INCREASED EQUITY

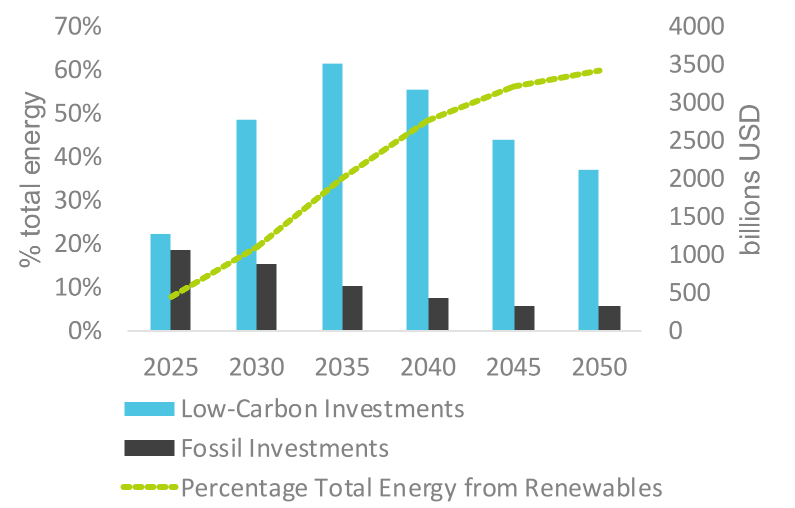
- After emissions and global temperatures stabilized, economic development in previously vulnerable regions was prioritized through **reparation programs and international legal frameworks that held past emitters responsible** for climate-related damages. These new international legal frameworks utilized sophisticated techniques to scientifically attribute responsibility, facilitating legally mandated climate reparations from high-income to low-income economies for historical damages, including loss of life, land, culture, and community. As a result of these significant reparation and adaptation strategies and the continued increase in carbon prices, transition costs continued to increase another 50% by the end of the decade but were deemed necessary to foster a more equitable and resilient economic future globally.
- As it became clear that climate change's worst impacts had been averted, **attention shifted to restoring ecosystems and reversing biodiversity loss**, and similar calls were raised to attribute past responsibility for these impacts to specific companies, countries, and industries.

Net Zero 2050

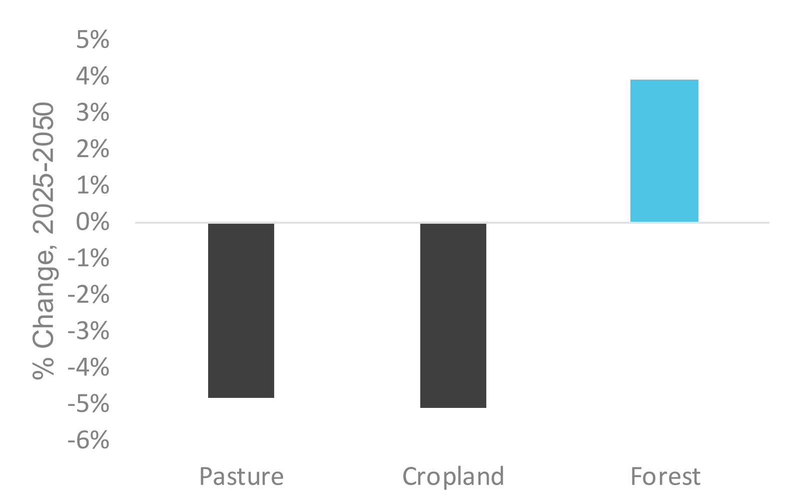
- Global CO2 emissions in 2050 were reduced to a mere 11% of 2020 levels and global temperatures began to decrease thanks to natural and technological removals.
- Chronic physical impacts still led to annual global GDP losses of 7% but had at least stabilized at 2035 levels.
- Climate reparation programs levied heavy fines against past corporations and countries responsible for the climate crisis. The redirected funds helped to stem inequality.

Net Zero 2050

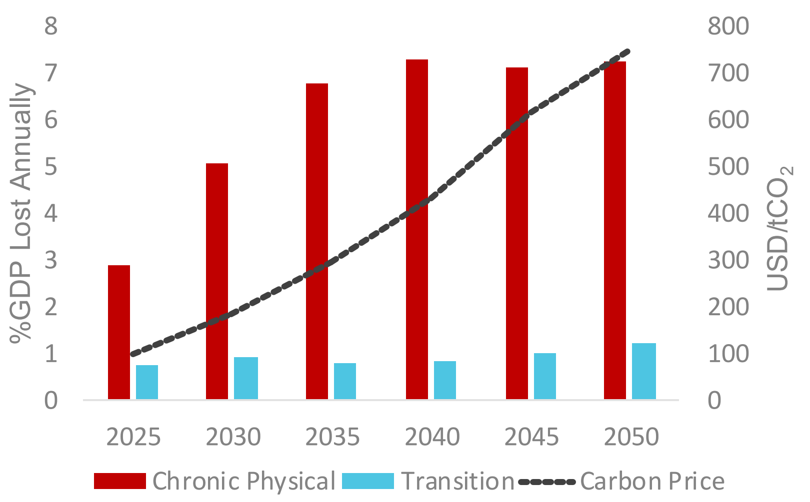
Sustained investment led to 60% of primary energy production being non-biomass renewables by 2050



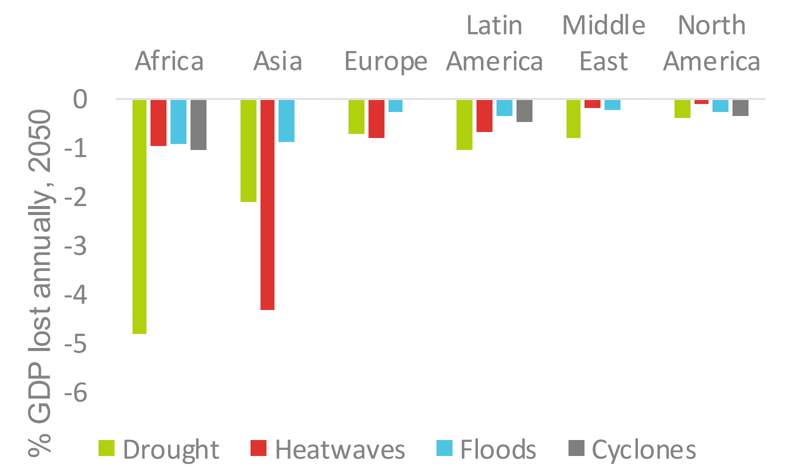
Pasture cover and cropland cover decreased to help forests recover and sequester carbon



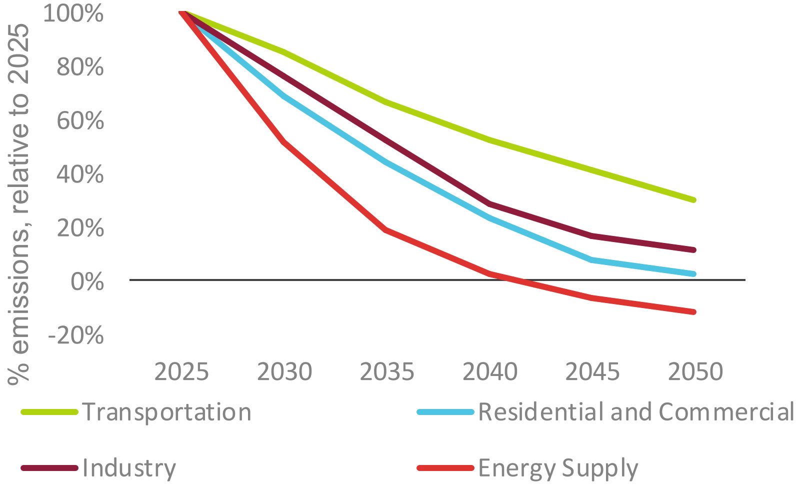
Carbon prices & policies in late 2020s stabilized physical damages, but at the expense of some transition costs



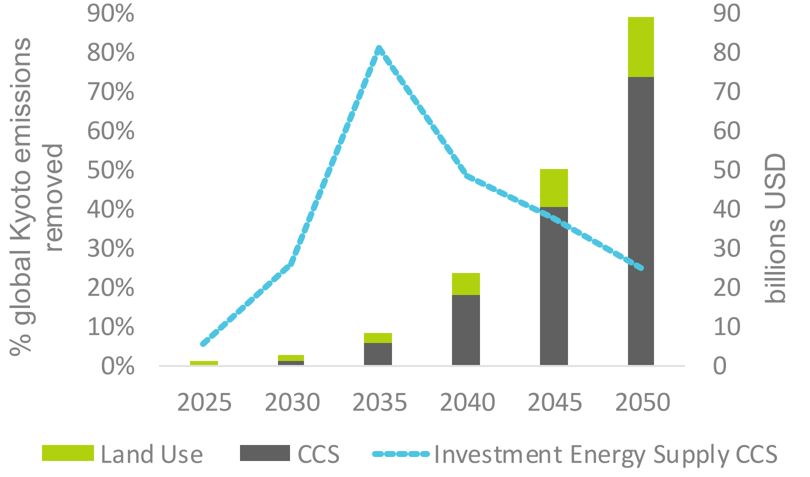
Except for droughts in Africa and heatwaves in Asia, most acute physical risks were kept at manageable levels



Emissions reduction initially focused on energy supply to enable reductions in other sectors



Targeted investment in CCS in the early 2030s helped the world reach net zero by 2050



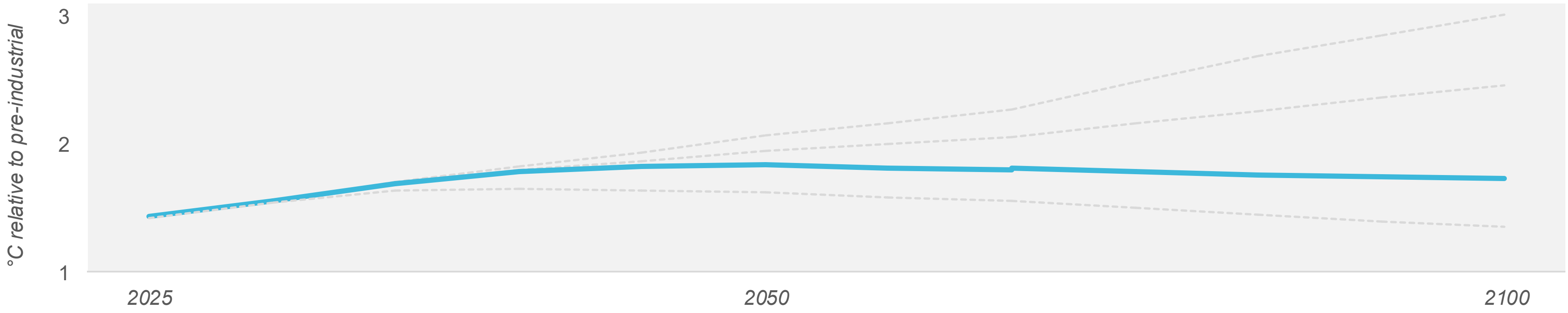
Delayed Transition

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

Physical risk
low/med.

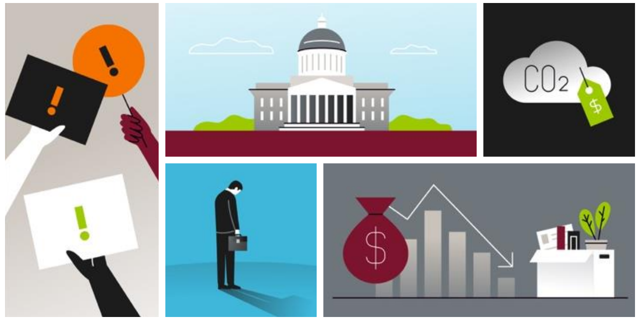
Transition risk
med./high

Global warming
1.8°C peak



Delayed Transition

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



Key Scenario Characteristics

- Global emissions fail to decrease substantially through 2030, causing physical impacts to continue to increase through the late 2030s, early 2040s
- Global carbon prices spike nearly from around 10 USD/ton in 2030 to 100 USD/ton in 2035
- Global policy costs due to the transition reach over 2 trillion USD annually by 2040, costing the world about 1.3% GDP
- Inflation, unemployment, and interest rates also spike in the 2030s in response to rushed policies and lack of climate justice focus
- Annual GDP losses due to chronic climate damages eventually stabilize by 2050 below 11% of global GDP

Key Scenario Assumptions

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

Delayed Transition

The 2020s

CLIMATE POLICY STALLED

Governments and businesses took **limited action to curb emissions** due to lack of political capital, concerns regarding inflation, and rapidly growing energy demands to power AI. Companies continued to set **voluntary commitments but** lacked robust strategies to implement and reach their targets.

RELIANCE ON FOSSIL FUELS CONTINUED

Fossil fuel development continued, with renewables being viewed as a secondary, less reliable, option. By 2030, only 10.2% of the world's total energy needs were met by renewables.

PHYSICAL IMPACTS BECAME MORE APPARENT

Physical impacts from climate change became more frequent and severe. Businesses experienced **supply chain disruptions**, increasing / volatile prices, and competition for resources.

The 2030s

AN ABRUPT CRISIS RESPONSE BEGAN

As climate change's impacts became increasingly evident, many governments took forceful and disruptive action to reduce emissions. Global **carbon prices** spiked to 125 USD/ton by 2035, and global **investments in low-carbon solutions** reached 3 trillion annually by 2040.

BUSINESSES FACED HIGH COMPLIANCE COSTS

Businesses faced high compliance costs during the transition, including rapidly increasing **carbon prices** and **volatile prices** for key inputs. **Government mandates to reduce emissions** also forced the adoption of expensive and sometimes unproven technologies.

EMISSIONS REDUCTION WAS SUCCESSFUL BUT TURBULENT

By 2040, the world's aggressive policies had achieved a 45% emissions reduction relative to 2030, largely due to the tectonic shift in the energy sector where renewable electricity capacity surged 121% in the decade. However, these policies also resulted in global GDP losses of 1.3% annually by 2040.

The 2040s

A NEW LOW-CARBON ECONOMY EMERGED

After the successful emissions reduction efforts of the 2040s, attention shifted towards **climate adaptation and climate equity**. Public investment in job retraining and other revitalization efforts helped the hardest hit regions recover.

DECARBONIZATION FOCUS SHIFTED TO HARD-TO-ABATE SECTORS

After the successful energy sector transition, decarbonization efforts now shifted toward hard-to-abate sectors, such **as aviation, steel production, and mining**. Industrial hydrogen production increased nearly fourfold from 2035-2050 and was critical to achieving these reductions.

PHYSICAL IMPACTS STABILIZED

Continued progress and investment in carbon removal eventually enabled the world to achieve net-zero emissions. Global **temperatures peaked at 1.8C** above pre-industrial levels, in 2050, but chronic physical impacts still led to roughly 11% annual global GDP losses.

View from 2050

A decade of inaction in the 2020s drove mounting pressure for climate action.

↓

This led to the adoption of hasty and reactionary policies in the 2030s

↓

The disorderly approach came with high social and economic costs but ultimately led to a halving of emissions and peak warming at 1.8°C.

The 2020s: What Defined the Decade

POLICYMAKERS IMPLEMENTED LIMITED ADDITIONAL CLIMATE ACTION

- Following initial policy progress in the early 2020s, such as from the United States' Inflation Reduction Act and the EU's Fit for 55 package, **climate action began to stall in the latter of the decade** as climate bills were watered down or reversed. The slowdown was caused by a variety of factors, including lack of political capital, concerns regarding inflation, supply chain constraints, rapidly growing energy demands to power AI, and competing priorities for land-use. International congresses to advance climate action continued to take place but produced limited tangible progress and impact. Many **countries continued to weaken their national climate targets**, widening the gap between reality and the original goals set forth by the Paris Agreement.
- Without additional regulation, companies continued to set voluntary commitments and adhered to emerging reporting requirements but often **lacked robust strategies to reach their targets**. As a result, GHG emissions remained relatively constant throughout the decade, and temperatures continued to rise, reaching 1.55°C above pre-industrial levels by 2030.

