THEIA FINANCE LABS

INEVITABLE POLICY RESPONSE

MAKE OR BREAK

The conversation around temperature projections & forecasts

WHERE WILL TEMPERATURES PEAK THIS CENTURY?

PLAY THE CLIMATE TEMEPRATURE MEMORY GAME…

DISCLAIMER (*PLEASE ACTUALLY READ THIS PRIOR TO READING THE REPORT, THIS DISCLAIMER IS IMPORTANT!*)

This note forms part of a new briefing series from Theia Finance Labs research programme called "MAKE OR BREAK" exploring the perspectives for key initiatives in the sustainable finance space, starting with a review of GFANZ. Further briefing notes are planned in the course of 2023.

The series are "opinion pieces" authored by Theia Finance Lab staff members providing a perspective on the way forward for these initiatives and key challenges and recommendations. They are not technical research reports, even where they cite research, and do not go through the same editorial review as other Theia Finance Lab research products. The ideas and recommendations presented here are attempts at discussion inputs. Goal of these notes is to surface key issues, discuss their ramifications, and outline potential resolutions. They are designed as an input to the debate. We expect part of this debate will involve changing people's minds just as we expect us to change our mind as well.

The documents are shared with the initiatives prior to publication and discussed. However, for the avoidance of doubt, the research presented here is not affiliated with the initiatives discussed, nor subject to their editorial control, nor in any way implicitly or explicitly endorsed by them. Nor is the research affiliated with 2° Investing Initiative France and 2DII France did not have editorial input.

About Theia Finance Labs

Theia Finance Labs (formerly 2° Investing Initiative Germany) is an independent, non-profit think tank incubating research solutions for the financial sector that help solve the climate crisis. The Theia Finance Labs name is inspired by the Greek goddess of sight, the light of the blue sky, and the value of gold, Theia, and by the Greek word Aletheia, which means "disclosure" or "truth", literally "the state of not being hidden". The new brand thus mirrors our goal to develop evidence-based research and tools that shed light on the intersection of finance, climate change, and long-term risks. Theia operates as a 100% non-profit organization.

About Inevitable Policy Response

Inevitable Policy Response is a climate policy forecasting consortium coordinated by Energy Transition Advisors & Theia Finance Labs. IPR was commissioned by the Principles for Responsible Investment (PRI) and is supported by world class research partners, philanthropies, financial institutions and NGOs, to forecast the speed and scale of the transition to net zero.

Author: Jakob Thomä, jakob@theiafinance.org, Research Director Theia Finance Labs & Inevitable Policy Response

FILL OUT THE 1 QUESTION SURVEY BY SCANNING THE QR CODE!!!

Introduction

There is widespread uncertainty about how to interpret the proliferation of 'temperature projections' currently available in the market.

Media reports, press releases, and newsletters provide a plethora of different angles on the temperature discourse, ranging from the 1.5°C no overshoot roadmaps of the IEA and others, to *business as usual* projections assuming that the ceiling to government ambition is effectively limited by the Nationally Determined Contributions (NDCs). There are even some organizations (e.g. FinanceWatch) that suggest we remain on a +3°C world.

