The COP30 Net Zero Atlas

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LSEG

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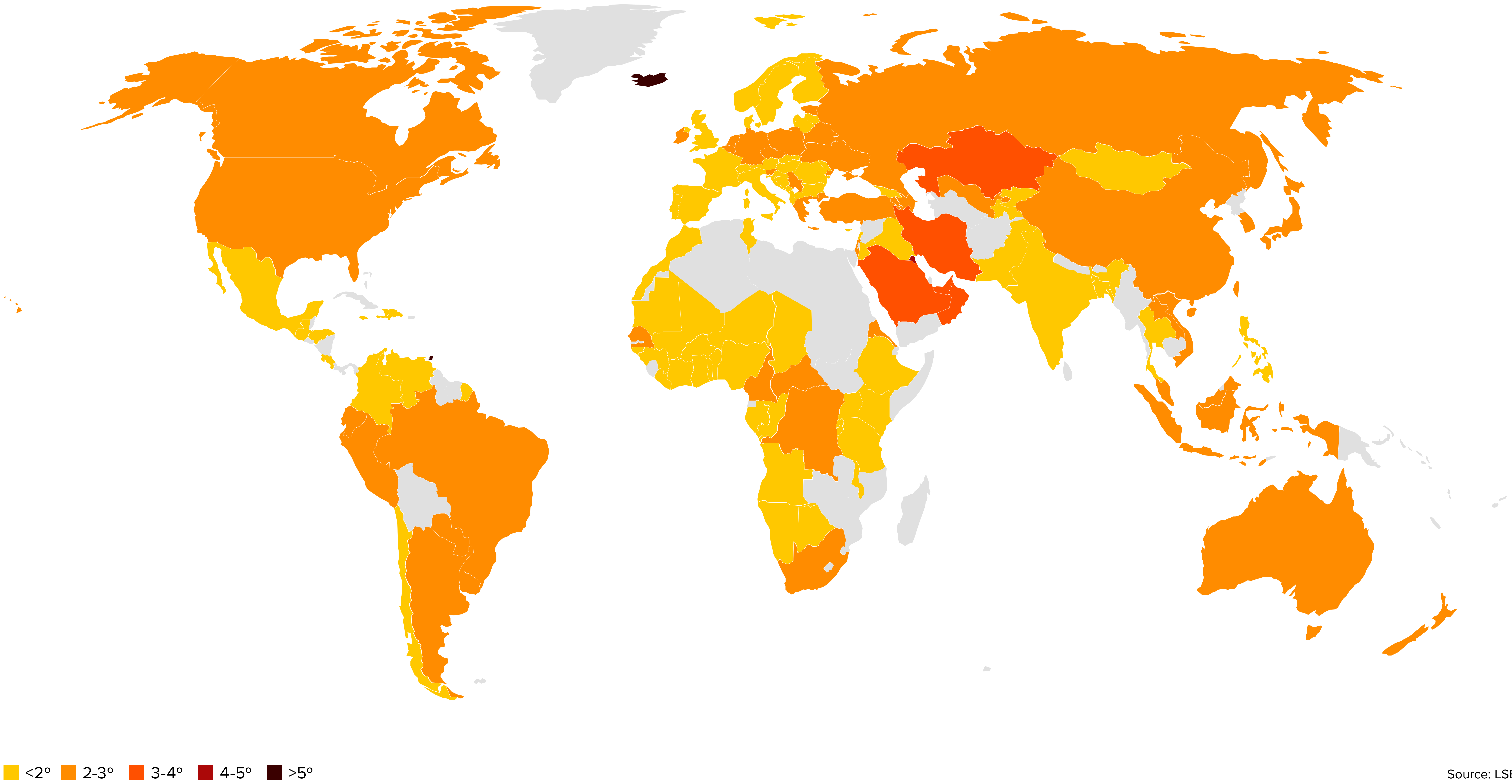
World Atlas

Figure 01: Implied Temperature Rise of every country with a quantifiable NDC target



Source: LSEG

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Foreword

As COP30 begins in Belém, Brazil, global climate action faces a defining moment.

The next round of national climate commitments – 'NDCs 3.0' – will chart the course of global emissions to 2035 and beyond.

These new climate targets – now submitted by over 70 countries ahead of COP30 – are critical to climate transition.

When I speak to investors and customers, climate change and sustainability continue to be key considerations in their strategies. But they need trusted data and insights to drive action.

Our fifth annual Net Zero Atlas analyses the G20's NDC pledges, drawing on LSEG's unparalleled depth and quality of analysis.

It examines many of the factors impacting today's transition efforts, from global policy trends to the physical hazards affecting economies around the world.

In a complex geopolitical environment, the COP30 Net Zero Atlas will be a valuable guide for investors who want to create lasting sustainable growth.