RELIANCE ON FOSSIL FUELS CONTINUED

- Although global investments in the low-carbon energy transition grew by over 40% from 2025-2030, this was not enough to cover the world's growth in energy needs. As a result, the world continued to depend on fossil fuels to supply its energy needs, and **investment in fossil fuel extraction continued to rise** throughout the late 2020s.
- By 2030, only **10.2% of the world's total energy was derived from renewables** and less than 50% of total electricity demand was met by renewables. Without substantial progress in decarbonizing the energy supply, many businesses struggled to procure the renewable energy they required to meet their short-term climate goals.

PHYSICAL IMPACTS BECAME MORE SEVERE AND APPARENT

- In the second half of the decade, physical impacts from climate change became more frequent and severe. In just the five-year period from 2025-2030, **global GDP losses due to chronic physical impacts from climate change jumped from 3% to 5.3% annually**. Acute physical impacts also became dramatically more pronounced by the decade's end. In 2030, droughts alone wiped away nearly 4% of Africa's annual GDP and heatwaves cost Asia 3.5% of its annual GDP. Mexico experienced a 38% rise in annual damage from hurricanes by 2030 relative to 2015, leading to significant ramifications for the U.S. and other trading partners given Mexico's status as an emerging manufacturing hub.
- Meanwhile, businesses faced worsening **supply chain disruptions**, **volatile prices** for key inputs, and **greater competition for resources**. By the decade's end, the undeniable impacts of climate change on economies, people's physical and mental wellbeing, and long-term business viability began to galvanize popular support for more ambitious climate action and policies.

Delayed Transition

- Without significant climate policies, transition risks were low and global emissions failed to decrease by 2030.
- By 2030, only 10.2% of the world's total energy was derived from renewables.
- Physical impacts became more severe and apparent as chronic physical damages to the global economy increased from 3% to 5.3% of global GDP by 2030.

The 2030s: What Defined the Decade

AN ABRUPT CRISIS RESPONSE BEGAN

- As the social and economic impacts of climate change became increasingly evident, many governments declared the climate crisis an emergency and began taking swift and disruptive action to reduce emissions. Over the course of the decade, **investments in the low-carbon energy transition nearly doubled** to 3.1 trillion USD annually in 2040. **Global carbon prices also spiked** precipitously from merely 9.45 USD/ton in 2030 to over 125/ton by 2035.
- However, the rapid pace of the transition led to **inconsistent policy adoption** worldwide. Some countries most affected by physical impacts focused on adaptation instead of mitigation, and nations such as China and those in the Middle East continued to invest in fossil fuels to support their economic growth, favoring development over aggressive emissions cuts. In contrast, some more developed countries, including OECD and EU members, adopted aggressive carbon prices that were often 2-3x higher than carbon prices in Asia, Latin America, or the Middle East & Africa.

BUSINESSES AND CITIZENS FACED HIGH COMPLIANCE COSTS DURING THE TRANSITION

- The swift and forceful implementation of government policies in the 2030s unfortunately resulted in significant costs to society and economies. Countries reliant on heavy industry or fossil fuel exports, such as the United States and Canada, saw **significant jumps in unemployment**. Globally, **inflation rose close to 1% over baseline** by the middle of the decade and was as high as 3.7% over baseline in particularly hard-hit regions, such as eastern Europe.
- Businesses faced similarly difficult challenges. The rapid increase in carbon taxes caused **price shocks to many raw materials and inputs**, while government mandates to halve emissions by 2040 forced companies to invest in expensive, untested technologies. Hasty electrification efforts brought **energy reliability issues** and were limited by a power grid infrastructure that struggled to keep up with demand and lacked the required supply of critical minerals. Barriers to renewable energy deployment in some jurisdictions led to reshoring and nearshoring of operations to mitigate supply vulnerabilities.

EMISSIONS REDUCTION WAS ULTIMATELY SUCCESSFUL, ALTHOUGH TURBULENT

- By the end of the decade, total **global emissions had dropped 45%** compared to 2030. To accomplish this drastic reduction, the energy sector underwent a tectonic shift as global coal power plant capacity shrunk by 65% in the decade, and **renewable electricity capacity increased 121%** to account for 80.1% of all electricity demand by 2040.
- After an initial focus on reducing energy sector emissions, **global policies then shifted to the industrial sector**. From 2035 to 2040, the sector was coerced into reducing its overall emissions by 34%. However, these aggressive policy measures came at high economic cost. By 2040, **the transition costs resulted in annual global GDP losses of 1.3% of global GDP**.
- Although the decade's aggressive policies were beginning to show signs of stabilizing the climate, the **chronic physical impacts of climate change were still substantial**, causing annual GDP losses of 9.6% in 2040.

Delayed Transition

- Carbon prices spiked aggressively from 9.45 USD/ton in 2030 to over 125 USD/ton by 2035.
- Global inflation rates rose nearly 1% over baseline due to the transition, and many countries initially struggled with unemployment.
- By 2040, the world's transition efforts cost the global economy 1.3% of global GDP, but also helped reduce emissions 45% compared to 2030.

The 2040s: What Defined the Decade

A NEW LOW-CARBON ECONOMY EMERGED

- As the drastic emission reduction efforts of the 2030s began to show signs of stabilizing the climate, governments started the 2040s with an **increased focus on climate adaptation and climate equity**. Achieving a just transition (i.e., an economic transition that is fair, inclusive, and equitable for those most affected) became the focus of economic recovery programs. Public incentives drove investment in low-carbon industries, particularly in regions that had experienced the greatest job losses, creating **new economic opportunities and retraining programs** for displaced workers.
- Meanwhile, growing public pressure and stricter regulations ensured that emissions continued their downward trend and resulted in **increased monitoring and accountability** for high-emitting economic sectors and national governments.

DECARBONIZATION EFFORTS SHIFTED TO HARDER-TO-ABATE SECTORS

- Following the rapid period of change in the 2030s, many sectors began to stabilize as **costs for key inputs like freight and electricity normalized.** However, many companies continued to invest in new technologies as increased resilience became a business imperative across markets.
- After the intensive and successful investments in low-carbon energy in the 2030s, attention was able to shift to hard-to-decarbonize sectors like heavy industry, steel, cement, aviation, and mining. This led to a surge in innovation in low-carbon technologies, such as **industrial hydrogen** which increased nearly four-fold from 2035 to 2050. The use of industrial hydrogen was particularly valuable in decarbonizing sectors like cement production, which saw emissions reductions of 52% from 2030 to 2050. The development of new, lower-carbon forms of production, combined with the use of carbon capture and sequestration (CCS) technologies where necessary, led to the stabilization of steel and cement production markets, which had seen nearly 30% reduced demand in the 2030s. Despite the high cost of **carbon removal technologies**, companies continued to invest in them to address residual emissions and meet their climate targets.

GLOBAL TEMPERATURES AND PHYSICAL IMPACTS STABILIZED

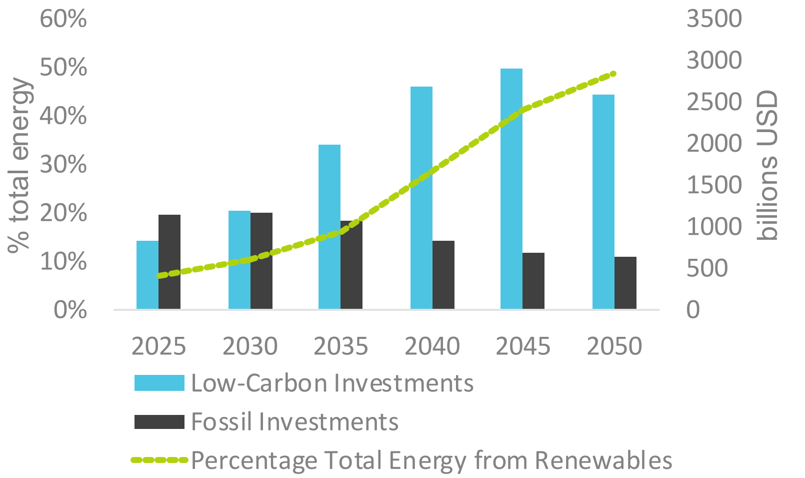
- As a result of the world's concerted climate action efforts **global temperatures peaked at 1.83°C** above pre-industrial levels in 2050 Natural areas began to recover and helped to sequester additional carbon-dioxide through land-based sinks. Continued investment in low-carbon technologies, energy infrastructure, and carbon removal eventually enabled the world to achieve net-zero emissions.
- Although these efforts were successful at slowing down climate change, **significant impacts from the warmer climate still remained.** In 2050, chronic physical impacts still leave global GDP about 10.8% lower than a climate-neutral baseline and acute physical impacts (inclusive of floods, heatwaves, cyclones, and drought) driving losses as high as 10% in Africa and Asia. Localized adaptation responses allowed some populations and industries to build resilience to some of the acute and chronic physical impacts, but ongoing investments in hardening of infrastructure remained necessary to mitigate risks.

Delayed Transition

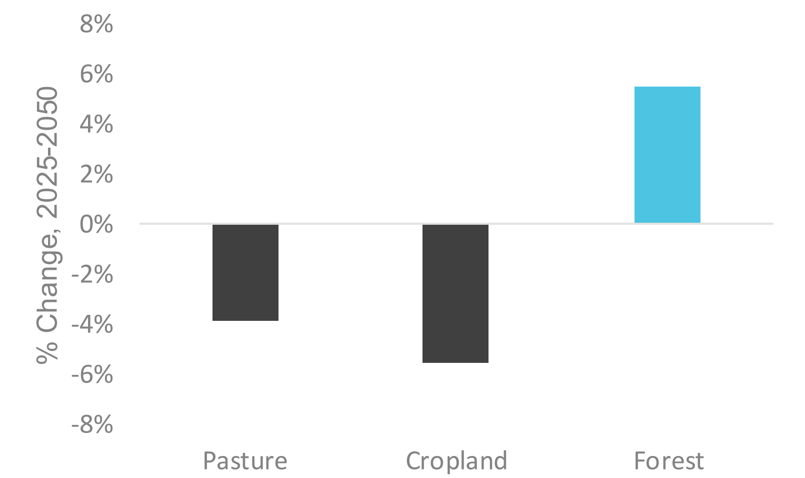
- Achieving a more just transition became the central focus of many governments in the 2040s
- Industrial hydrogen use grew nearly four-fold from 2035-2050 and played a central role in sectors like cement production reducing their emissions by 55%.
- Global temperatures began to level off around 1.8°C, but chronic physical impacts still led to annual damages close to 11% of global GDP.

Delayed Transition

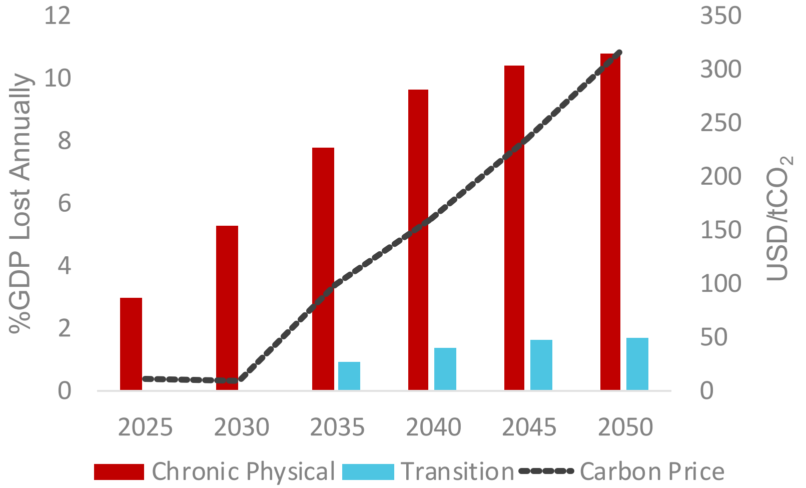
Steadily increasing renewables investment through 2050 helped to clean up the world's energy supply



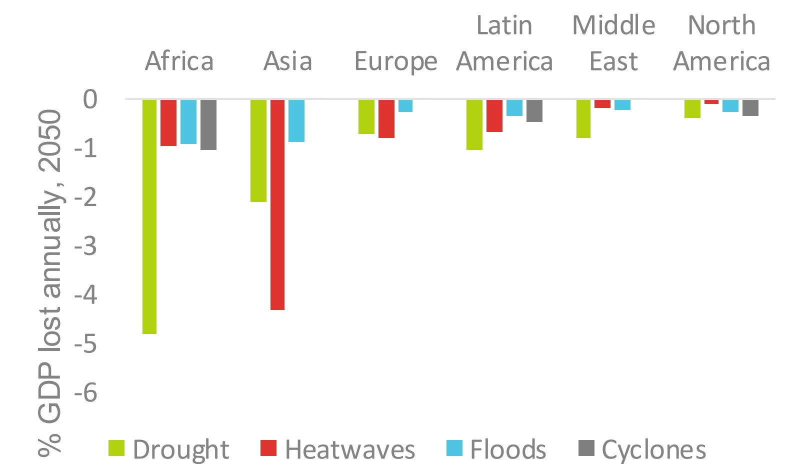
Agriculture land decreased significantly to allow for increase in forests and land-based carbon sinks



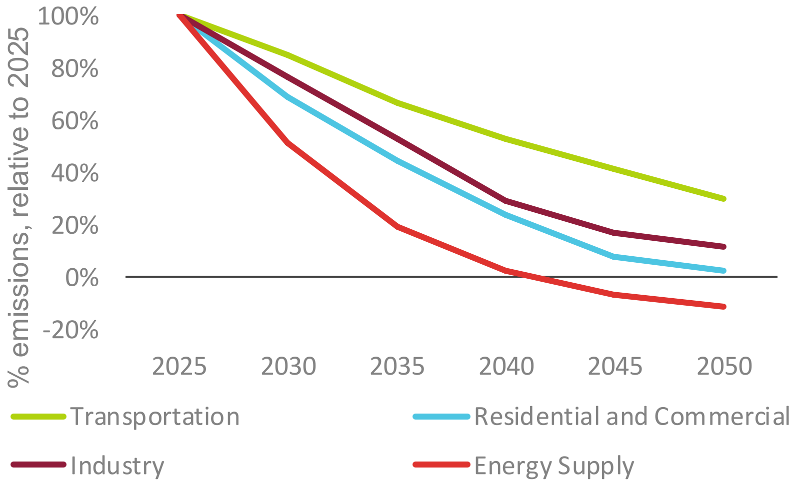
Aggressive carbon prices decreased GDP and consumption, but also reduced chronic physical damage



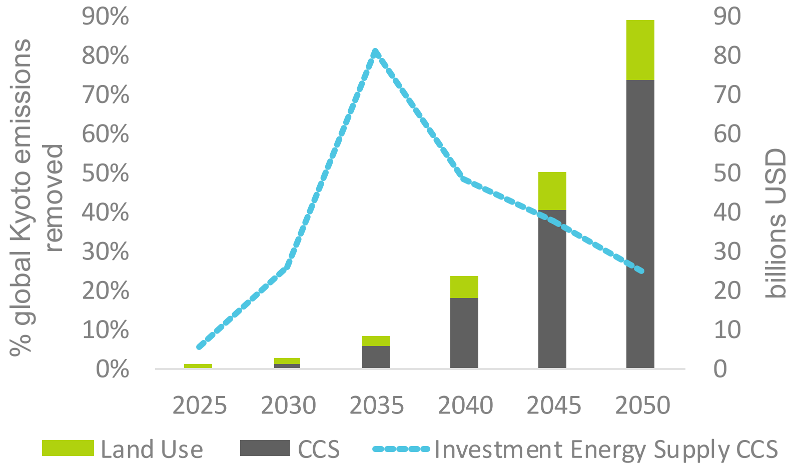
Climate impacts disproportionately damaged GDP in Africa and Asia, especially for droughts and heatwaves



Substantial emissions reduction was required of all sectors in the 2030s



Intensive CCS investment in the early 2040s helped remove nearly 20% of remaining emissions



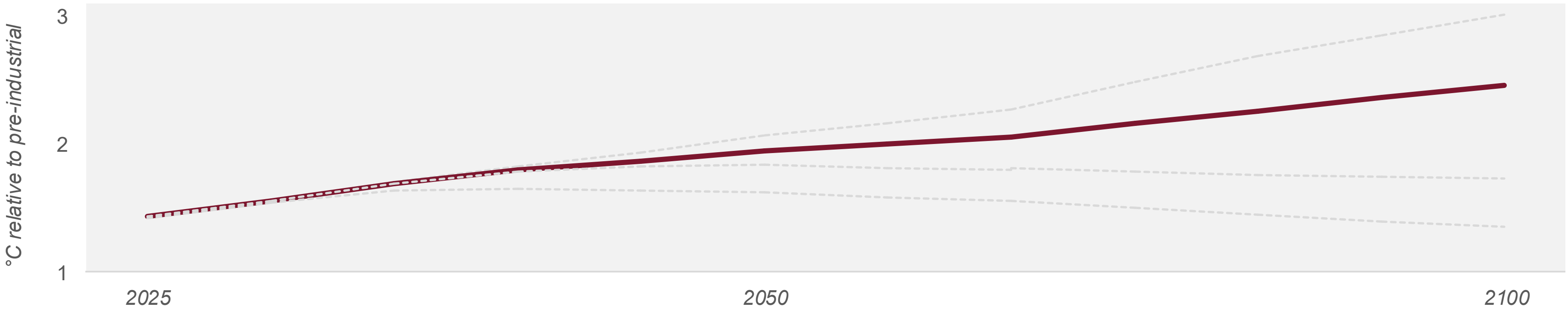
Fragmented World

A delayed and fragmented policy response leads to both high physical and transition risks.