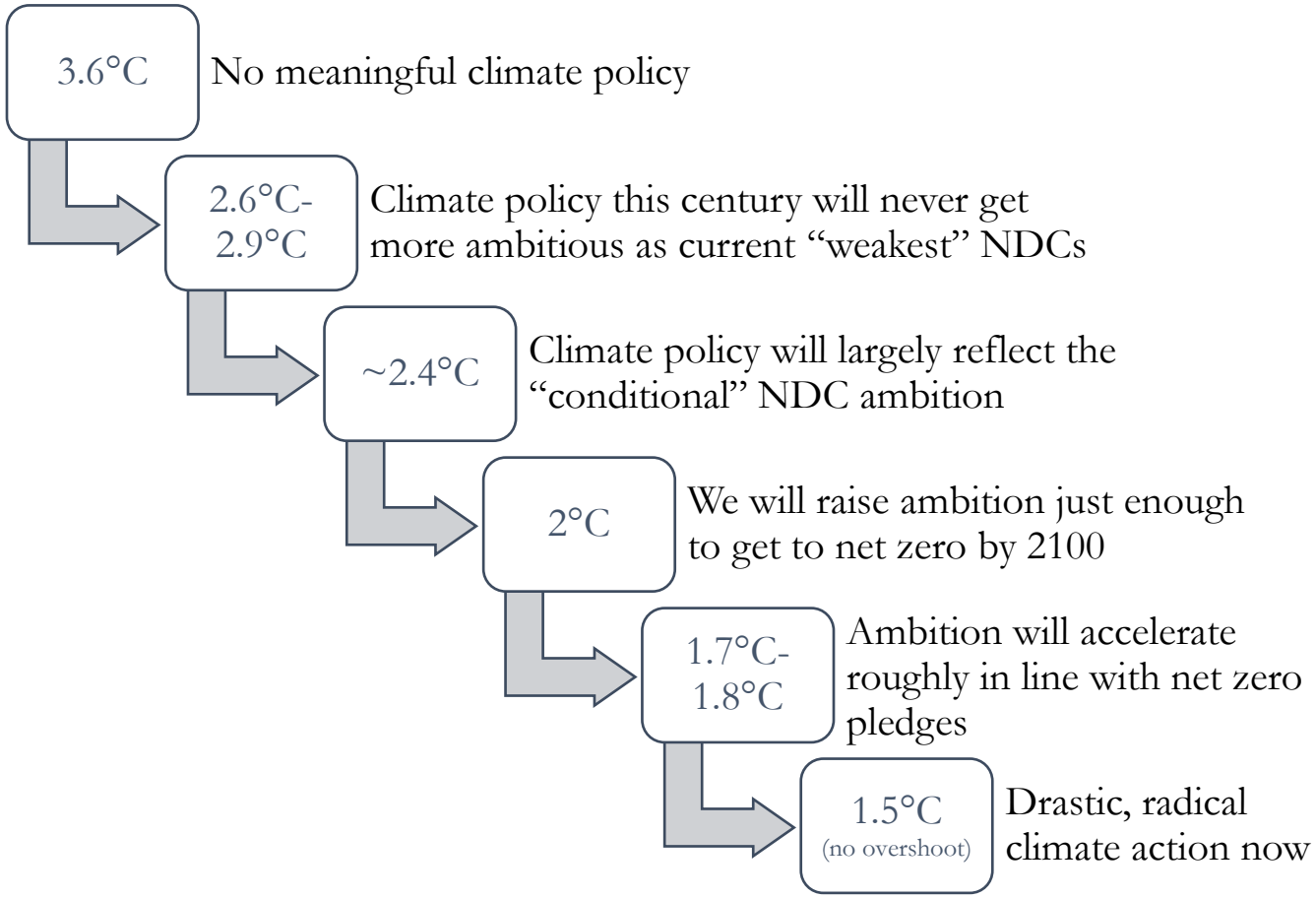
Between these two poles in turn is a wide range of analysis, including temperature projections reflecting assumptions around some policy acceleration based on policy announcements (e.g. IEA Stated Energy Policy Scenario), private sector analysis (e.g. MSCI, Blackrock), models of the implications of government net zero targets (e.g. IEA Announced Pledges Scenario) and actual forecasts involving assessing the most likely policy development over the next decades (e.g. Inevitable Policy Response IPR, Rhodium Group). In principle, each of these serve a different purpose, however, media coverage and lack of nuance in their presentation make it difficult to understand *why* these analyses are different and *which* analysis is the most relevant for understanding the different transition pathways at play.

Theia Finance Labs third *Make or Break* note, published in collaboration with Inevitable Policy Response, seeks to address this confusion by outlining the key distinctions and steps across different temperature projections.