David Schwimmer
CEO, LSEG

Executive Summary

Transition Risk: COP30 and the future of global climate ambition

As governments convene in Belém for COP30, the stakes for global climate cooperation are high. The third generation of Nationally Determined Contributions (NDCs 3.0) will define the emissions trajectories of G20 economies to 2035 and beyond, shaping the transition risk landscape for investors and determining the feasibility of limiting warming to well-below 2°C.

This year's Net Zero Atlas shows that, despite initial delays, last-minute announcements mean that there is now a critical mass of NDCs 3.0 commitments emerging, covering over 70% of G20 emissions. Using our updated LSEG sovereign climate assessments and Implied Temperature Rise (ITR) metrics, our analysis shows that:

- **Announced 2035 targets imply a 13-18% additional emissions cut over five years**, compared to 2030 goals.
- **Average annual decarbonisation rates are set to increase**, to -2.6 to -3.5% in 2030-35 (up from -0.5 to -0.7% between 2023 and 2030 under NDCs 2.0).
- **Temperature alignment improves modestly**, with announced NDCs 3.0 consistent with 2.2-2.3°C warming, still short of the Paris Agreement goals.
- **Faster G20 emission reductions, driven by peaking emissions in large emerging economies** including China and Türkiye. Among the G20 countries where have already peaked, the 2035 pledges imply faster decarbonisation in some cases (like the UK and Australia) offset by decelerating cuts in others (e.g. Canada and Japan).

Our analysis shows that while the NDCs 3.0 still fall short of the goals of the Paris Agreement, they entail material new emission reduction commitments. In our eyes, this new generation of climate targets underscores the continued resilience of the Paris mechanism in face of major headwinds linked to geopolitical tensions and political fragmentation.

Physical Risk: Analysis of over 4,400 regions in eight G20 countries show that climate hazards are projected to intensify significantly

As climate extremes become more frequent and severe, physical risk is also emerging as an increasingly urgent challenge for investors. This year's Atlas expands our analysis to sub-national regions across eight G20 economies, covering 4,416 regions home to 2.2 billion people and generating over 60% of global GDP.
Key findings include:

- **By 2050, over 800 million people and US$28 trillion in GDP will be exposed to high physical climate risk**, up from 155 million and US$7.8 trillion today.
- **Cyclone and flood risks will intensify**, with major urban centres like New York, Tokyo, and Shanghai facing high exposure.
- **Heatwaves and water stress will expand dramatically** Over 327 million people will face extreme heat (>35°C for 30+ days/year) by 2050 – including Los Angeles, Houston, Shanghai, and Hong Kong – up from just under 10 million today.
- **Flooding**: across the 8 countries, the UK is the most exposed by share of GDP and population. The Thames Estuary could face $100 billion in GDP at risk, with national exposure rising to 9.7% of GDP by 2050.
- **Wildfires**: wildfire risk will intensify, with 16.4 million more people exposed. In California alone, some 9.5 million people are projected to be at risk.

Taken together, these findings highlight a dual challenge: while transition risk is evolving as countries accelerate decarbonisation under NDCs 3.0, physical risk is becoming systemic threatening people and economies.

Chapter 1

Transition Risk

COP30 – a defining juncture for global climate cooperation

Over the past decade, the Paris Agreement's central mechanism, the Nationally Determined Contribution (NDC) process, has coordinated meaningful emissions commitments across sovereign states. The Agreement's ultimate goal – limiting global warming to well below 2°C and pursuing efforts toward 1.5°C – remains out of reach under present pledges. However, despite the absence of a formal enforcement mechanism, the process has steadily raised ambition and lowered projected global emissions.

On conclusion of the Agreement in 2015, 195 Parties submitted initial 2030 emissions reduction targets (NDCs 1.0). 174 Parties subsequently revised these 2030 pledges (with the enhanced pledges referred to as NDCs 2.0). While the NDC 1.0 aimed for annual emissions to hit 70% above 1990 levels by 2030, the updated NDC 2.0 reduced this to c. 50%, with a peak before 2030 – a target that remains within reach (see Box 1).[1]

Now, the five-year review process of the Agreement asks countries to set a new, third generation of commitments for 2035, known as the NDCs 3.0.

For the first time, this will require governments on record to outline concrete national GHG reduction trajectories for the coming decade. These national targets will shape the transition risk environment for investors and companies. Ultimately, they also define global emission pathways, making them key to gauging temperature outcomes and physical-risk exposure over the coming decades (see our Physical Risk chapter).

This makes the COP30 Summit, where governments are meant to formalise the NDCs 3.0 commitments, a critical litmus test. Whatever its outcome, it will send a powerful policy signal to companies and investors about governments' decarbonisation intentions and their ability to effectively collaborate on global climate action.

Stress testing the Paris Agreement

Political fragmentation and geopolitical tensions have significantly delayed the submission of new NDCs in the run up to the Summit in Belém, leaving the Paris process hanging in the balance.

After the **US** – the world's largest economy and second-largest emitter – withdrew from the Paris Agreement in January 2025,[2,3] most other signatories missed the formal February UNFCCC deadline for NDC submission. A few notable exceptions included the **UK**, **Japan**, and COP-host **Brazil**.