Physical risk
med./high

Transition risk
high

Global warming
2.4°C+



Fragmented World

A delayed and fragmented policy response leads to both high physical and transition risks.

Key Scenario Characteristics

- Countries without net-zero targets follow current policies. Countries with net-zero* targets push forward, but eventually achieve just 80% of their target
- Global carbon prices spike to 70 USD/ton in net-zero countries by 2040, but reach only 10 USD/ton elsewhere
- By 2050, renewables account for 47% of total energy in net-zero countries, but only 25% elsewhere
- By 2050, chronic impacts from climate change cost the world nearly 13% GDP annually
- Policy costs in net-zero aligned countries are more than double the policy costs elsewhere, and food prices are nearly 2-3x higher

Key Scenario Assumptions

- 2.4°C+ warming by 2100
- Delayed and fragmented policy reaction
- Slow, then fragmented technology change
- Low/medium use of CO_2 removal
- High variation in regional policies

*See appendix for list of countries with net-zero targets included in this analysis

Fragmented World

The 2020s

CLIMATE POLICY STALLED

Global collaboration to tackle climate change collapsed, and governments took **limited action to curb emissions** due to lack of political capital, concerns regarding inflation, and rapidly growing energy demands to power AI. Companies continued to set **voluntary commitments but** lacked robust strategies to implement and reach their targets.

RELIANCE ON FOSSIL FUELS CONTINUED

Fossil fuel development continued, with renewables being viewed as a secondary, less reliable, option. By 2030, only 10.2% of the world's total energy needs were met by renewables.

PHYSICAL IMPACTS BECAME MORE SEVERE AND APPARENT

Physical impacts from climate change became more frequent and severe, leading to annual GDP losses of nearly 7% across Asia and Africa from chronic impacts. Businesses experienced **supply chain disruptions** from frequent supply shortages, increasing / volatile prices, and competition for resources.

The 2030s

THE GLOBAL POLICY RESPONSE DIVERGED

Countries that had previously made net-zero commitments--such as the U.S., EU, and China—adopted **aggressive policies** to tackle climate change. However, the rest of the globe did not follow, and by 2040, **carbon prices were 6.5x higher** in net-zero aligned countries than the rest of the world.

FRAGMENTED POLICIES LED TO GEOPOLITICAL TENSION

The fragmentation of climate policy resulted in an **unequal distribution of transition costs**. Countries taking action experienced higher inflation, GDP losses, and inflation. This disparity **heightened geopolitical tensions** and businesses struggled amidst the uncertainty.

INCREASING CLIMATE RISKS AMPLIFIED INEQUALITY

Severe **weather events increased in frequency**, with GDP losses due to chronic impacts totaling nearly 13% in Africa and Asia, but only 3.5% in Europe. The cumulative weight of these impacts **pushed millions into poverty** and triggered a growing **refugee crisis**..

The 2040s

GLOBAL TRADE BECAME INCREASINGLY COMPLEX

To preserve domestic industry, many net-zero-aligned countries implemented **protectionist trade policies** and carbon tariffs. These policies **disrupted global supply chains**, such as for rare-earth minerals, and led many businesses to pursue onshoring.

PROGRESS FROM NET-ZERO-ALIGNED COUNTRIES WAS TOO-LITTLE TOO-LATE

Although net-zero-aligned countries achieved emissions reductions of 60% by 2050 compared to 2030, their efforts weren't enough to compensate for **limited progress elsewhere**, where emissions increased 4.9% over the same period.

PHYSICAL IMPACTS STABILIZED

Climate change's **physical impacts accelerated** in the 2040s, leading to intense heatwaves that disrupted physical infrastructure, worsening droughts that exacerbated food insecurity, and more frequent hurricanes that wiped out homes and ports. **By 2050, the world crossed 1.95°C of warming and** was on pace for greater than 2.4°C warming by 2100.

View from 2050

A decade of inaction in the 2020s drove mounting pressure for climate action.

↓

Hasty policies were adopted in the 2030s by only net-zero-aligned countries.

↓

The fragmented policy response heightened geopolitical tensions and was ineffective at substantially reducing global emissions. By 2100, warming surpassed 2.4°C.

The 2020s: What Defined the Decade

CLIMATE POLICY STALLED

- After promising developments in the early 2020s (e.g., United States' Inflation Reduction Act, EU's Fit for 55 package), **climate policy stalled in the latter half of the decade** due to political gridlock, economic concerns, surging energy demand from AI, and the ascendancy of nationalist parties that de-prioritized climate action. **Global collaboration on climate collapsed**, leaving countries isolated in their emissions reductions and climate adaptation efforts. As a result, the world fell well short of the 50% emissions reduction required by 2030 to stay on a 1.5°C pathway and many companies failed to meet their near-term targets.
- The limited government action that was taken focused primarily on **climate-related disclosures** and failed to stimulate significant change as the global average carbon price remained below 11 USD/ton for most of the decade. And although early investments helped reduce emissions by 11% in regions like the EU and member states of the OECD, they were insufficient at making a dent into global emissions, which remained stable through the end of the decade.

ENERGY SYSTEMS REMAINED RELIANT ON FOSSIL FUELS

- Despite a 42% increase in global investments in the low-carbon energy transition from 2025 to 2030, these efforts failed to keep pace with the world's continually increasing energy demands. As a result, **the world still needed fossil fuels** to satisfy its energy needs, and investments in fossil fuels continued to increase through the end of the decade. By 2030, renewables accounted for just 10.2% of the world's total primary energy needs and supplied less than 50% of the world's total electricity.
- Without significant progress on decarbonizing the energy supply, **many businesses struggled to source renewable energy** to meet short-term climate targets, and scope 2 emissions remained high.

PHYSICAL IMPACTS BECAME MORE SEVERE AND APPARENT

- In the second half of the decade, the **physical impacts from climate change became more frequent and severe**. In the five-year period from 2025-2030, global GDP losses due to chronic physical impacts from climate changed spiked from 3% to 5.3%, equivalent to nearly 5 trillion USD. The acute physical impacts from climate change also became more pronounced by the decade's end. In 2030, droughts alone wiped away nearly 4% of Africa's annual GDP, and heatwaves cost Asia 3.5% of its annual GDP.
- Meanwhile, businesses faced worsening **supply chain disruptions, volatile prices** for key inputs, and greater competition for resources. These challenges were further compounded by a retreat from globalization driven by a rise in nationalistic ideologies and security concerns.

Fragmented World

- Government action on climate change was limited, and carbon prices remained below 10 USD/ton in the decade.
- By 2030, renewables supplied just 10.2% of the world's energy, and roughly 48% of electricity.
- Physical impacts increased, such as in Africa where droughts alone led to annual GDP losses of 4%.

The 2030s: What Defined the Decade

THE GLOBAL POLICY RESPONSE DIVERGED

- As the economic and social impacts of climate change became more evident, countries that had previously committed to net-zero goals—including China, the United States, India, Japan, and the EU member states—**intensified their efforts** and began taking swift and decisive action to reduce their emissions. However, the rest of the globe, including the majority of developing countries, **did not follow their lead**, partly due to political pressure to prioritize economic growth over climate mitigation. This fragmentation **weakened international cooperation** on climate action.
- By 2040, net-zero-aligned countries had raised carbon prices to an average of 70 USD/ton CO_2 and were investing 1.1 trillion USD annually in the low-carbon energy transition. In contrast, the rest of the world had an average carbon price of 10.80 USD/ton CO_2 and invested less than 600 billion USD annually in low-carbon energy systems. By the end of the decade, **net-zero aligned countries** derived over 75% of their electricity from renewables and had **reduced their collective Kyoto emissions by 32%** while the rest of the world still relied on natural gas or coal for over a third of their electricity needs and had only reduced their emissions by a mere 1%.

FRAGMENTED GLOBAL POLICIES LED TO GEOPOLITICAL TENSION AND ECONOMIC TURBULENCE

- Due to the fragmented nature of international climate policy, **transition costs were not shared equally** across the globe. In net-zero aligned countries, stringent policies such as carbon pricing and emissions reduction mandates led to annual policy costs of nearly 0.5% GDP --roughly 400 billion USD--, while non-net-zero countries experienced essentially no policy costs. These higher policy costs led to rising inflation, unemployment, and price shocks for many raw materials and inputs in net-zero-aligned countries. This disparity in impacts heightened geopolitical tensions and prompted some net-zero countries to adopt protectionist trade policies that upended existing supply chains.
- Amidst these high transition costs and geopolitical instability, many **businesses struggled to adapt** as carbon prices increased costs, and government mandates forced sectors to adopt costly technologies that had not been proven at scale.

INCREASING CLIMATE RISKS AMPLIFIED INEQUALITY

- In countries without significant adaption efforts, changing climate patterns and increasingly severe weather events began to **exacerbate social inequality**. By 2040, the chronic impacts from climate change led to global GDP losses of nearly 10% annually. These losses, however, were not distributed equally across regions. In Africa and Asia, annual GDP losses averaged 12.5%, while in Europe and North America, losses averaged only 3.5% and 7.4%, respectively.
- The cumulative weight of climate change's physical impacts—including rising food insecurity, and increasingly frequent storms that wiped out homes and livelihoods—**pushed millions into poverty**. These impacts triggered a growing refugee crisis, heightening geopolitical tensions and fueling reactionary, nationalist movements across the globe. Companies operating in the hardest hit regions faced increasing pressure to invest in under-served communities to help address the escalating social consequences of climate change.

Fragmented World

- Carbon prices surged to 70.4 USD/ton in net-zero aligned countries, 6.5x higher than in non-net-zero countries.
- Policy costs in net-zero aligned countries reached 0.8% of GDP by 2040, while non-net zero aligned countries experienced no policy costs.
- Chronic GDP losses in Africa and Asia reached 12.% by 2040, compared to just 3.5% in Europe, and 7.4% in North America.

The 2040s: What Defined the Decade

GLOBAL ECONOMIC NETWORKS BECAME INCREASINGLY COMPLEX

- To preserve domestic industry and prevent businesses from re-locating to lower-cost regions, net-zero-aligned countries such as the U.S. and China implemented increasingly **protectionist policies and carbon tariffs**. In response, many non-net-zero-aligned countries retaliated by imposing their own tariffs and restricting exports of critical resources, such as of food and rare-earth minerals. Companies with more **globalized supply chains struggled to adapt** to the rapidly evolving landscape and were forced to pass on higher costs to consumers.
- In response to the tariffs and import restrictions, many businesses in net-zero-aligned countries chose to **onshore** significant portions of their supply chain. Other multinational corporations attempted to navigate the carbon tariffs by creating **two distinct supply chains**—one lower-carbon supply chain for net-zero-aligned countries, and another to serve non-net-zero-aligned countries.

PROGRESS FROM NET-ZERO ALIGNED COUNTRIES ALONE WAS TOO-LITTLE, TOO-LATE

- Thanks to the concerted policy efforts of the 2030s and 2040s, total **emissions in net-zero-aligned countries in 2050 were 60% lower** compared to 2030, when policy efforts intensified. However, these reductions were insufficient to compensate for the **limited progress in the rest of the world**, where emissions increased by 4.9% over the same period. As this reality set in, most net-zero-aligned countries relaxed their net-zero goals, causing global policy momentum to stall. After the global average carbon price had increased nearly 230% the 2030s, it only increased an additional 70% in the 2040s to 57 USD/ton CO_2e, well below the rate required to reign in emissions.
- Despite falling short of net-zero targets, net-zero aligned countries still saw benefits from their efforts. By 2050, approximately 96% of electricity in net-zero-aligned countries was derived from renewables or nuclear and **electricity prices were on average 36% lower** than in non-net-zero-aligned countries. This newfound energy-independence provided a buffer to economic shocks and global disputes, and both business and consumers benefited from the more affordable and reliable grid.

PHYSICAL IMPACTS CONTINUED TO INCREASE

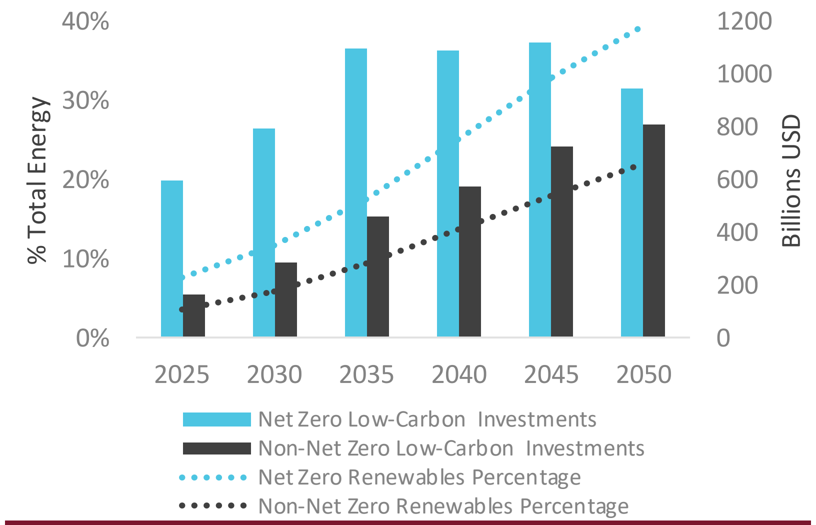
- By 2050, the severity of **climate change's physical impacts** became increasingly apparent worldwide, particularly in Asia and Africa. In Asia, physical impacts such as intense heatwaves and flooding disrupted physical infrastructure, reduced labor productivity, and led to annual chronic GDP losses of 15.7% annually by 2050. In Africa, impacts such as worsening droughts exacerbated food insecurity, displaced millions as climate refugees, and led to chronic annual GDP losses of 15.6% annually by 2050. North America and Europe fared slightly better but still experienced annual GDP losses of 9.5% and 4.5%, respectively, due to chronic physical impacts. This disparity in physical impacts **worsened wealth inequality** worldwide and only added to the existing stresses on geopolitical relations.
- Despite these worsening impacts, **global climate policy ambition continued to wane** as the world crossed 1.95°C of warming in 2050, putting the world on track for 2.45°C by 2100.