The note will seek to illustrate each level of the temperature curve, starting at the pre-Paris agremenet +3.6°C pathway projections to the 1.5°C no overshoot scenarios. The goal is to help illustrate why not all reports arrive at the same temperature outcome, and illustrate what some of the key differences are in the assumptions or approaches across different projections.

We consider this a make or break issue as the temperature debate is increasingly becoming a challenge for the sustainable finance community. On the one hand, there is growing consensus across the scientific community that the 1.5°C no overshoot goal is no longer realistic. On the other hand, the mainstream narrative suggests that we remain on ~3°C pathway, despite the apparent policy progress over the past few years. While temperature debates are inherently challenged by the uncertainty around forcing effect of GHG emissions, they anchor the public discourse on progress towards climate goals. We consider that addressing this debate is crucial in order to help anchor market expectations around temperatures, understand the roadmap we are actually on, and the remaining feasibility of the *well-below 2°C goal* in light of the growing challenges associated with the 1.5°C objective.

What should you believe?



FILL OUT THE 1 QUESTION SURVEY BY SCANNING THE QR CODE!!!

WHAT DETERMINES THE DIFFERENCES BETWEEN TEMPERATURE PROJECTIONS?

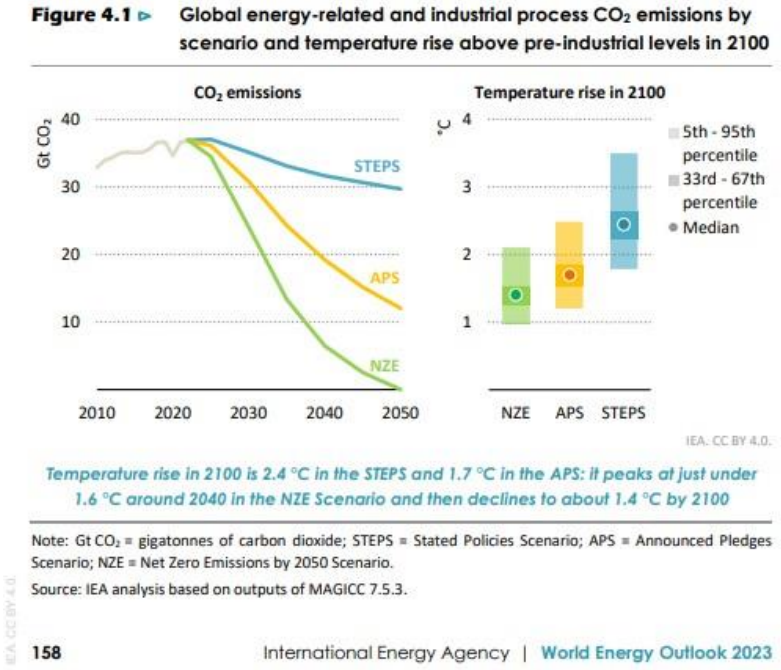
Forecasts vs. scenarios	• A crucial difference between different temperature projections relates to the extent to which they are 'forecasts' (i.e. assumptions around the 'most likely' future) or 'scenarios' (i.e. 'what-if' simulations based on hypotheticals around the evolution of different political and economic drivers. The actual ambition level across forecasts are then a function of the forecast process.
Probabilities	• Temperature projections will differ on probabilities of achieving a certain temperature outcome. The UNEP Emissions Gap Report for example will typically use a 66% probability in its headline results, whereas the IEA will typically use a 50% probability.
Post 2030 assumptions	• Many climate policies are time bound and thus only provide insight into 'policy ambition' over the time horizon of the policy. Distinctions in different temperature projections until 2100 thus depend to a large degree on the assumptions about future policy ambition. To illustrate the point, <10% of NDCs extend beyond 2030.
Negative emissions assumptions	• While not the core focus of this note given its focus on 'temperature peaks', differences between temperatures at the end of the century are influenced by the assumptions around negative emissions. Forecasts like IPR for example consider that temperatures will be reduced from their peak by 2100.