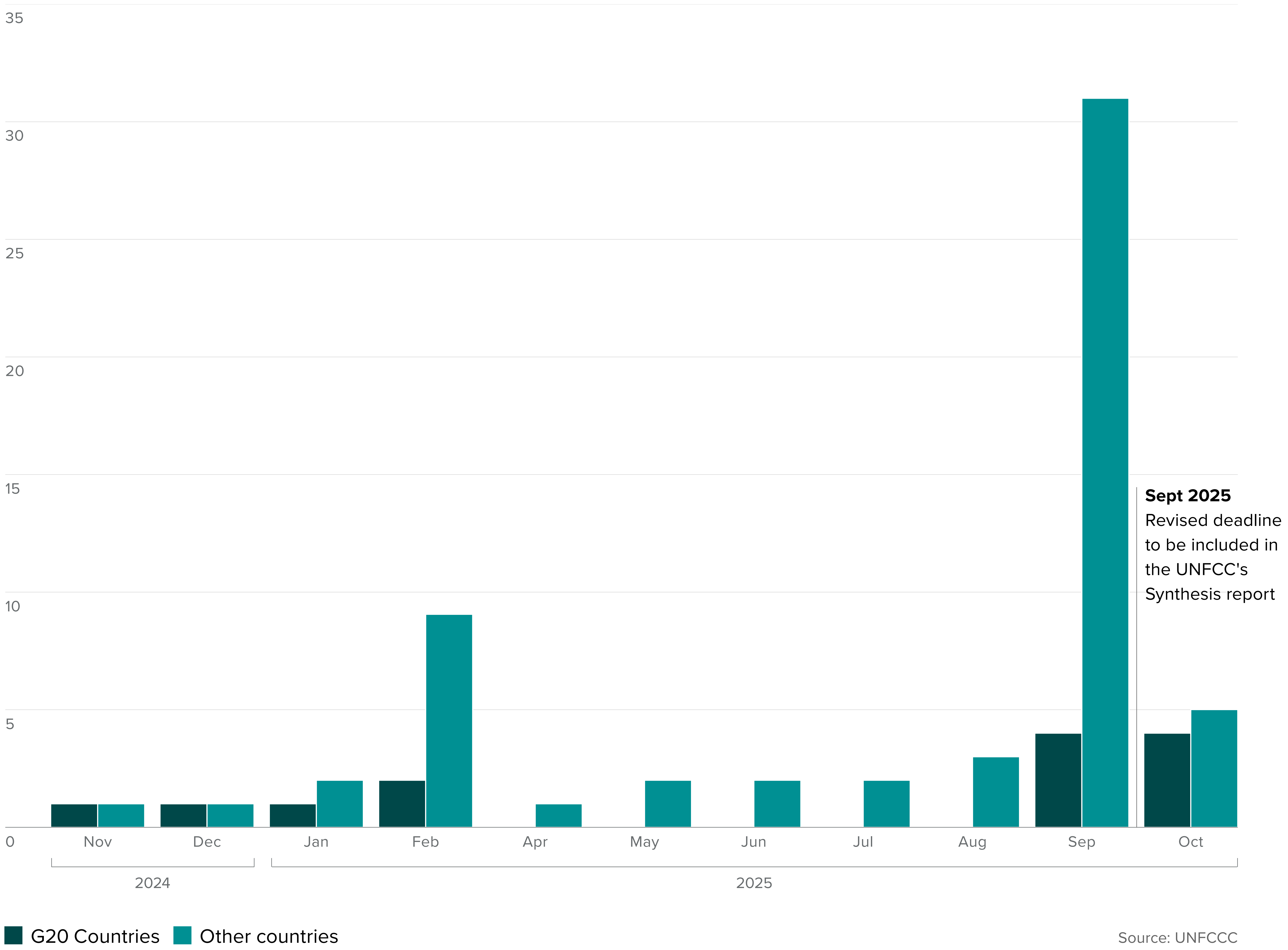
Meanwhile, persistent tensions within and among EU Member States have repeatedly stalled the formal adoption of a 2035 target for the bloc.[4] To date, the world's fourth-largest GHG emitter has issued only a non-binding statement of intent for its NDC 3.0. This delay has further undermined momentum, given the EU's historic role in driving global negotiations through early, ambitious climate goals.

However, a string of recent announcements in September and October have shifted the landscape. Over 70 countries have now either formally submitted new 2035 targets, informally outlined their new commitments, or publicly committed to the NDCs (Figure 2).[5]

This includes key emerging economies, with new UNFCCC submissions from **Indonesia**, **Russia** and **South Africa**; and recent public announcements outlining new targets from the **EU**, **China**,[6] **Türkiye**,[7] and **South Korea**.[8] **India**[9] and **Mexico**[10] have signaled they are in the process of preparing their submissions but specifics remain undisclosed. Among G20 countries, this leaves only **Argentina** and **Saudi Arabia** – alongside the US – without new climate commitments in the run-up to COP30.