Fragmented World

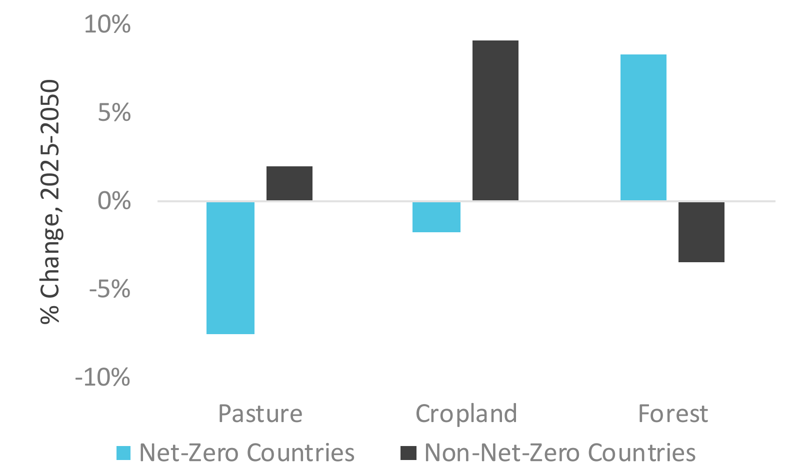
- Protectionist policies and carbon tariffs became common and made it difficult to maintain globalized supply chains.
- By 2050, emissions were 60% lower in net-zero aligned countries than in 2030, but 4.9% higher in non-net-zero aligned countries.
- By 2050, global temperatures crossed 1.95C of warming, putting the world on pace for at least 2.4C of warming by 2100.

Fragmented World

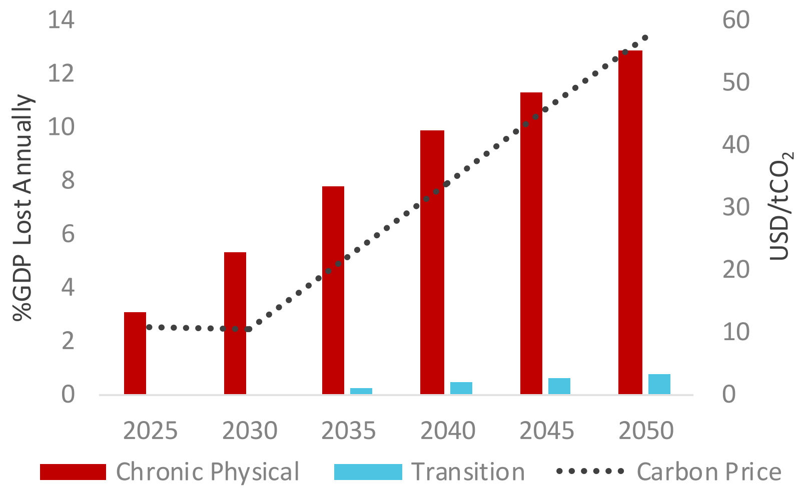
Net-zero countries invested in renewables to transition their energy supply, but non-net zero countries did not



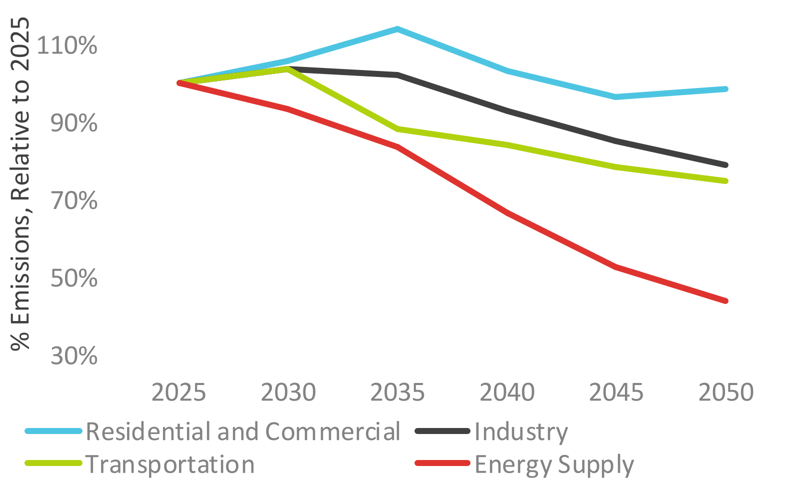
Net-zero countries placed more emphasis on preserving natural lands than non-net-zero countries



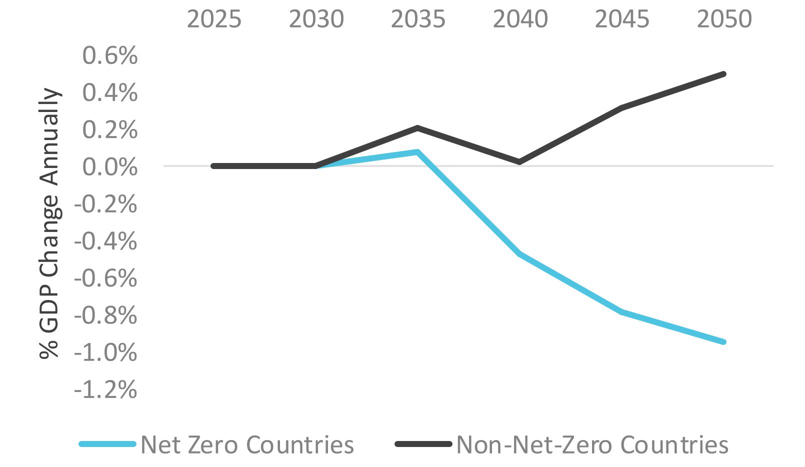
Inconsistent global policies allowed physical climate impacts to continue to spiral out of control



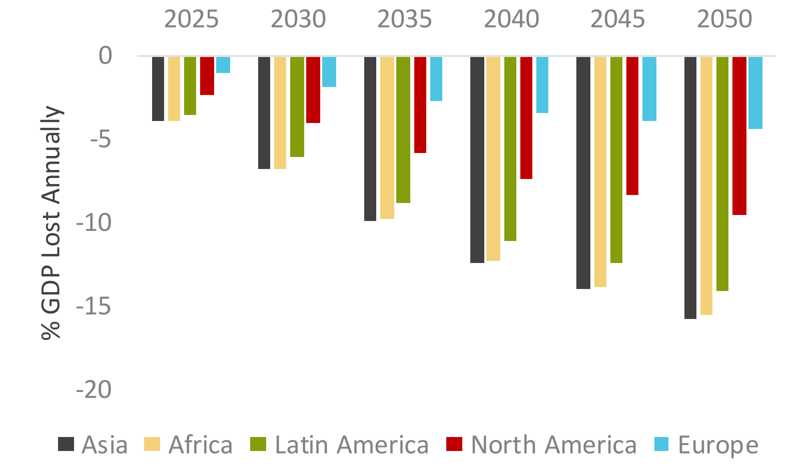
Energy supply was the only sector to achieve major emissions reduction through 2050



By 2050, policy costs caused a 1% decrease in annual GDP in net-zero countries



Inequitable climate impacts caused 3-7X greater acute physical damages in Asia/Africa than the EU or NA



04 | Sector-Specific Climate Scenarios & Data

Food, Beverage, and Agriculture

Current Policies

High Physical

Low Transition

- Without substantial climate policies, agricultural commodities and price for key inputs like fuel and water remained relatively stable throughout the 2020s and 2030s
- Extreme physical impacts like water scarcity and drought escalated in the 2040's and began to significantly disrupt crop production in critical regions like the Western U.S. and India, leading to food insecurity and volatile food prices
- In response to physical impacts, much of the industry was forced to turn to technologies like greenhouse farming and bio-engineered crops to improve climate resiliency

Net Zero 2050

Low Physical

Low/Med. Transition

- Increased competition for land to support reforestation and bioenergy production, and high carbon prices increased the costs for inputs (e.g., fuel, fertilizer) and resulted in higher commodity prices in the mid 2020s-2030s
- Meat and dairy demand was hit particularly hard by climate policies and higher input costs, facilitating a shift towards alternative proteins and lab-grown animal products
- FBA companies responded to the higher costs by investing in technologies (indoor farming, bioengineered crops) and reducing food waste to eventually stabilize relative costs in the 2030s
- Physical impacts from climate change remained manageable with mitigation efforts, but the hardest hit regions still struggled with water availability due to localized water stress and a lagged physical response despite mitigation

Delayed Transition

Low/Med. Physical

High Transition

- Beginning in the 2030s, the agricultural sector faced sudden and intense competition for land from reforestation efforts, high carbon prices, and mounting pressure to adopt efficiency and yield saving practices in a very short period
- Commodity prices for wheat and soy jumped sharply in the 2030s and led to increased food insecurity, particularly in regions also facing high physical impacts
- The relatively high physical impacts starting in the 2030s led to water scarcity, drought, and floods that frequently disrupted agricultural production
- Eventually, efficiency and yield improvements combined with efforts to reduce food waste allowed for food prices to stabilize in the 2040s

Fragmented World

High Physical

High Transition

- Physical impacts from climate change continue to increase well into the 2040s and beyond, increasing water scarcity, and drought and disrupting agricultural production
- Costs for food and critical inputs, such as water, pesticides, fertilizer, increase substantially in net-zero aligned countries, but remain relatively stable elsewhere
- Increasing geopolitical conflicts and physical risks leads to regulation of global food trading as countries attempt to preserve food security
- Meat and dairy demand increases in developing countries without net-zero aligned policies, but is driven down by climate policies in net-zero aligned countries like much of the EU, U.S., and China

FBA Sector Overview

Current Policies

- Stable commodity and input prices in 2020s and 2030s
- Minimal pressure to change diets
- High physical risks eventually disrupt production, leading to crop failures and food insecurity

Net Zero 2050

- High commodity and input prices in 2020s and early 2030s
- Meat and dairy demand decreases due to high carbon prices
- Agricultural production faces manageable physical impacts

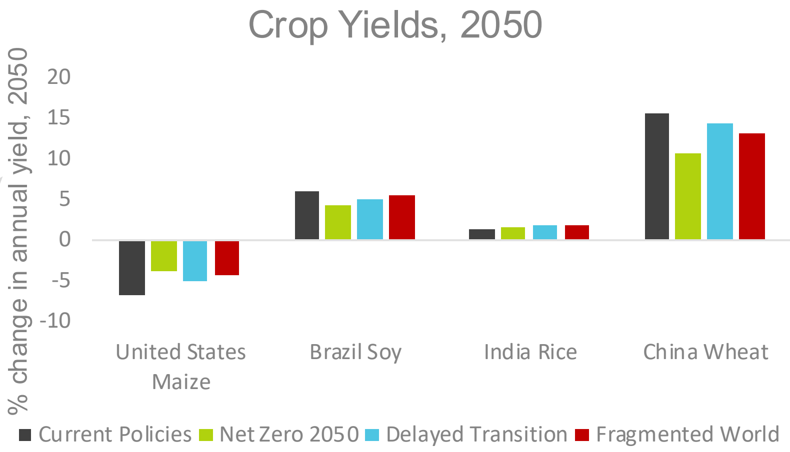
Delayed Transition

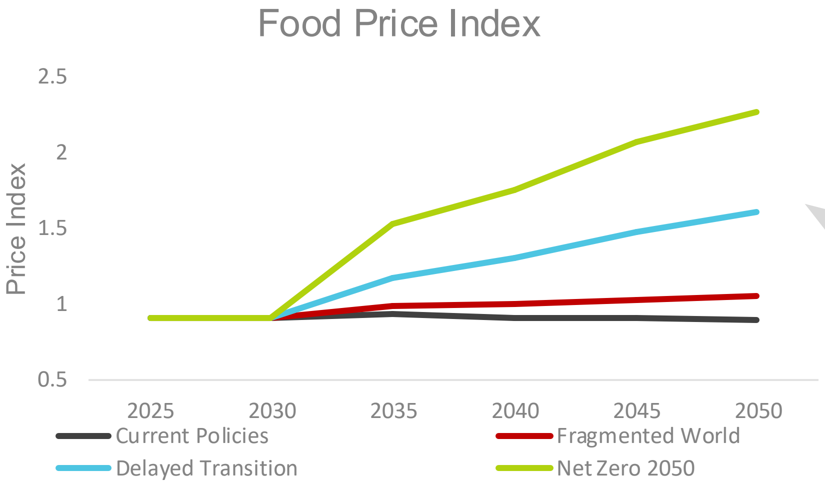
- Commodity and input prices jump sharply in 2030s due to carbon prices and climate policies
- Meat and dairy demand decreases sharply in 2020s
- Medium physical risks disrupt production and lead to water scarcity in 2030s, eventually stabilizing in 2040s

Fragmented World

- High inputs and commodity prices in net-zero countries in 2030s, but stable elsewhere
- Some pressure to change diets in net-zero countries, but overall meat/dairy demand increases globally
- High physical risks disrupt production, leading to crop failures and food insecurity

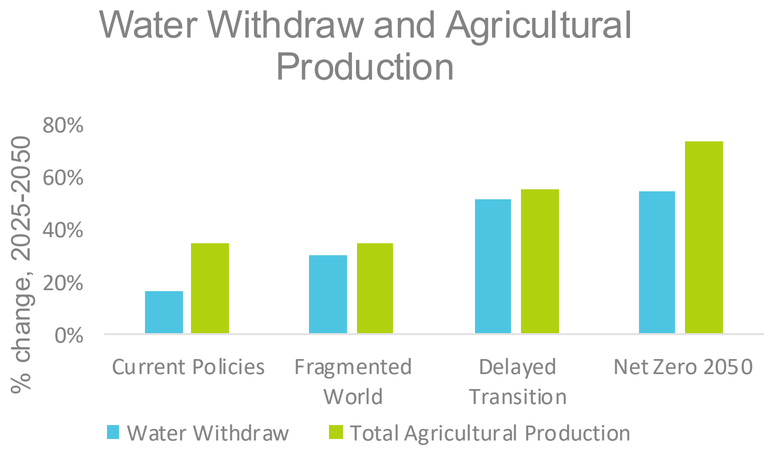
Although some crops, such as US maize production, declined at increased temperatures, other crops, such as soybeans and wheat saw a slight increase in productivity in the warmer climate





The global crop price index remained stable in current policies, while the global price index in more ambitious climate scenarios continued to rise into 2050.

Water withdraw and total agricultural production were highest in the transition scenarios by 2050, highlighting the importance of a healthy climate to water availability and agricultural productivity.