The “probability conundrum”

- One key challenge with temperature projections is the extent to which they ‘hide’ the inherent uncertainty of the sensitivity of global temperatures to climate outcomes. For example, the IPR forecast has a 90% probability of limiting global warming to under 2°C. But in communications, it is presented as a 1.7-1.8°C outcome. Similarly, the IEA highlights significant temperature uncertainty (see Fig. on right) For the purpose of forecasting and describing the ‘most likely’, this is sensible. For the purpose of climate safety, it leaves much to be desired.

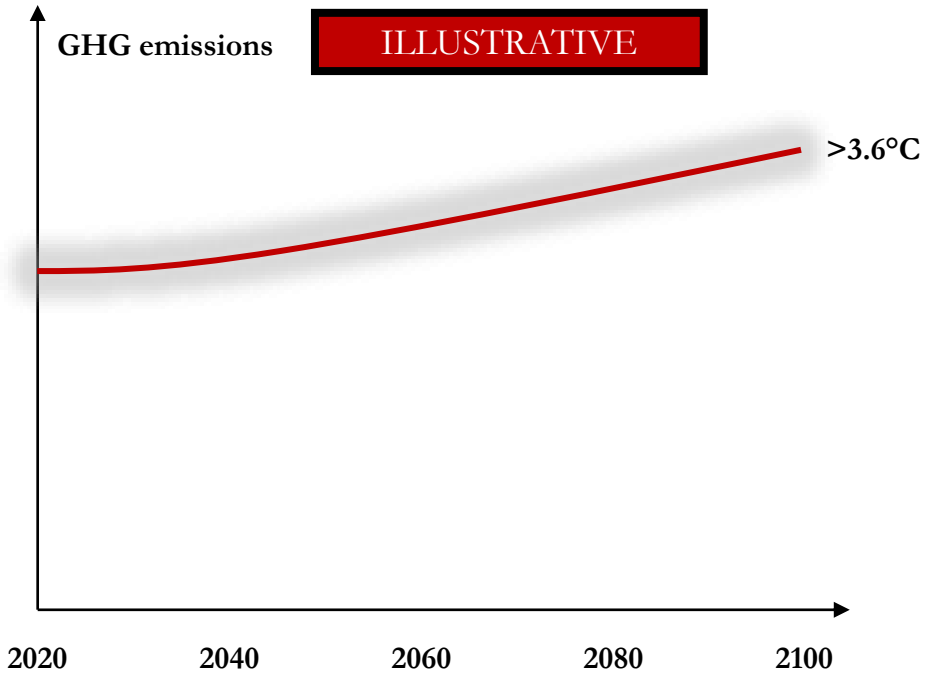
- At the same time, this is not to suggest that temperature steps are ‘minor’. Depending on the temperature model, 0.1°C of additional warming links to +200 GT of CO_2 emissions.

- While temperatures are an important barometer of progress (and indeed, our core goal), they are likely not an effective reference point in target-setting. Instead, the focus on net zero years and (where applicable) negative emissions is likely to be a more effective performance indicator.