Against a backdrop of geopolitical strains and acrimonious negotiations over climate finance,[11] an inconclusive summit in Belem could still derail the NDC process – and even call the foundations of the Paris Agreement itself into question. Conversely, a COP30 anchored by firmed up 2035 commitments from major actors could keep the Paris process on track and underscore the resilience of the NDC mechanism despite significant headwinds.

Figure 2. No. of submissions of NDCs 3.0. To date, only one third of Parties have set a 2035 target



Source: UNFCCC

G20 countries' NDCs 3.0 submissions

Nov 2024	Brazil
Dec 2024	United States
Jan 2025	United Kingdom
Feb 2025	Canada Japan
Sep 2025	Australia China* European Union* Russia
Oct 2025	Indonesia South Africa South Korea* Türkiye*

* NDC 3.0s from these states are not yet formally submitted to the UNFCCC registry or are in preliminary draft form

Box 1. Are the G20 still on track for the 2030 NDC 2.0 milestone?

While governments deliberate new NDCs, we analyse how countries have been progressing towards their existing 2030 targets (NDCs 2.0).

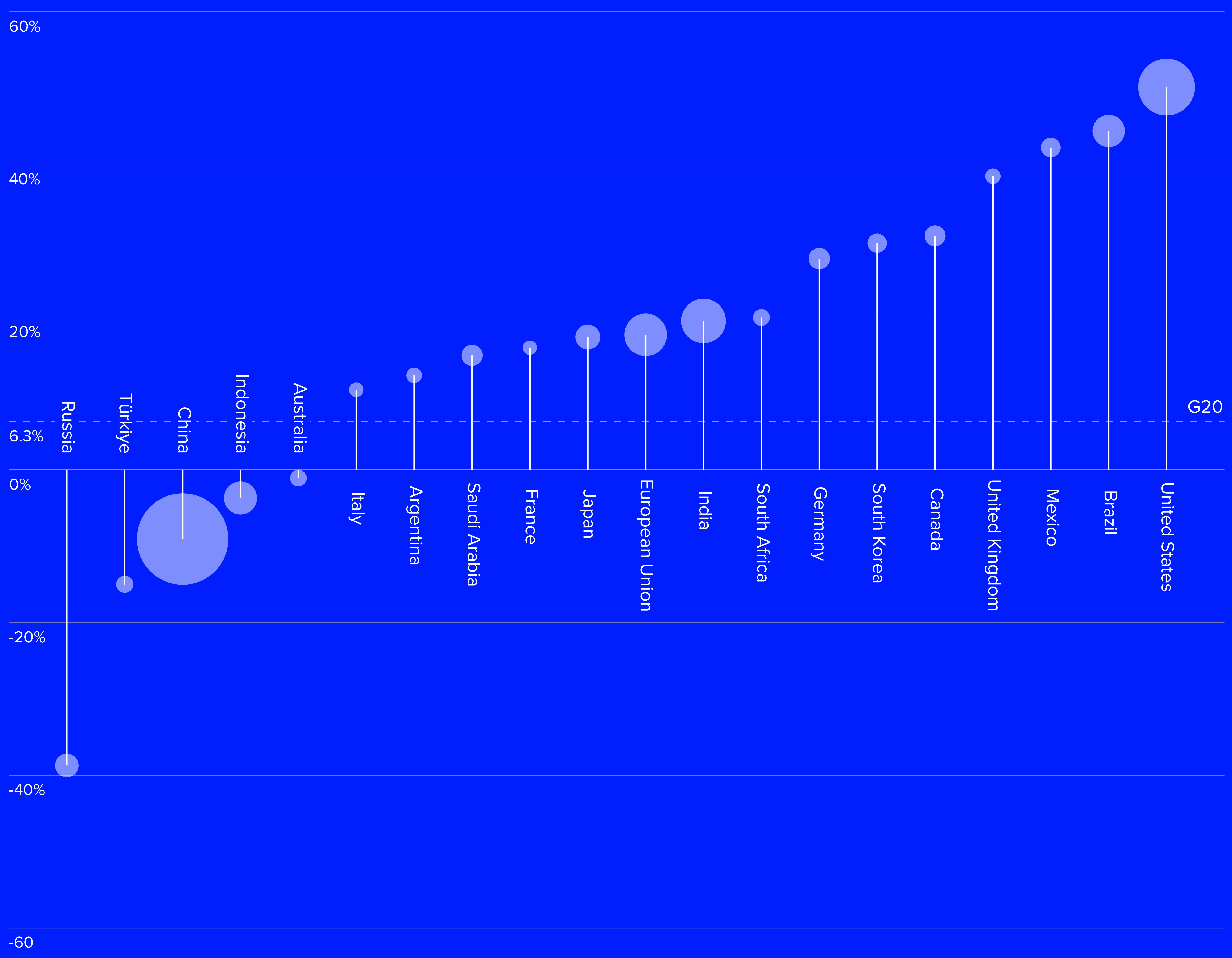
For this, we work with experts from the NewClimate Institute to project G20 countries' 2030 emissions based on currently enacted policies (rather than future targets). The gap between these 'Current Policies' projections and the 2030 NDCs is a measure of the 'implementation gap' – how close countries are tracking towards achieving their self-set climate goals.