Technology

Current Policies

High Physical

Low Transition

- Without significant climate policies, electricity prices and costs for rare earth minerals remained relatively stable
- Tech companies with climate reduction targets struggled to meet their goals without government support and investment in renewables and grid improvements
- Consumer demand for tech hardware continued to increase globally
- By the late 2030s, physical risks such as heatwaves posed significant risks to digital infrastructure, and led to frequent blackouts that raised the risk of cybersecurity threats
- As water scarcity worsened, water-intensive facilities such as data centers faced higher costs and increased public scrutiny, particularly in water-stressed regions

Net Zero 2050

Low Physical

Low/Med. Transition

- Strong climate policies in the 2020s led to increased costs for electricity and rare earth mineral exploration, but eventually stabilized in the late 2030s
- Consumer demand for tech hardware decreased as climate policies led to declines in consumer discretionary income
- The transition also created opportunities for tech companies that were able to help reduce others’ emissions
- Prices for electricity and rare earth minerals eventually stabilized in the late 2030s
- Physical risks to digital infrastructure were manageable, but were still necessary for resilience in high-risk regions

Delayed Transition

Low/Med. Physical

High Transition

- Rushed government policies in 2030s resulted in compliance costs and frenzied competition for renewable energy to meet emissions reduction requirements and goals
- The rushed transition and medium physical risks resulted in volatile energy prices and disruptions to the electricity grid and digital infrastructure that raised cybersecurity risks
- Technology companies that prepared early by investing in energy efficiency and onsite renewable energy gained a competitive advantage in the 2030s
- Costs for rare earth minerals, like lithium and cobalt, spiked sharply amongst competing demand from renewables and energy storage

Fragmented World

High Physical

High Transition

- High physical risks threaten critical digital infrastructure, including electricity grid, data centers
- The water and energy usage associated with AI and data centers is increasingly regulated and scrutinized in net-zero aligned countries, resulting in increased operational costs
- Geopolitical conflicts disrupted global trade and rare earth mineral supply chains, making circularity increasingly important to securing future supply
- Demand for consumer tech declines in the 2030s in net-zero-aligned countries like the EU, US, and China, but remains unaffected in the rest of the world

Tech Sector Overview

Current Policies

- Stable electricity prices and costs for rare earth minerals
- High physical risks caused blackouts and heightened cybersecurity risks
- Tech companies with climate reduction targets struggled without gov't investment in renewables

Net Zero 2050

- High costs for electricity and rare earth minerals in 2020s, stabilized in 2030s
- Consumer demand for tech hardware wanes as disposable income dips in 2020s and early 2030s
- Physical risks to digital infrastructure are manageable

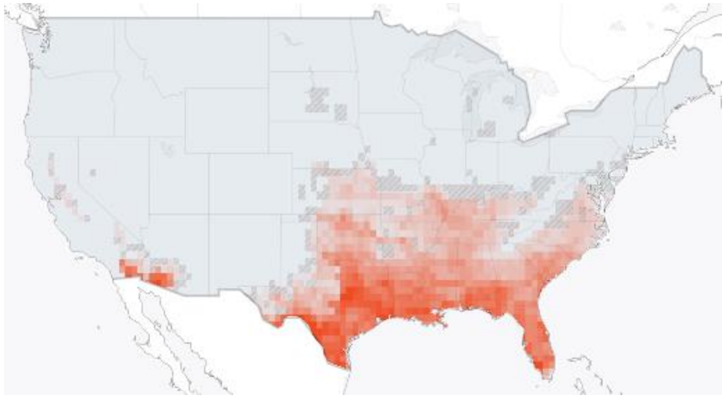
Delayed Transition

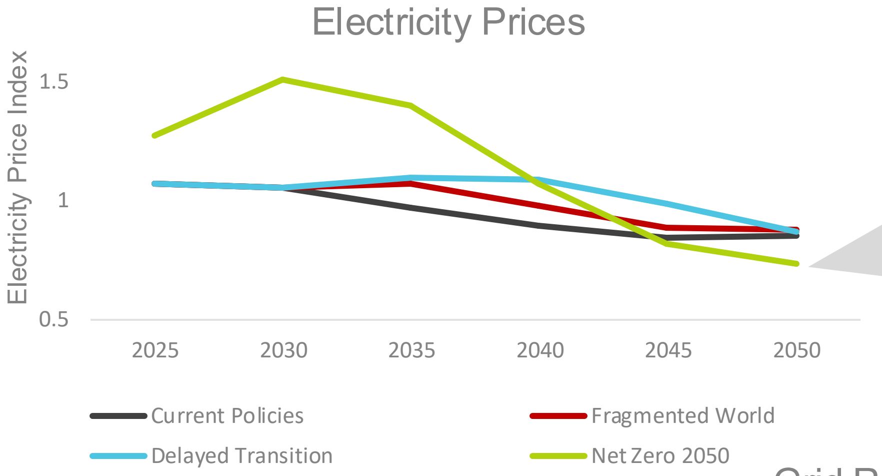
- Costs for electricity and rare earth minerals spike in 2030s amidst transition
- Tech companies struggle to procure the RE they require to meet climate goals in 2030s, early movers gain competitive advantage
- Medium physical risks eventually stabilize in 2040s

Fragmented World

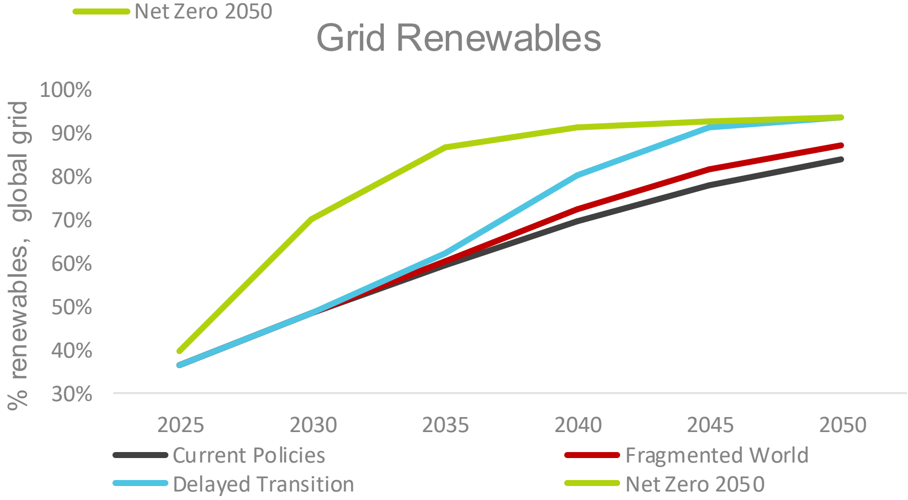
- High transition costs and electricity prices in net-zero countries, business as usual elsewhere
- Geopolitical conflicts disrupted global trade and rare earth mineral supply chains
- High physical risks caused blackouts and cybersecurity risks

At 2°C warming (2050 in current policies), significant portions of the U.S. were exposed to annual extreme heat waves, causing grid blackouts and risks to technology infrastructure.

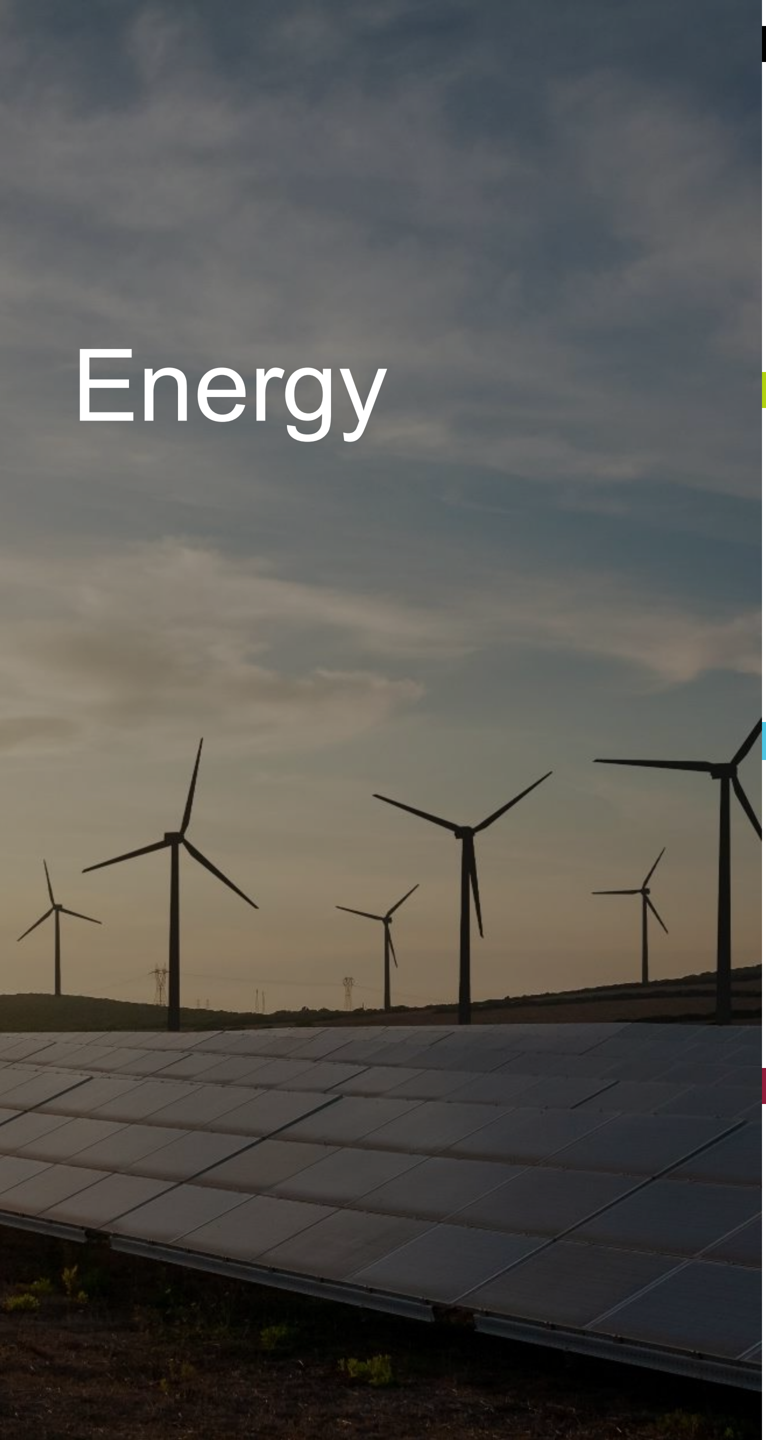




Electricity prices spiked during the initial transition periods in Net Zero and Delayed Transition but eventually settled to low levels in the late 2030s.



Net Zero reaches 90% renewables on the grid before 2040, and Delayed Transition by 2045.



Energy

Current Policies

High Physical

Low Transition

- The lack of substantial climate legislation enabled energy companies to operate business as usual in the 2020s and early 2030s
- Fossil fuel investments continued, carbon pricing was minimal, and energy prices remained low
- By the mid 2030s and early 2040s, extreme weather events frequently strained energy infrastructure and disrupted energy supply chains, leading to frequent blackouts and energy price swings
- Energy companies were forced to either invest in adaptation and resilience or face increasingly prohibitive maintenance costs and litigation penalties

Net Zero 2050

Low Physical

Low/Med. Transition

- Energy companies faced significant climate policies and high carbon prices in the 2020s, forcing a rapid transition to renewables that stranded existing fossil fuel assets
- Governments provided generous incentives and removed regulatory barriers for deploying renewables to smooth out the transition and minimize grid reliability issues
- Government job retraining programs minimized the impacts of job losses on individuals and local communities
- Physical impacts remained relatively manageable, and energy companies were able to mitigate most of the impacts by hardening existing infrastructure
- The transition also created significant opportunities for energy companies, such as in hydrogen

Delayed Transition

Low/Med. Physical

High Transition

- Fossil fuel assets remained viable through the 2020s, but the aggressive climate policies and high carbon prices of the 2030s forced fossil fuel assets into retirement and led to the rapid adoption of renewables. First-movers in this scenario gained a significant competitive advantage
- Amidst the rapid transition, energy companies struggled with grid improvements and preserving grid reliability, and were forced to pass on higher costs to consumers
- The rapid transition unfortunately also resulted in significant job losses for the energy sector
- Medium physical risks emerged in the 2030s, forcing the industry to also invest in hardening of energy infrastructure against climate events such as extreme heat

Fragmented World

High Physical

High Transition

- Rushed government policies in net-zero-aligned countries like the U.S, EU, and China in the 2030s focused heavily on reducing emissions from the energy sector, forcing energy companies to transition to renewables, but also leading to reliability issues and increased energy prices for consumers
- Meanwhile in non-net-zero aligned countries, the lack of regulation allowed energy companies to continue to rely on fossil fuels for much of energy production
- Increasing geopolitical conflicts led to instability in fossil fuel supply chains, leading to increased global volatility
- Extreme weather events, such as heat waves, began to frequently disrupt energy supply chains and infrastructure in the 2030s and 2040s

Energy Sector Overview

Current Policies

- Minimal carbon prices and climate policies allow for continued fossil fuel use
- High physical risks disrupt energy infrastructure and supply chains
- Large investments in adaptation and resilience eventually required

Net Zero 2050

- Initially very high carbon prices lead to stranded fossil assets and force early renewables adoption
- Significant government investments in energy infrastructure
- Physical impacts were minimal
- Large opportunities created by transition, such as in hydrogen

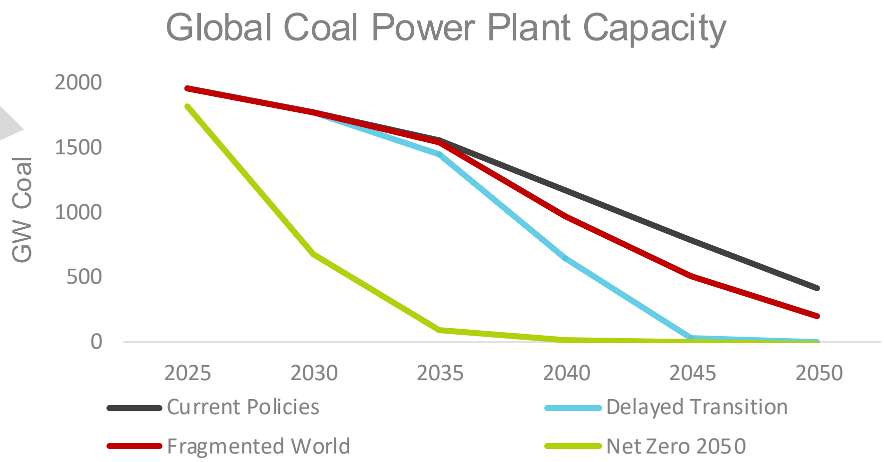
Delayed Transition

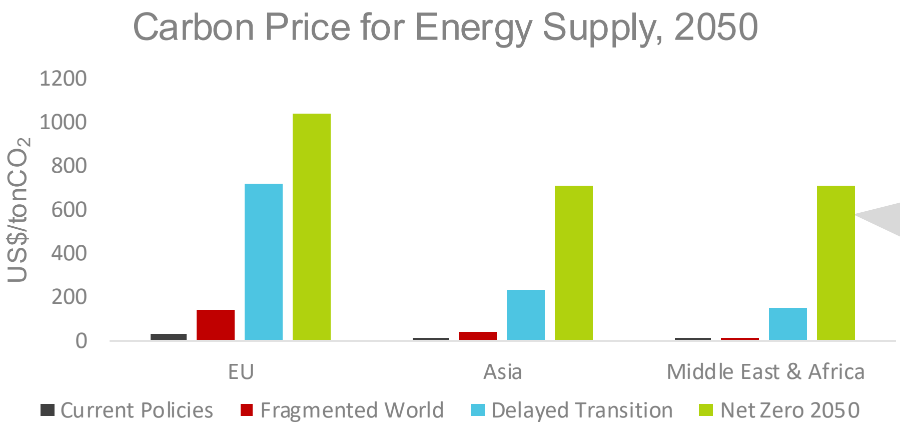
- Fossil fuel assets remain viable in 2020s, but are quickly forced out by high carbon prices in 2030s
- Rapid transition and lack of government investment leads to high transition costs
- Medium physical risks force investment in hardening of infrastructure

Fragmented World

- High carbon prices and transition costs in net-zero aligned countries
- Lack of climate policies in non-net-zero countries allows for continued use of fossil assets
- Geopolitical conflicts and high physical risks destabilize energy supply chains

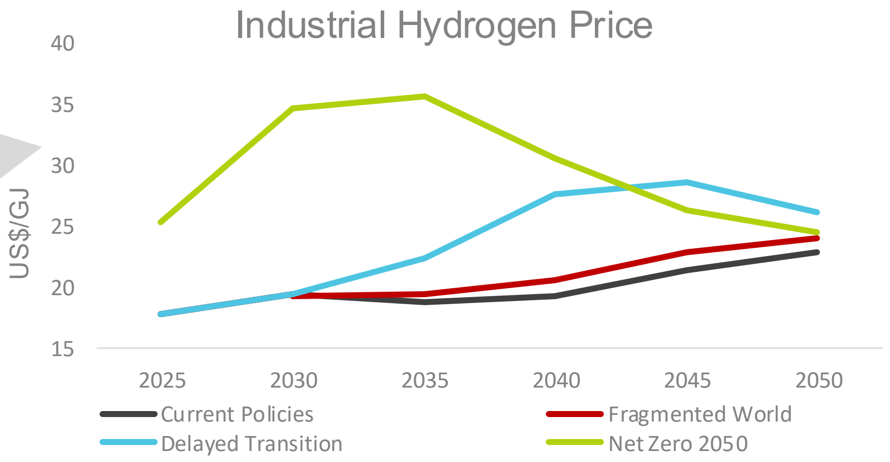
Coal power plant capacity saw a decline in all scenarios and was nearly totally wiped out by 2035 in Net Zero, and by 2045 in Delayed transition.