THE WORLD BEFORE THE PARIS AGREEMENT…

>3.6° C

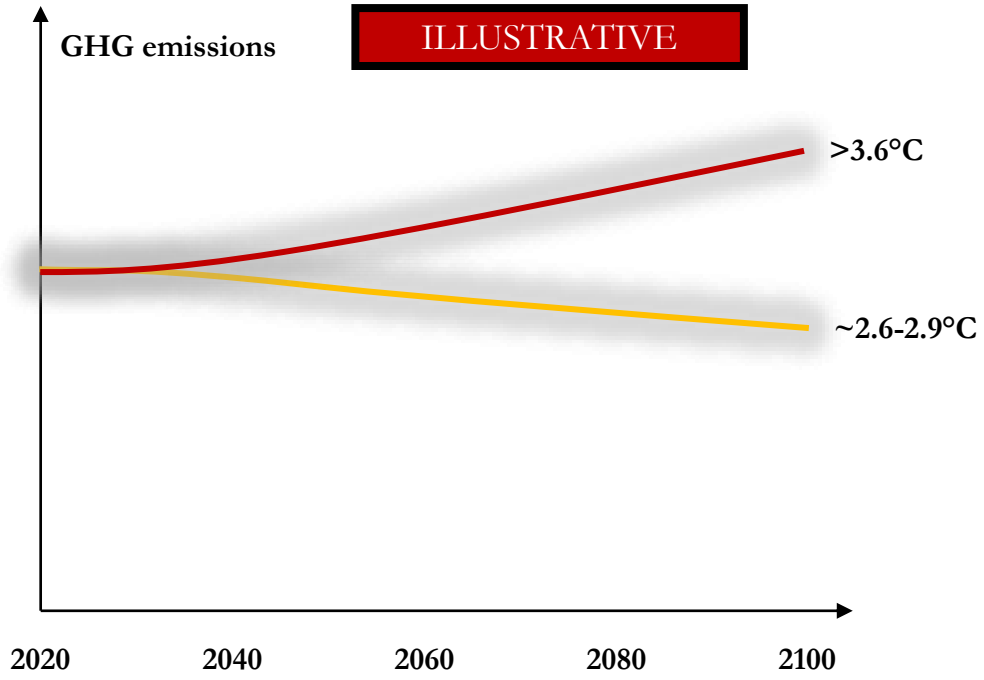


- The "Current Policies" of the international community prior to the development of the "Nationally Determined Contributions" under the Paris Agreement put us on a +3.6°C pathway, according to the World Energy Outlook estimates of the International Energy Agency in 2014 and 2015.
- In this world, emissions were expected to rise indefinitely until the end of the 21st century. While the IEA projected 3.6°C, more pessimistic scenarios about future climate policies at this point still considered a +4°C or even +6°C world.
- Analysis by the Swiss Federal Office for the Environment from 2017 highlighted that corporate investment and financial portfolio trajectory plans still reflected such a world, suggesting that investment plans were lagging the Paris Agreement at the time.

"WE WILL HAVE POLICY BACKSLIDING!!!"

~2.6-2.9° C

THE PARIS AGREEMENT RESETS BUSINESS AS USUAL



- The Paris Agreement laid the foundation for the Nationally Determined Contributions which radically altered the projection of future warming. Within 1 year, the IEA projections were reduced from 3.6°C warming by the end of the century to 2.7°C at 50% probability. The UNEP Emissions Gap Report meanwhile set the warming projection with a 66% probability at 2.9°C. Clearly however, the NDCs fall short of the Paris Agreement temperature goal of "well below 2°C / 1.5°C".

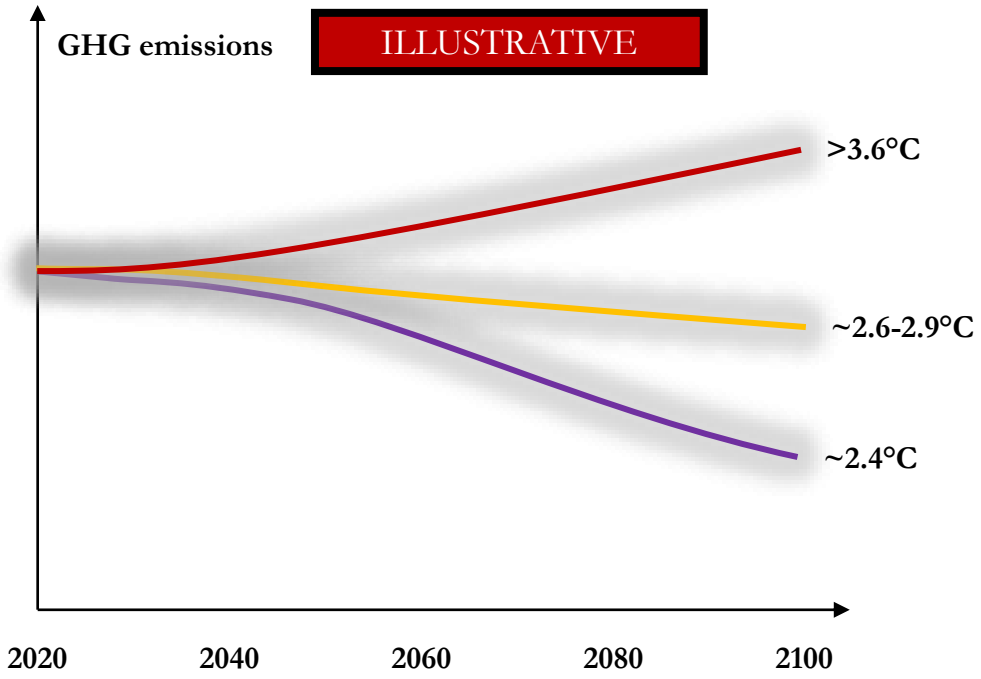
- One challenge with projecting the temperature implications of the NDCs is that +90% expire in 2030, leaving question marks about the emissions and by extension temperature trajectory post 2030. Most projections assume emissions either stay 'flat' or decline only very gradually post NDCs, although one could also assume policy acceleration given technology momentum.