Our data shows that while the G20 are not yet on track to deliver on the NDCs 2.0, they remain within reach. Without further policy action, G20 GHG emissions would reach 34.6 $GtCO_2e$ by 2030 – exceeding their aggregated 2030 NDC target by 2.1 $GtCO_2e$ (or c. 6%). This would align with a 2.5°C trajectory for Current Policies compared with 2.4°C for the 2030 NDCs.

However, compared to last year's analysis, this gap between NDCs 2.0 and current policies has widened by 0.4 $GtCO_2e$ for the G20. Key drivers are the US (+0.6 $GtCO_2e$) and India (+0.35 $GtCO_2e$) – reflecting, respectively, rollbacks related to the One Big Beautiful Bill Act[12] and slower than anticipated renewables deployment coupled with ongoing growth in fossil fuel use.[13] By contrast, in Türkiye, the newly introduced 2035 Renewable Energy Roadmap is set to drive meaningful (0.2 $GtCO_2e$) additional emission cuts by 2030.[14]

Figure 3 shows that this 'implementation gap' differs significantly across the G20. This reflects diverging levels of policy effort, but also differences in the ambition levels of targets. While some G20 members surpass modest commitments, others struggle with the ambitious goals they set for themselves.

Figure 3. 2030 emissions gap relative to NDC 2.0



Note: the size of the circles are proportional to each country's current emissions. The bars positive values show emissions above the NDC 2.0 level.

— Emission gap ● 350 $MtCO_2e$ ● 3,285 $MtCO_2e$

Source: LSEG

How ambitious are the NDCs announced so far?

The 2035 targets set by G20 economies already represent substantial new climate commitments. Covering fifteen G20 members and 71% of G20 emissions, our data shows they imply a 3.3-4.4 $GtCO_2e$ reduction compared to 2030 NDCs. This equates to a 13-18% additional reduction commitment over 5 years.[15]

In aggregate, the announced 2035 targets are broadly consistent with a straight-line trajectory from 2030 targets to countries' long-term commitments, aligning with a temperature increase of 2.2-2.3°C, compared with 2.4°C under G20 NDCs 2.0. The quality and comparability of new targets have also increased, with most NDCs 3.0 now covering all GHG emissions, being economy-wide and expressing commitments in terms of absolute emission reductions.[16]

The new targets also imply an acceleration in emission cuts. For countries with new pledges, average emission reductions are projected to increase from -0.5 to -0.7% per annum between 2023 and 2030 (under NDCs 2.0) to -2.6 to -3.5% p.a. between 2030 and 2035 (under NDCs 3.0). This is primarily driven by peaking emissions in several emerging economies, including China, Indonesia and Türkiye. Among countries where emissions have already peaked, the 2035 pledges imply faster decarbonisation in some G20 economies (the UK and Australia) offset by decelerating emission cuts in others (Canada and Japan).

Table 1. Announced 2035 targets suggest acceleration in emissions cuts[17]

	Historical (2018–2023)	NDC 2.0 (2023–2030)	NDC 3.0 (2030–2035)
Continuing to decarbonise	Average annual emissions change (% p.a. relative to 2023 emissions)		
Brazil	2.2	-4.3	-1.8 to -4.1
Canada	-1.5	-4.5 to -5.3	-1.1
European Union	-3.8	-4.8	-2.8 to -4.7
France	-3.9	-4.7	-2.8 to -4.8
Germany	-4.8	-5.6	-2.6 to -4.3
Italy	-1.7	-4.2	-2.8 to -5.0
Japan	-3.3	-4.2	-3.7
South Africa	-1.7	-1.5 to -3.6	-1.3 to -1.7
Accelerating decarbonisation			
Australia	-1.9	-3.5	-5.0 to -7.2
South Korea	-2.8	-4.5	-4.6
United Kingdom	-3.7	-4.8	-5.4
Emissions peak			
China	2.2	0.4	-1.9 to -2.5
Indonesia	4.7	2.5 to 4.3	-0.1 to -1.5
Russia	-3.2	10.6	-16.2 to -17.3
Türkiye	0.9	3.6	-1.9
No 2035 NDC Commitment yet			
Argentina	0.7	-1.3	
India	2.5	0.4	
Mexico	2.5	-2.8	
Saudi Arabia	1.1	-0.4	
United States	-2.1	-5.4 to -5.7 (withdrawn)	-2.8 to -3.5 (withdrawn)
G20 Total	**0.5**	**-1.2 to -1.4**	
G20 Total (announced NDC3.0 only)	**0.8**	**-0.5 to -0.7**	**-2.6 to -3.5**