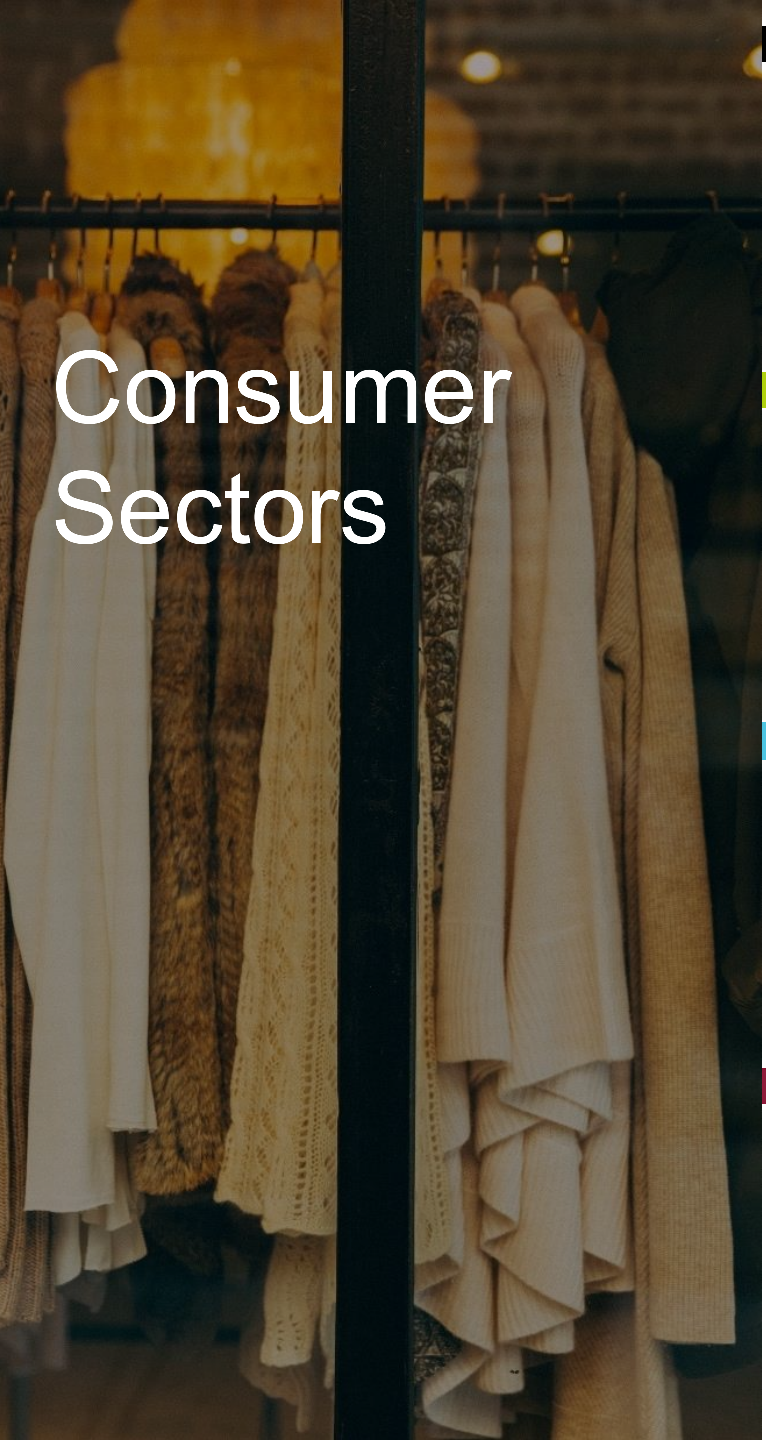


Energy companies incurred high prices for carbon emissions in transition scenarios, especially in developed regions like the EU.

The price for industrial hydrogen spiked in Net Zero, creating an economic opportunity for energy companies to capitalize on.



Consumer Sectors



Current Policies

High Physical

Low Transition

- The lack of climate policies allowed brands to continue their growth unabated, particularly in emerging economies
- Prices for key inputs, and consumer disposable income were initially unencumbered by climate policies, but became increasingly impacted by physical risks in the 2030s
- High physical risks eventually led to significant disruptions to global supply chains and key agricultural production regions in the 2030s, and forced brands to reconsider their sourcing strategies
- As impacts worsened, brands that contributed to the crisis faced increasing backlash and scrutiny from consumers who viewed them as partially responsible for the crisis

Net Zero 2050

Low Physical

Low/Med. Transition

- Strong climate policies and carbon prices immediately raised the price for key inputs in the 2020s
- Consumer disposable income dropped in the 2020s, but bounced back as soon as the early 2030s as economies recovered
- Governments incentivized brands to produce more durable, circular, and energy efficient products, and penalized brands for greenwashing
- Brands responded to the emerging incentives by shifting models of production (e.g., distributed, additive manufacturing), and transitioned to business models built around rentals, reuse, repair, and sharing

Delayed Transition

Low/Med. Physical

High Transition

- Rushed climate policies led to intense price increases for key inputs like palm oil and fiber crops in the 2030s
- Consumer disposable income declined sharply in the 2030s as unemployment and inflation increased, with emerging economies seeing the biggest hits
- Global supply chains suffered due to the combination of rising physical impacts and high carbon prices that greatly increased the cost of global shipping
- Brands that prioritized more resilient local sourcing strategies and began decarbonizing their value chain early saw a significant first-mover advantage

Fragmented World

High Physical

High Transition

- Increasing extreme weather events caused major supply chain disruptions in 2030s and 2040s, increasingly taking down manufacturing sites and shipping routes and incentivizing brands to shorten their supply chains
- Increasing transition costs in net-zero-aligned countries like the U.S. and E.U. led to decreased consumer discretionary income, and increased costs of production
- Geopolitical tensions led to significant import taxes, export restrictions, and carbon border pricing policies that complicated global supply chains and strategies
- Calls for brands to reach net-zero grew in net-zero aligned countries, but inconsistent global policies made it difficult for brands to decarbonize their supply chain

Consumer Sectors Overview

Current Policies

- Minimal carbon prices and climate policies allowed for business-as-usual brand growth in 2020s
- High physical risks eventually threaten global supply chains and degrade consumer disposable income
- Brands are forced to reconsider global sourcing strategies

Net Zero 2050

- High costs for inputs and low consumer disposable income in 2020s, stabilizes in 2030s
- Governments incentivize alternative business models (e.g., circular, reuse/repair)
- Physical risks remain manageable

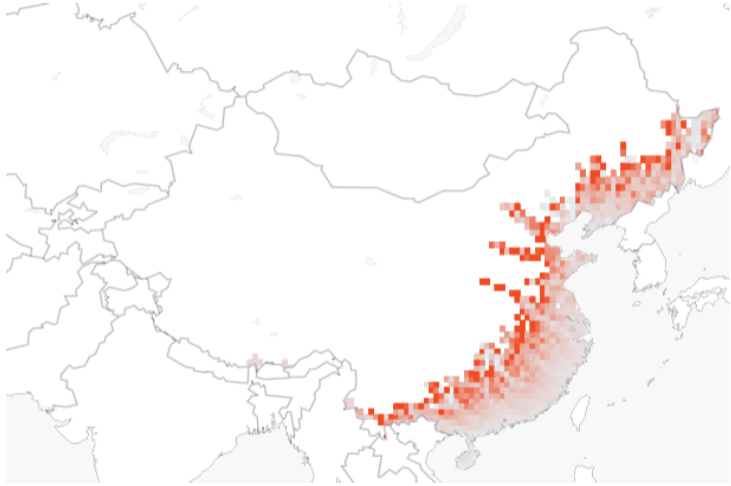
Delayed Transition

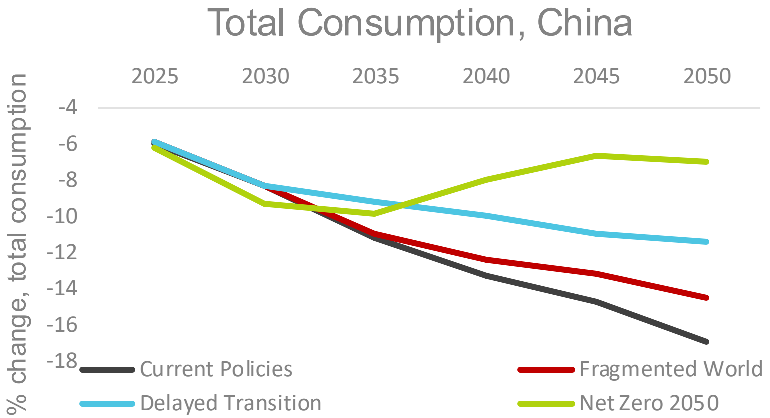
- High costs for inputs and low consumer disposable in 2030s
- Medium physical risks threaten viability of global supply chains
- Brands that prioritized resilience and decarbonization early saw significant first-mover advantage

Fragmented World

- High transition costs and costs for inputs in net-zero aligned countries, business as usual elsewhere
- High physical risks and geopolitical conflicts threaten global supply chains
- Inconsistent global policies complicate value chain decarbonization

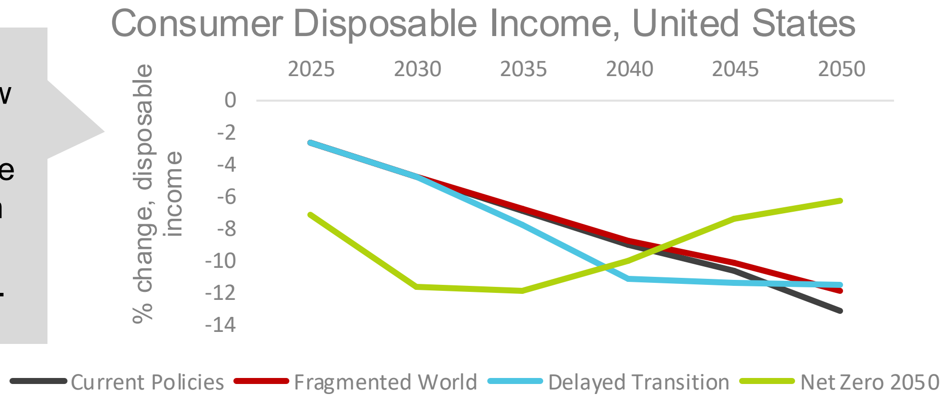
At 2°C warming (equivalent to 2050 in Current Policies scenario), coastal regions in SE Asia experienced 20%+ more damage from cyclones, including in new regions further inland.





Total consumption in China decreases in all scenarios, with Current Policies and Fragmented World seeing continued declines through 2050.

The transition scenarios saw initially higher declines in consumer disposable income but eventually beat out both Current Policies and Fragmented World by 2045.



Financial Sector

Current Policies

High Physical

Low Transition

- The lack of climate policy allowed for most sectors and regions to continue their economic trajectory in the 2020s
- As extreme weather events accelerated in the 2030s, economic shocks became increasingly common due to disruptions of supply chains and physical infrastructure
- Housing markets in coastal regions collapsed due to the increased risk of storm surges, hurricanes, and sea level rise
- As a result, the financial sector pushed for increased disclosure of climate risks, and poured investment into financial models to better incorporate and predict these risks
- Some financial sector companies chose to divest from the highest-risk regions, such as North Africa and SE Asia

Net Zero 2050

Low Physical

Low/Med. Transition

- Strong climate policies in the 2020s brought immediate economic disruption, including high inflation, interest rates, unemployment, and stranded fossil fuel assets
- After the initial shock of the 2020s, the steady and predictable nature of this transition helped to minimize economic losses, and most economies stabilized in the 2030s
- The transition period also created significant investment opportunities, such as in renewable energy, hydrogen, and in mineral extraction required for energy storage
- Physical risks remained manageable, and financial models were able to incorporate the risks quite reliably

Delayed Transition

Low/Med. Physical

High Transition

- Economic growth continued unabated in the 2020s, but was stunted in the 2030s due to the rapid adoption of climate policies which led to increased inflation, interest rates, unemployment, and stranded assets
- Economic volatility and inconsistent global policies increased the important of hedging strategies, and created liquidity risks (e.g., runs on banks) for consumer-facing financial sector companies
- This scenario also brought unique economic opportunities, such as in supporting investments in transitional technologies like biofuels and renewable hydrogen
- Worsening physical risks in the 2030s led to additional economic uncertainty, but eventually stabilized in the mid-to-late 2040s

Fragmented World

High Physical

High Transition

- Economic growth was stunted in net-zero-aligned regions, such as the U.S. and EU, in the 2030s by high carbon prices and restrictive climate policies, while economic growth continued relatively business as usual elsewhere through the mid 2030s
- High physical risks eventually caused substantial economic losses in highly impacted regions such as SE Asia, Africa, and the Middle East
- The combination of physical risks, transition risks in net-zero aligned countries, and increasing geopolitical tension led to highly volatile markets and a drop in global trade. The financial sector responded by creating new products to hedge against this volatility risk

Financial Sector Overview

Current Policies

- Minimal climate policies allowed for business-as-usual growth in 2020s and early 2030s
- Extreme weather events eventually caused increasingly common economic shocks
- Financial sector pushed for increased disclosure of climate risks

Net Zero 2050

- Strong climate policies in 2020s led to inflation, high interest rates, and stranded assets
- Economic losses were ultimately limited by stable and predictable nature of the transition
- Significant investment opportunities in transitional technologies