WEO Publication	STEPS	APS
2014	3.6	
2015	3.6	
2016	2.7	
2017	2.7	
2018	2.7	
2019	2.7	
2020	2.7	
2021	2.6	2.1
2022	2.5	1.7
2023	2.4	1.7

"WE WILL NEVER ACCELERATE AMBITION BEYOND NDCs!!!!"

THE CONDITIONAL NDCS & "STATED POLICIES"

~2.4° C



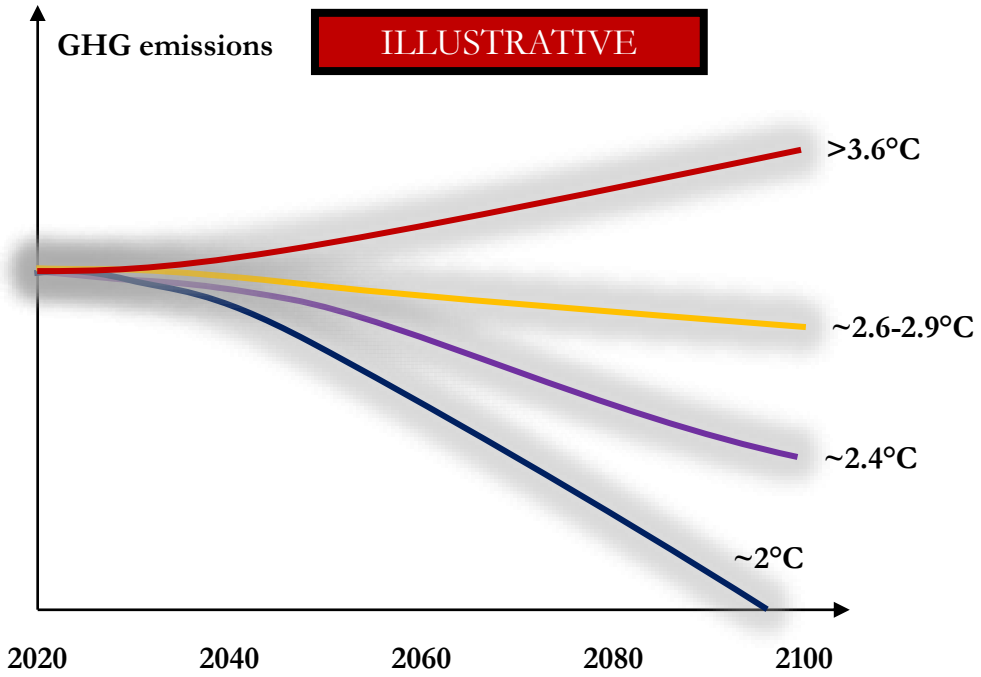
- There is a growing body of evidence that bottom-up climate policies, coupled with market trends around low-carbon cost reductions and adoption curves are set to outpace the unconditional NDCs and potentially even the additional conditional NDCs, defined by emerging markets on the basis of developed markets action.