Comparing G20 ambitions

Implied Temperature Rise (ITR) scores (in °C) provide a useful lens for comparing the NDC ambitions across G20 countries. They indicate the global implied temperature increase that would result if every country adopted targets or policies with the same level of ambition as the studied country.[18]

The metric is derived by comparing the cumulative emissions implied by a country's target to its remaining emissions budget (assuming no further reductions beyond the target). The resulting temperature outcome is then calculated, assuming that all other countries would over/undershoot their respective carbon budgets to the same degree.[19]

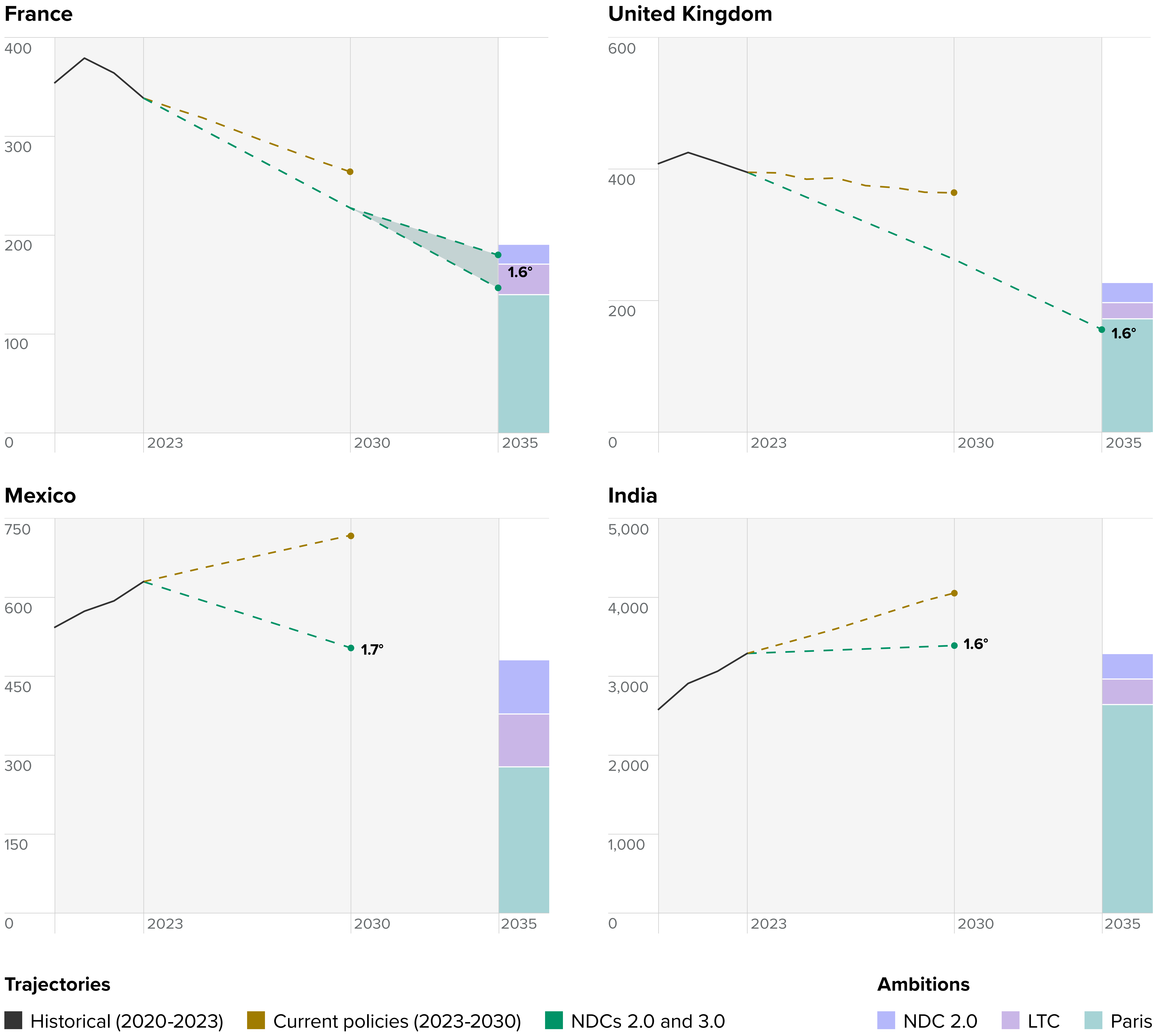
Closest to 1.5°C alignment

Four G20 countries NDCs are currently aligned with the Paris Agreement's 1.5°C goal. **France** and the **UK** both improve slightly from 1.7°C in 2030 to 1.6°C in 2035. **Mexico** and **India** have not yet announced their new 2035 NDCs, but modest historical emissions currently imply low 2030 ITRs at 1.7°C and 1.6°C respectively. As emissions in the latter two countries have not yet peaked, their 2035 targets could result in higher ITRs.