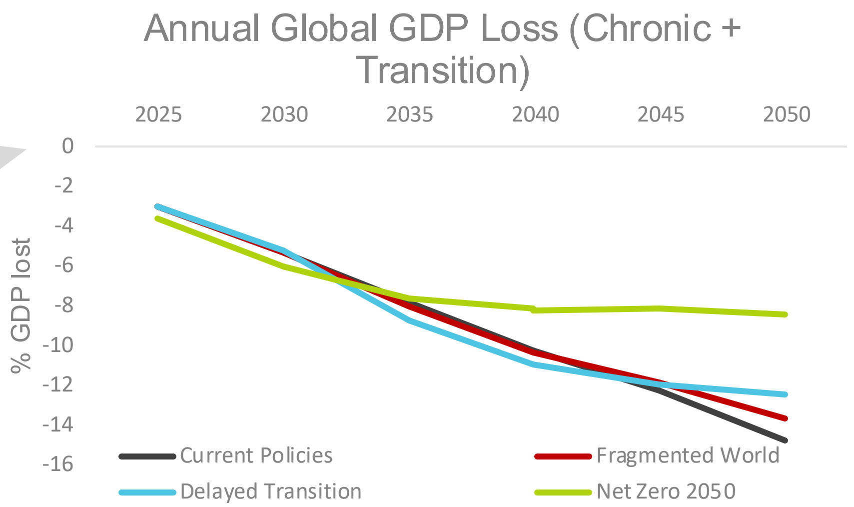
Delayed Transition

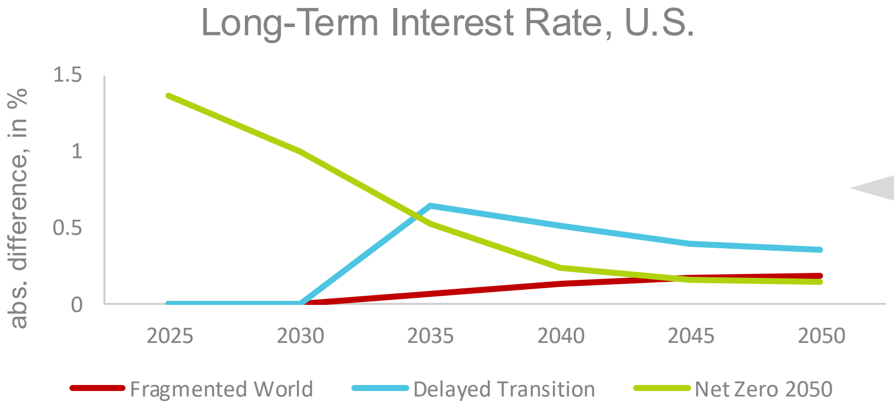
- Unabated economic growth of 2020s gives way to significant transition costs in 2030s, economies struggle amidst high inflation and rising costs
- Economic volatility increased importance of hedging strategies
- Physical risks in 2030s created additional uncertainty

Fragmented World

- Economic growth continued business as usual except in net-zero aligned countries like U.S. and China
- Geopolitical tension hampered global trade and created economic volatility
- High physical risks caused substantial economic losses in SE Asia, Africa, and Middle East

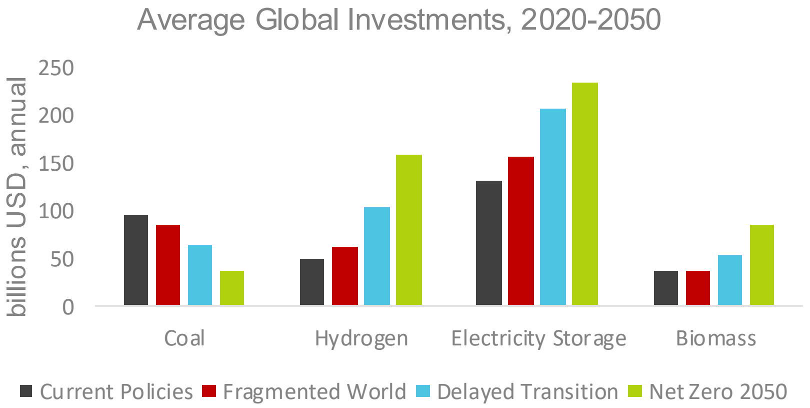
The initial transition costs in Net Zero are far outweighed by the avoidance of long-term physical costs of climate change.



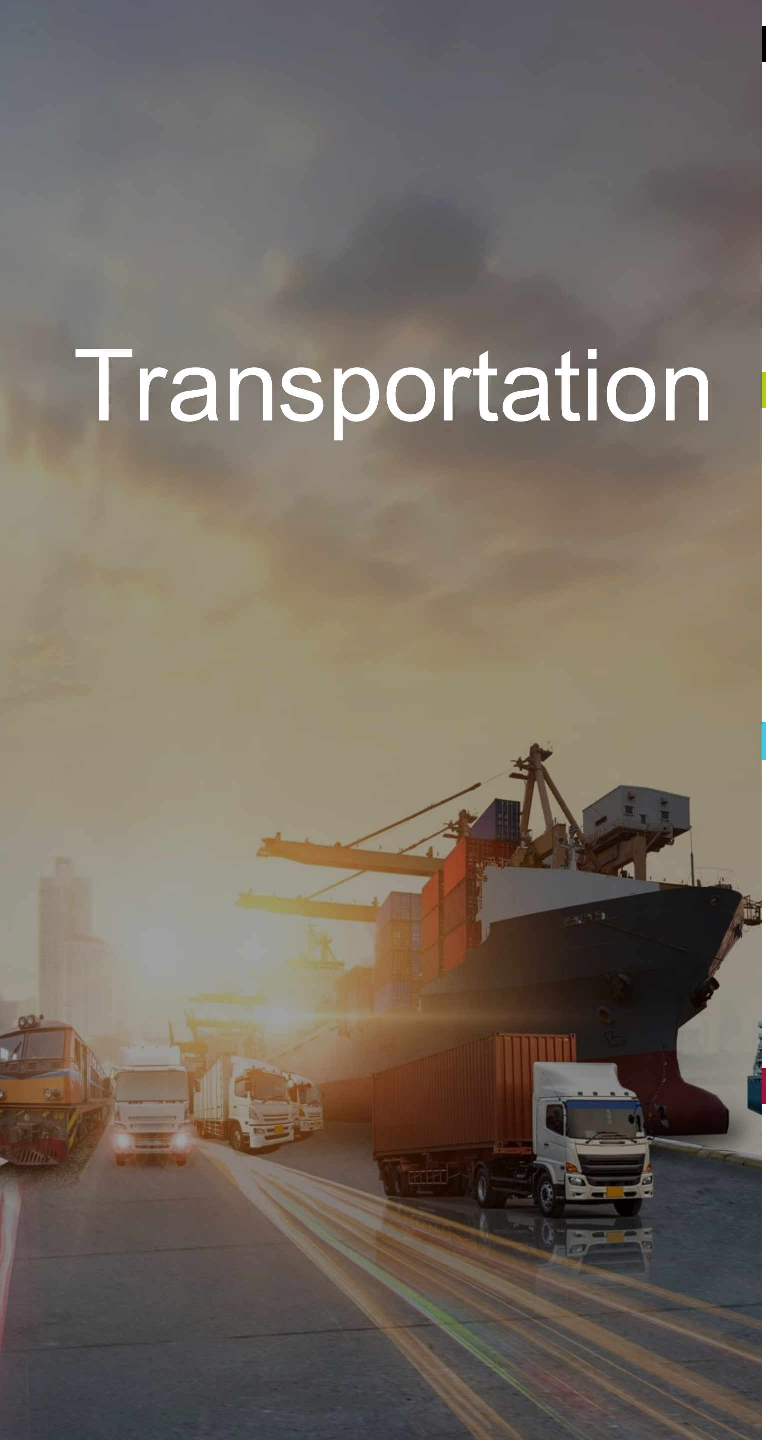


Long-term interest rates spiked sharply due to climate policy impacts in transition scenarios.

Global investments in key transitional technologies through 2050 were on average slightly higher in Net Zero 2050, but Delayed Transition required more concentrated investment, particularly in the 2030s.



Transportation



Current Policies

High Physical

Low Transition

- The lack of climate policies and carbon prices allowed transportation companies to continue business as usual
- By the early 2030s, physical disruptions to transportation infrastructure from extreme weather events became increasingly common and costly
- While some transportation companies adopted EVs or fuel cells in niche markets where operational cost advantages emerged, the absence of carbon pricing and climate policy delayed widespread sectoral decarbonization
- The sector was forced to invest heavily in the hardening of infrastructure, but struggled to keep up given the exponential and unpredictable nature of climate change's impacts

Net Zero 2050

Low Physical

Low/Med. Transition

- Immediate start to the transition led to decreased demand for freight, passenger vehicles, and air travel in the 2020s
- High carbon prices starting in the 2020s forced the sector to abandon fossil-fuel powered assets and make the switch to EVs and fuel-cells
- Substantial government investment in crucial infrastructure and technologies, such as for hydrogen and EVs, reduced helped to minimize disruptions and transitional costs
- Physical risks such as extreme weather events continued to increase through 2030s, but remained at relatively manageable levels

Delayed Transition

Low/Med. Physical

High Transition

- High carbon prices and economic difficulties of 2030s decreased demand for freight, passenger vehicles, and air travel
- Rapid transition of 2030s provided less time to develop crucial infrastructure, such as for EVs and hydrogen, and resulted in increased disruptions as the sector adapted
- The rapid transition and government emissions reduction mandates imposed high costs as companies were forced to switch off fossil fuels to low-carbon solutions (e.g., hydrogen) before they were fully scaled. However, this scenario also created large opportunities for first-movers
- Physical risks to transportation infrastructure eventually stabilized at relatively manageable levels in the mid-2040s

Fragmented World

High Physical

High Transition

- Transportation companies focused on serving non-net-zero aligned countries, such as much of the developing world, were able to continue their growth business as usual
- Transportation companies serving net-zero countries faced high carbon prices and stakeholder pressure to switch to low-carbon fuels. However, the limited public investment and lack of global cooperation made decarbonizing the full transportation supply chain difficult
- By the early 2030s, physical impacts began to ramp up, disrupting key ports and road infrastructure, and increasing the importance of resilience strategies
- Global freight demand declined as geopolitical conflict increased and companies increasingly on-shored production

Transport Sector Overview

Current Policies

- Minimal climate policies allowed for business-as-usual growth in 2020s and early 2030s
- Companies continued use of fossil fuels
- Extreme physical risks frequently disrupted transportation infrastructure, and led to exponential adaptation costs

Net Zero 2050

- Aggressive climate policies in 2020s forced early transition off fossil fuels
- Significant public investment in infrastructure and low-carbon solutions led to a smoother transition
- Physical risks increased marginally through 2030s, but stabilized at manageable levels

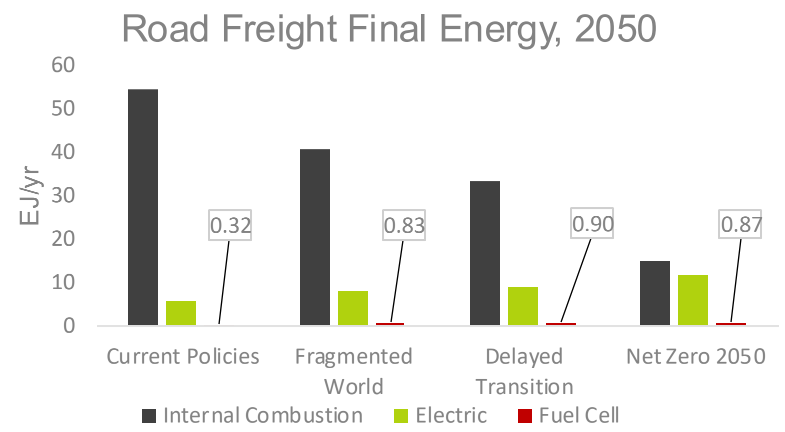
Delayed Transition

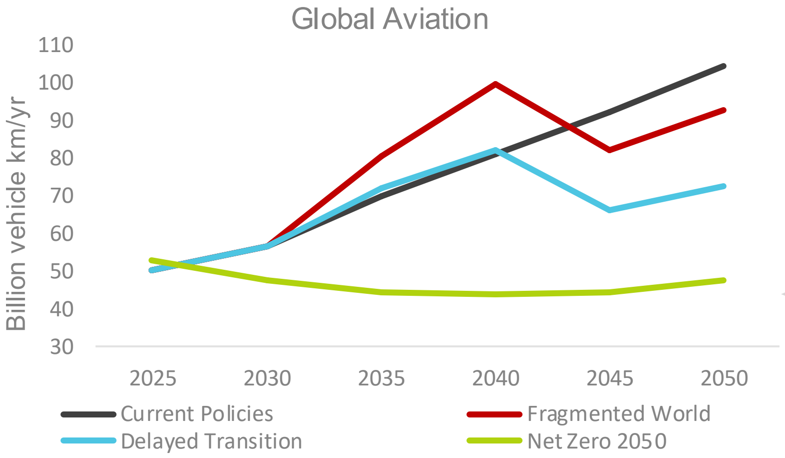
- Business-as-usual growth of 2020s gives way to high transition costs and carbon prices in 2030s
- Sector struggles to rapidly adopt low-carbon solutions in 2030s, in part due to lack of public investment
- Physical risks cause significant disruptions before eventually stabilizing in mid 2040s

Fragmented World

- High carbon prices and transition costs in net-zero aligned countries, business as usual elsewhere
- Geopolitical conflict decreased global trade and freight demand, and complicated global supply chains
- High physical risks frequently disrupted transportation infrastructure and increased adaptation costs

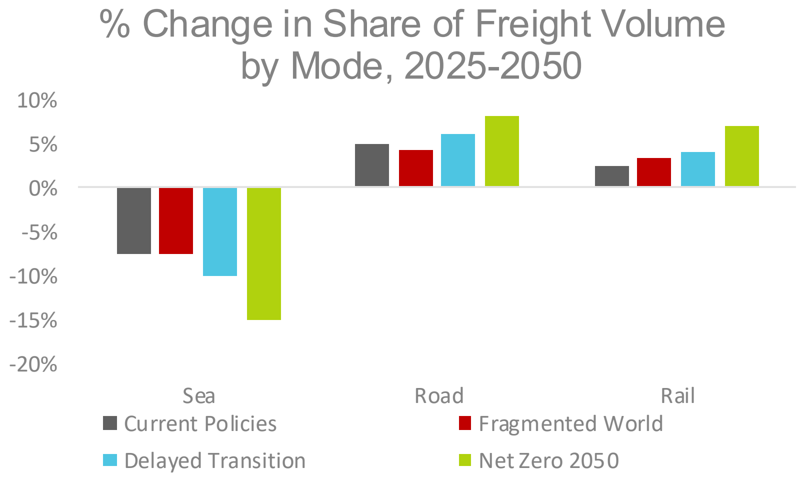
By 2050, the transition scenarios accomplished drastic reductions in road freight energy use and emissions through increased efficiency of vehicles and the adoption of EVs.





Although absolute aviation rates still increased in all scenarios, the growth rate of aviation (passenger and freight) was 30-40% lower in Delayed Transition and Net Zero 2050, than in Current Policies.

International shipping saw a reduction in all scenarios, while both road and rail saw the greatest growth in total share of freight volume in the transition scenarios.