- The IEA Stated Energy Policy Scenario seeks to reflect this potential policy acceleration based on assumptions around planned policy implementation (including ambition consistent with the conditional NDCs) and some policy 'acceleration' post 2030. This type of trajectory is also consistent with some private sector analysis (e.g. MSCI, abdrn), as well as an accelerated transition modelled in the UNEP Emissions Gap Report.

"AMBITION LEVELS WILL EFFECTIVELY PEAK AT CONDITIONAL NDCS LEVEL!!!"

THE STRETCH TO 2°C…

~2° C

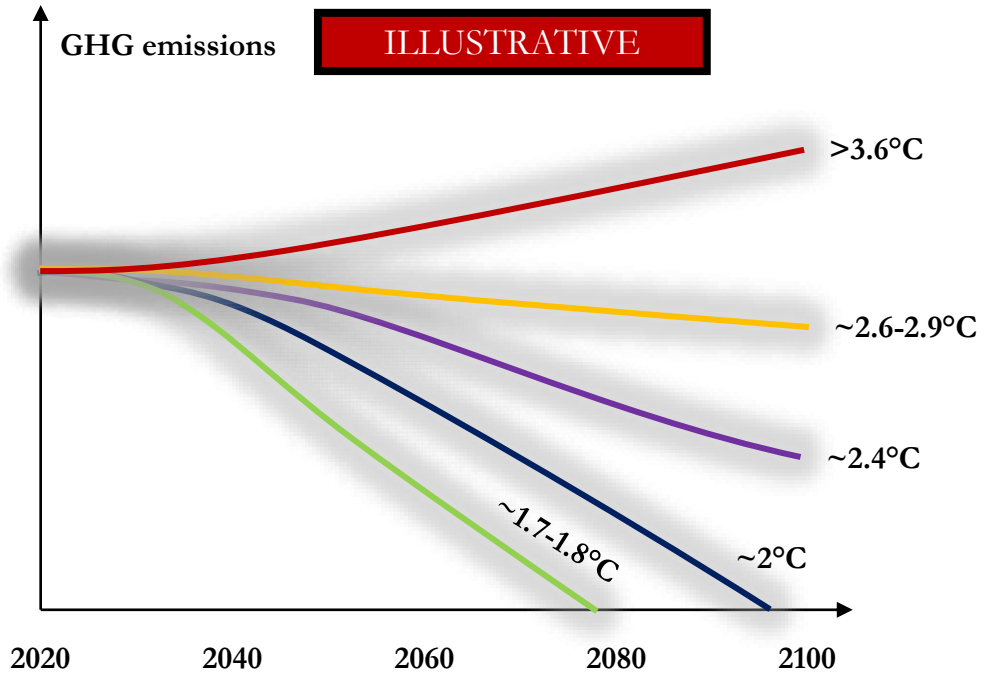


- There is a simple rule of thumb that helps orient the 2°C goal. Achieving net zero GHG emissions by the end of the century as part of a transition consistent roughly consistent with the "NDC pathway" until the 2030s is expected to deliver a 2°C world.
- There are obviously countless different curves one can map around the 2°C "threshold". At 2°C, some scenarios begin to provide for some 'overshoot' which drives negative overall emissions at some point in the century, depending on how quickly decarbonization trends accelerate.
- 2°C scenarios are not often found across the leading 'headline scenarios' as it increasingly sits between two poles: the "do nothing / "do little" world of +2.4°C or the ambitious 'well below' and even 1.5°C scenarios or forecasts.

"ONE STEP BACKWARD, TWO FORWARD, AND NET ZERO BY 2100!!!"