Note: NDC 3.0 Ambition Scenarios are detailed on page 17

Figure 4. Emissions trajectories ($MtCO_2e$) and ITRs (°C) implied by announced NDCs

Source: LSEG



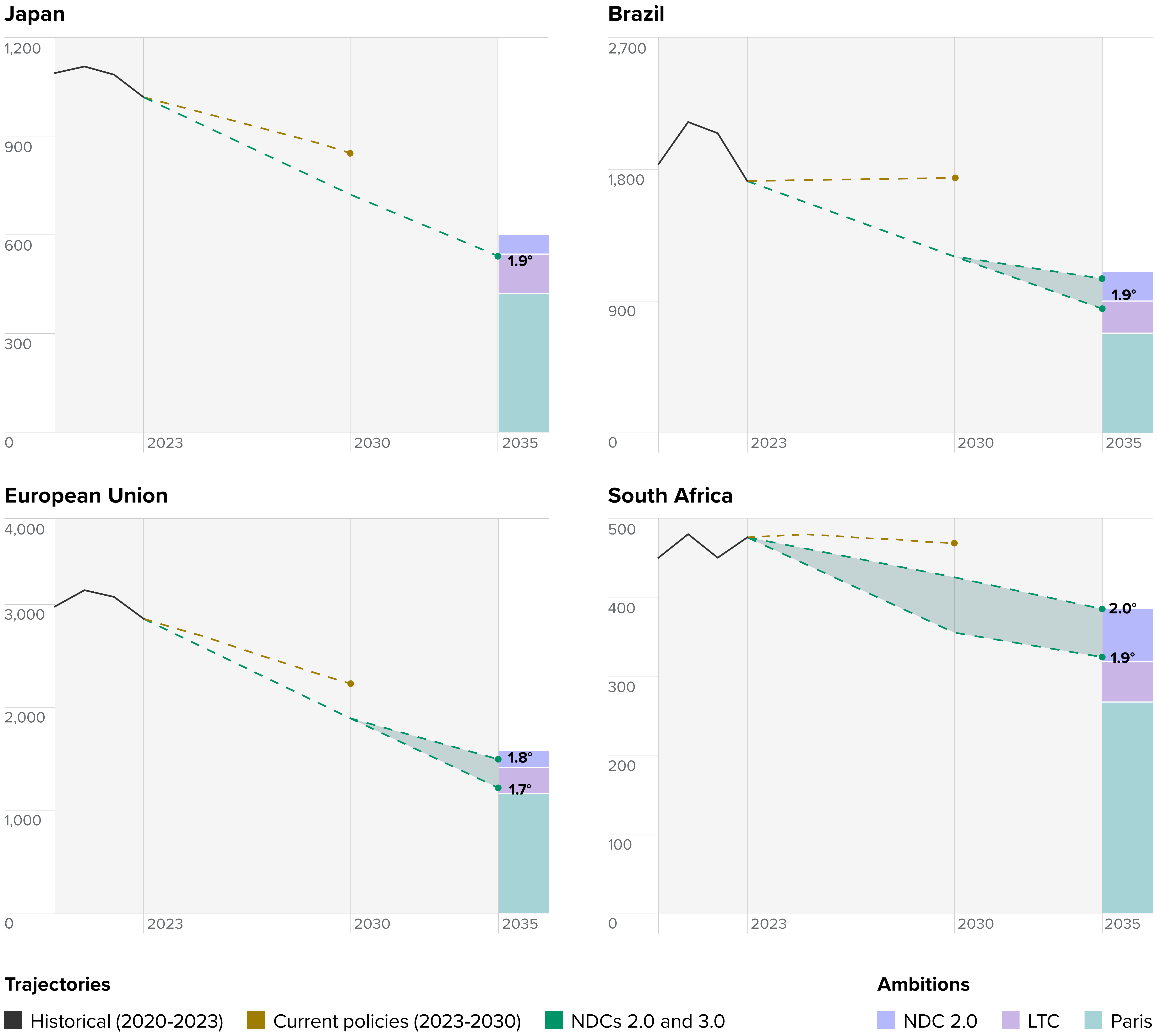
Aligning with below 2°C

Japan's new 2035 NDC, which aligns with a linear decarbonisation pathway to its 2050 net zero target, moves from 2.1°C to 1.9° C, with **Brazil** showing a modest improvement between its 2030 and 2035 NDCs, moving from 2.0°C to 1.9°C. **Germany** and **Italy** move into the below 2°C category with an ITR of 1.8-1.9°C and 1.7-1.8°C respectively. **South Africa**, which recently announced its 2035 target, aligns with 1.9-2.0°C.