Industrials

Current Policies

High Physical

Low Transition

- Without significant government restrictions and low carbon prices, the industrial continued to grow through the 2030s
- Industrial companies continued to utilize fossil-fuel powered infrastructure to make goods such as steel and cement
- Extreme physical risks in 2030s damaged manufacturing infrastructure, disrupted supply chains, and decreased worker productivity. Some companies were able to invest in hardening of their infrastructure, while others were forced to relocate production away from high-risk regions, such as SE Asia
- Increased climate risks for customers also created some opportunities, such as for climate-resilient building materials

Net Zero 2050

Low Physical

Low/Med. Transition

- High carbon taxes, mandatory emissions reduction, and tight regulation of industrial practices (such as fugitive emissions) forced the industrial sector to adopt low-carbon solutions and increased operational costs
- Industry growth stalled through the 2030s, but eventually recovered after the heavy infrastructure investments in low-carbon technologies had been absorbed
- Government incentives and changing consumer demand created opportunities in the transition, such as in green hydrogen, energy-efficient building materials, and non-fossil-fuel derived chemicals
- Physical risks remained relatively manageable and investments in hardening of infrastructure sufficed

Delayed Transition

Low/Med. Physical

High Transition

- Business as usual in 2020s gave way to aggressive climate policies of early 2030s that forced industrial sector to achieve extreme emissions reduction of nearly 50% in five-year span from 2030-2035
- The rapid transition forced the sector to take on high costs to adopt emission reduction solutions (e.g., hydrogen) that had not reached scale
- Industries, such as cement, had to scale back production as high carbon prices cooled demand. This led to economic hardship and layoffs for many industrial communities
- Early adopters of emissions-reduction solutions gained a substantial advantage in the 2030s as competitors struggled to keep up

Fragmented World

High Physical

High Transition

- In net-zero aligned countries, the industrial sector faced rapidly increasing carbon prices and emissions reduction requirements that imposed high transition costs (efficiency improvements, switching off fossil fuels, adopting hydrogen)
- Facing these high costs, industrial companies in net-zero countries struggled to compete on the global market, and pressured policymakers to impose carbon tariffs
- In non-net-zero aligned countries, the industrial sector faced low transition costs, and was able to continue its growth trajectory relatively unscathed in domestic markets
- By the late 2030s, the industrial sector around the world began to face significant physical risks (labor productivity, supply chain disruptions, damaged infrastructure)

Industrials Sector Overview

Current Policies

- Minimal climate policies allowed for business-as-usual growth in 2020s and early 2030s
- Industrial sector remained reliant on fossil fuels
- Extreme physical risks caused significant infrastructure damage and decreased productivity

Net Zero 2050

- Aggressive climate policies forced adoption of low-carbon solutions starting in 2020s
- Fossil fuel assets were quickly abandoned, but government incentives helped ease transition costs
- New opportunities were created, such as for green hydrogen, energy-efficient building materials

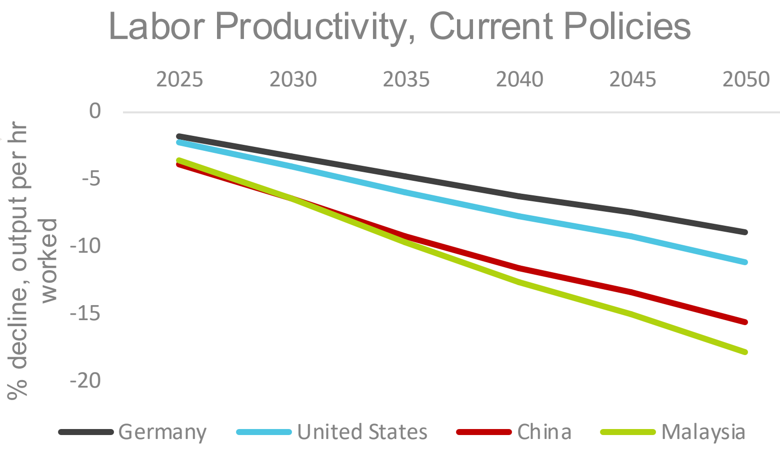
Delayed Transition

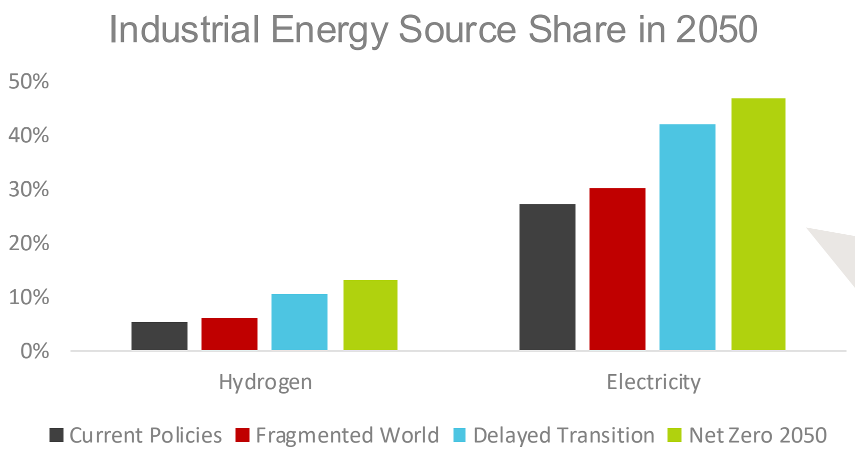
- Unabated industrial growth in 2020s gives way to high carbon prices and transition costs in 2030s
- Rapid transition leads to substantial economic difficulties and layoffs in industrial sector
- Physical risks increase in 2030s, damaging infrastructure, and creating additional uncertainty

Fragmented World

- Industrial sector in net-zero aligned countries forced to transition in 2030s, business as usual elsewhere
- Geopolitical tension threatens global supply chains and leads to high carbon tariffs
- High physical risks damage infrastructure and decrease worker productivity

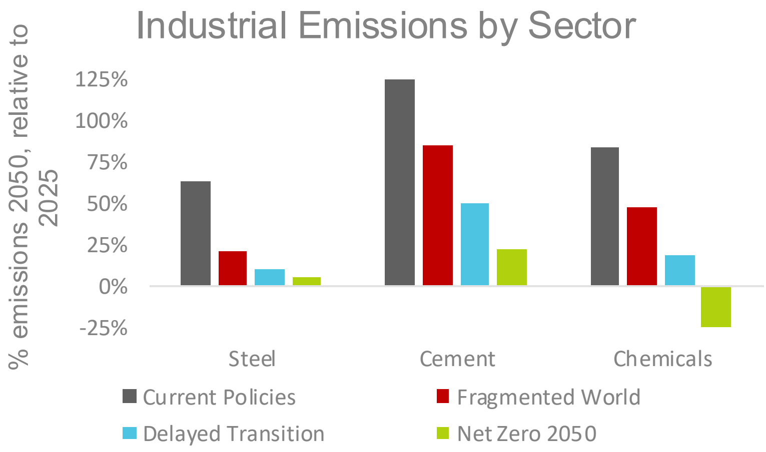
Labor productivity decreased most dramatically in Current Policies in regions most heavily impacted by heatwaves, such as SE Asia.





By 2050 in both Net Zero and Delayed Transition, the industrial sector derived more than 50% of its final energy from electricity or hydrogen, while also making significant gains in energy efficiency.

Industrial emissions declined dramatically in transition scenarios by 2050 across major sectors, with Net Zero even seeing negative net emissions in the chemical production sector.



05 | Conclusion

Next Steps for Climate Scenario Analysis

TCFD

While scenario analysis has long been a business tool used to stress test strategy in a rapidly changing world, the TCFD recommendations have made climate scenario analysis a key recommendation for business. Using BSR's set of climate scenario narratives, BSR works with member companies by tailoring the scenarios to a company-specific context and running cross functional strategy workshops.

Identifying Risks & Opportunities

- In collaboration with the member company through a series of discussions and workshops, BSR's climate scenario narratives and the relevant variables will be used **to brainstorm and identify the most relevant risks and opportunities** for the member.

Integrating with Business Strategy

- Once the risks and opportunities are identified, these can then be synthesized into **implications for the entire business and its strategy**.
- The top identified risks should also be incorporated into the company's existing **enterprise risk management** (ERM) taxonomy and process.

Reporting

- Once completed, the findings from the climate scenario analysis - including risks, opportunities, and strategies - can be incorporated into the company's **TCFD-aligned and/or CDP report.**
- This reporting is becoming **increasingly mandated**, such as by the CA Climate Bills and the EU's Corporate Sustainability Reporting Directive (CSRD).

06 | Appendix

Net-Zero Aligned Countries in Fragmented World

The following includes net-zero aligned countries in Fragmented World. This is useful for understanding where significant transition risks will take place in the scenario. As a reminder, net-zero aligned countries will reach 80% of their 2050 targets.

Net-Zero Country / Region	Net-Zero Year
Argentina	2050
Australia	2050
Brazil	2050
Canada	2050
China	2060
Colombia	2050
EU+UK	2050
India	2070
Indonesia	2060
Japan	2050
New Zealand	2050
Russia	2060
South Africa	2050
South Korea	2050
USA	2050

Source: NGFS Phase V Technical Documentation

Glossary

Key Terms & Definitions

Term	Definition	Source
Acute physical impacts (also see chronic physical impacts)	Physical impacts from climate change that are event-driven and generally short-term in nature, such as floods, tropical cyclones, or extreme heat waves.	EPA
Biodiversity	Biodiversity (amalgamation of biological diversity) refers to the variety of life found in a specific place--including genetic diversity, species diversity, and ecosystem diversity. Biodiversity loss occurs when species and/or genetic diversity are lost to impacts such as habitat destruction and climate change. This loss of biodiversity has negative ramifications for the overall health and resilience of ecosystems.	Smithsonian
Carbon capture and storage	A collection of technologies aimed at combating climate change by capturing carbon emissions from fossil fuel combustion, industrial processes, and other energy production practices that emit carbon (such as biofuels), and then storing the captured carbon (typically underground).	MIT Climate
Carbon price	A market-based approach to emissions reduction that puts a price on carbon emissions, such as through carbon taxes or emissions trading schemes (ETS).	UCS USA
Chronic physical impacts (also see acute physical impacts)	Physical impacts from climate change that are related to longer-term shifts in climate patterns, such as sustained higher temperatures, increased ranges for diseases, sea level rise, or changing precipitation patterns.	EPA
Climate adaptation	Actions taken to adapt processes or structures to moderate the potential damages from climate change.	UNFCC
Climate justice	A term and movement that attempts to address the fact that climate change will have more severe impacts on underprivileged populations, despite that these are the same populations that have often contributed the least to causing climate change.	Yale
Climate mitigation	Efforts to reduce or prevent the emissions of greenhouse gases.	UNEP

Key Terms & Definitions

Term	Definition	Source
Climate-related opportunity (also see climate risk)	The potential positive impacts of climate change on an organization. These often refer to additional benefits that may result from an organization taking steps to address climate change. Examples include cost savings or increased energy security that result from long-term renewable energy procurement plans, or increased sales from the development of new products and services aimed at addressing climate change.	TCFD
Climate resilience	The capacity of a system to withstand, respond, and recover from the impacts of climate change.	U.S. Climate Resilience Toolkit
Climate risk (also see climate-related opportunity)	The potential negative impacts of climate change on an organization. This includes both physical risks that result from climate change, such as extreme weather events, and the transition risks that result from the transition to a lower-carbon global economy, such as carbon prices.	TCFD
Consumption loss	A policy cost of climate change associated with decreased overall economic consumption.	NGFS
Energy transition	The transition in the global energy sector away from fossil fuels as the primary energy source and towards renewable or low-carbon forms of primary energy, such as solar, wind, and nuclear.	ENEL
Kyoto gases	A collection of six greenhouse gases that predominantly contribute to climate change and were established as part of the Kyoto Protocol in 1992. The collection of gases includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and the so-called F-gases (hydrofluorocarbons and perfluorocarbons) and sulphur hexafluoride (SF6).	UNFCC
Fugitive emissions	Often unintentional emissions of greenhouse gases from leaks, evaporative processes, or windblown processes.	California Air Resources Board
Green hydrogen	Hydrogen produced by electrolysis where the original energy to power the electrolysis process is derived from renewables. As opposed to grey hydrogen (natural gas powered), and blue hydrogen (natural gas powered with carbon capture).	World Economic Forum

Key Terms & Definitions

Term	Definition	Source
Hard-to-abate sectors	Sectors, such as cement, steel, and aviation, that are carbon intensive and currently have few, if any, viable low-emission solutions available.	Deloitte
Just transition	Transitioning to a low-carbon economy to meet climate targets in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities, and leaving no one behind.	ILO
Nationally Determined Contributions (NDCs)	Countries self-defined national climate pledges that detail how they will contribute to the Paris Agreement through actions to mitigate their emissions and adapt to climate change. As established by the Paris Agreement, signatories are required to update their NDCs every 5 years.	UNDP
Net Zero	A state of balance where all of humanity's greenhouse gas emissions (inclusive of all Kyoto gases) are balanced by its greenhouse gas removals. In reference to the Science-Based Target Initiative, net zero also requires organizations to achieve at least a 90% reduction in greenhouse gas emissions by no later than 2050.	SBTi
Paris Agreement	A legally binding international treaty to address climate change established at the UN's Climate Change Conference (COP21) in Paris in 2015. The overarching goal of the treaty was to hold global temperature change well below 2°C above pre-industrial levels and pursue efforts to limit temperature change below 1.5°C above pre-industrial levels.	UNFCC
Physical risks (also see transitional risks)	Climate risks related to the physical impacts of climate change, such as extreme heat tropical cyclones. Includes both chronic and acute physical risks (see the first slide of key terms and definitions).	EPA
Policy costs	The costs associated with enacting climate policies, such as decreased consumer spending and unemployment.	NGFS

Key Terms & Definitions

Term	Definition	Source
Primary energy	The final source of energy before it was transformed or exploited. Typical primary energy sources include fossil fuels, renewables, and nuclear. NGFS commonly also mentions final energy, which refers to the final form that an energy source is converted to before being utilized. Typical final energy types include electricity, gasoline, and hydrogen.	EIA
Residual emissions	Emissions that remain after efforts (typically referring to very substantial efforts) have been made to reduce emissions. Residual emissions typically remain because reducing them is economically or technologically unfeasible.	Nature Journal
TCFD	The Taskforce on Climate-related Financial Disclosures is a voluntary framework for companies and other organizations to use to report on their climate performance, risks, and opportunities.	TCFD
Technology transfer	The transfer of knowledge, experience, and equipment for mitigating and adapting to climate change between different stakeholders. This has historically referred to the transfer of technologies from developed countries to developing countries but also encompasses the need for indigenous knowledge and solutions to be adopted and transferred to existing power structures that have ignored the value of their knowledge.	IPCC
Transitional risks (also see physical risks)	Climate risks related to the transition to a lower-carbon economy, such as carbon prices or job loss.	EPA
Transition minerals	Minerals such as cobalt, copper, lithium, and nickel that are essential to technologies (e.g., solar panels, wind turbines, and electric vehicles) that are crucial to the world's transition to a low-carbon economy.	Resource Governance

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BSR & NGFS Resources

BSR

- 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)

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- 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.

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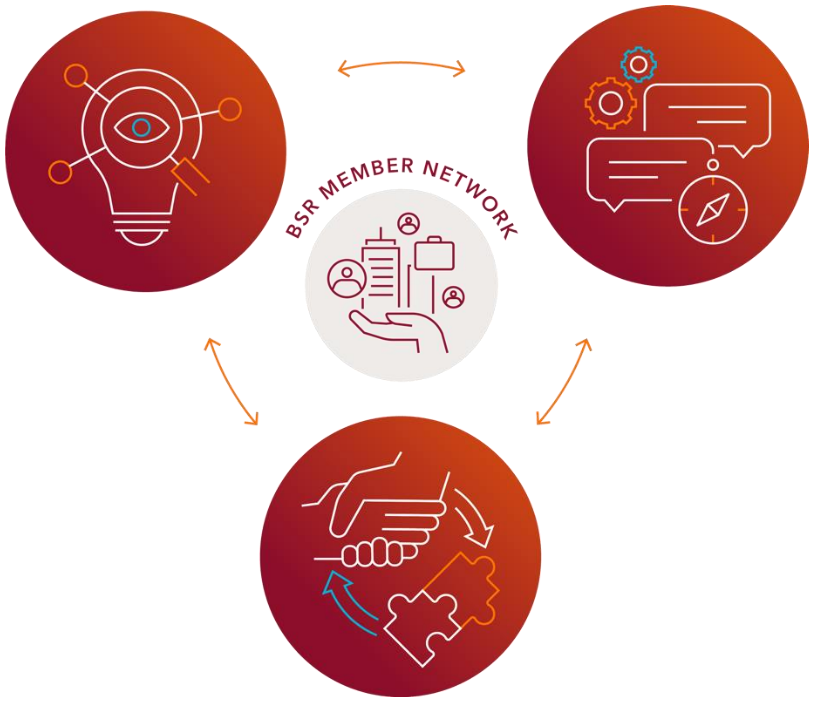

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