~1.7-1.8° C

NET ZERO TARGETS & THE WELL BELOW 2°C GOAL…



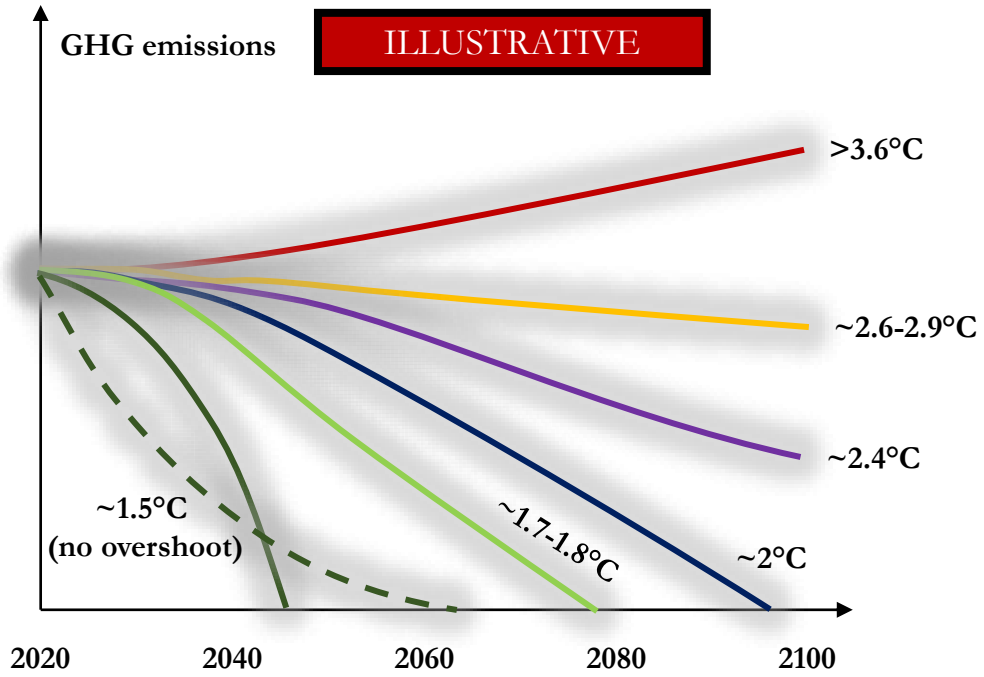
- While there are questions around governments long-term net zero targets, achieving them would, according to estimates of the IEA, drive a 1.7°C temperature outcome with net zero across all GHG emissions by the 2080s. The UNEP Emissions Gap report is slightly more pessimistic and projects that these targets 'only' achieve 2°C, consistent with pathways highlighted previously.

- The Inevitable Policy Response (IPR) forecasting consortium' bottom-up policy forecasting over the next 50 years, while not 100% consistent with the net zero pledges (e.g. IPR assumes some net zero pledges will be missed and some emerging market pledges accelerated) also generates a 1.7°C-1.8°C outcome. IPR does not 'temperature optimize' in these projections. As at 2°C, there may be some negative emissions allowing for further temperature reductions post net zero.

"NET ZERO GOALS ACHIEVED OR ONLY SLIGHTLY MISSED!!!"

THE FINAL GOAL: 1.5°C…

~1.5° C



- While the IPR Forecast Policy Scenario (FPS) – consistent with some other scenarios and projections – describes a roadmap of reducing temperatures post peak towards 1.5°C, scenarios that are consistent with the 1.5°C no overshoot goal face an increasingly narrow pathway, given the remaining carbon budget.

- These scenarios either see immediate emissions reductions dramatically more ambitious than the NDCs (dashed green line) and some residual runway for net zero CO2 by 2050 and net zero GHG emissions by the 2060s or – with every year of delay – a curve that increasingly becomes horizontal (green line). There are growing reservations about the feasibility of this temperature outcome, although of course single digit percentage probabilities for achieving 1.5°C no overshoot remain across the 1.7°C-1.8°C forecasts and scenarios, given the temperature uncertainty.

“RADICAL, TRANSFORMATIVE CLIMATE ACTION NOW!!!”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