Note: NDC 3.0 Ambition Scenarios are detailed on page 17

Figure 4. Emissions trajectories ($MtCO_2e$) and ITRs (°C) implied by announced NDCs

Source: LSEG



2.0°C or slightly above

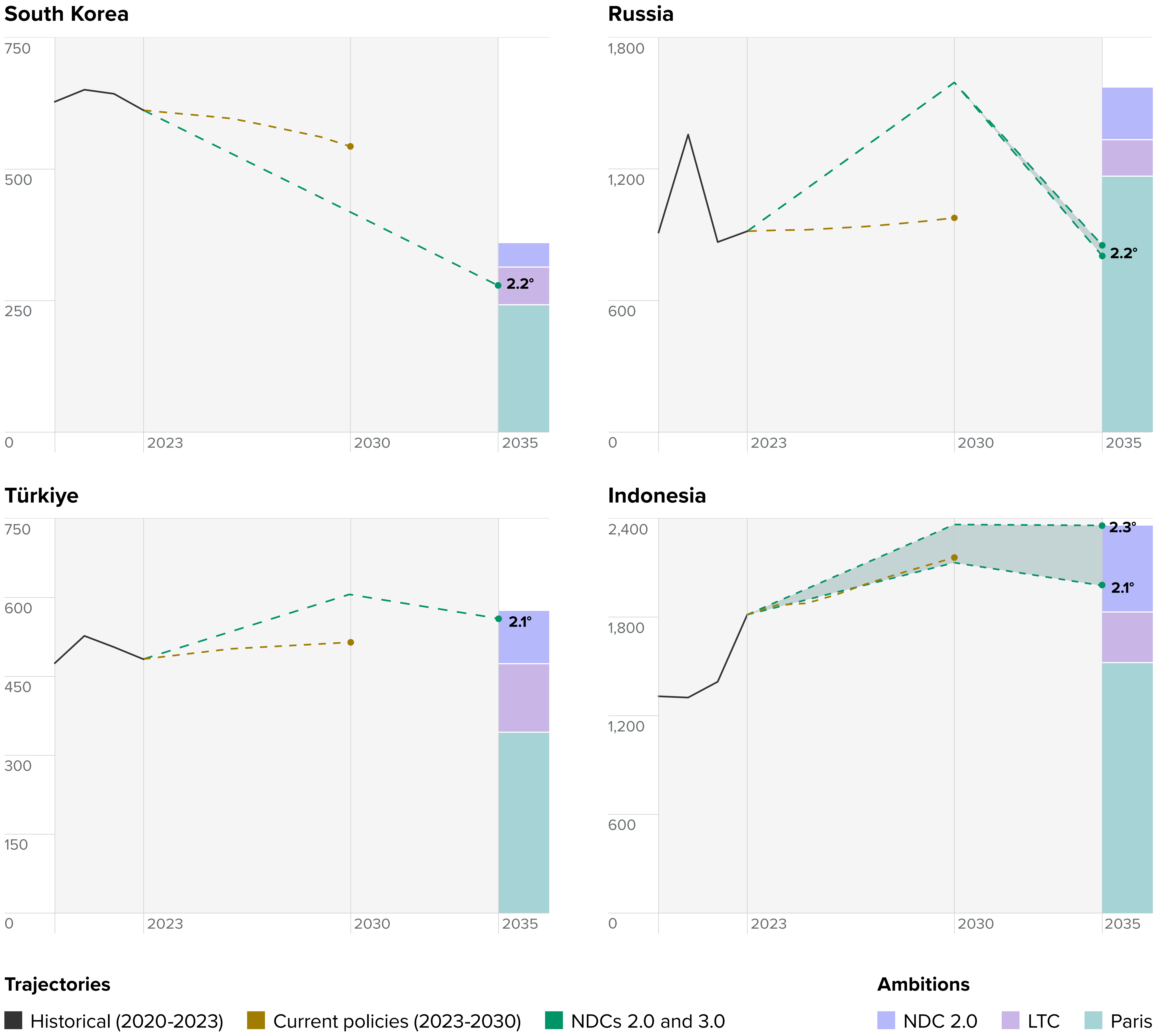
South Korea's new 2035 target, which broadly traces a straight-line from its NDC 2.0 to its net zero target in 2050, lowers its ITR from 2.4°C to 2.2°C. Under its new NDC, **Russia's** ITR drops from 2.7°C to 2.2°C. However, we note that these revisions follow mainly from the government's 2024 restatement of its LULUCF (land use, land-use change, and forestry) inventory, rather than new climate policies.[20]

In **Türkiye**, the 2035 target emissions levels announced by President Erdogan aligns to 2.1°C. This would also imply peak emissions in the early 2030s instead of the current official target of no later than 2038. **Indonesia**, which refined its 2030 and 2035 targets in its recent NDC 3.0, now aligns with a 2.1-2.3°C.

Argentina, which has not yet set a 2035 target, has a 2030 NDC that implies a temperature of 2.3°C.

Figure 4. Emissions trajectories ($MtCO_2e$) and ITRs (°C) implied by announced NDCs

Source: LSEG



Note: NDC 3.0 Ambition Scenarios are detailed on page 17

Well above 2°C

In this group, **Australia** has announced the most ambitious 2035 NDC, resulting in a marked improvement in its ITR from 2.9°C in 2030 to 2.3-2.5°C in 2035.

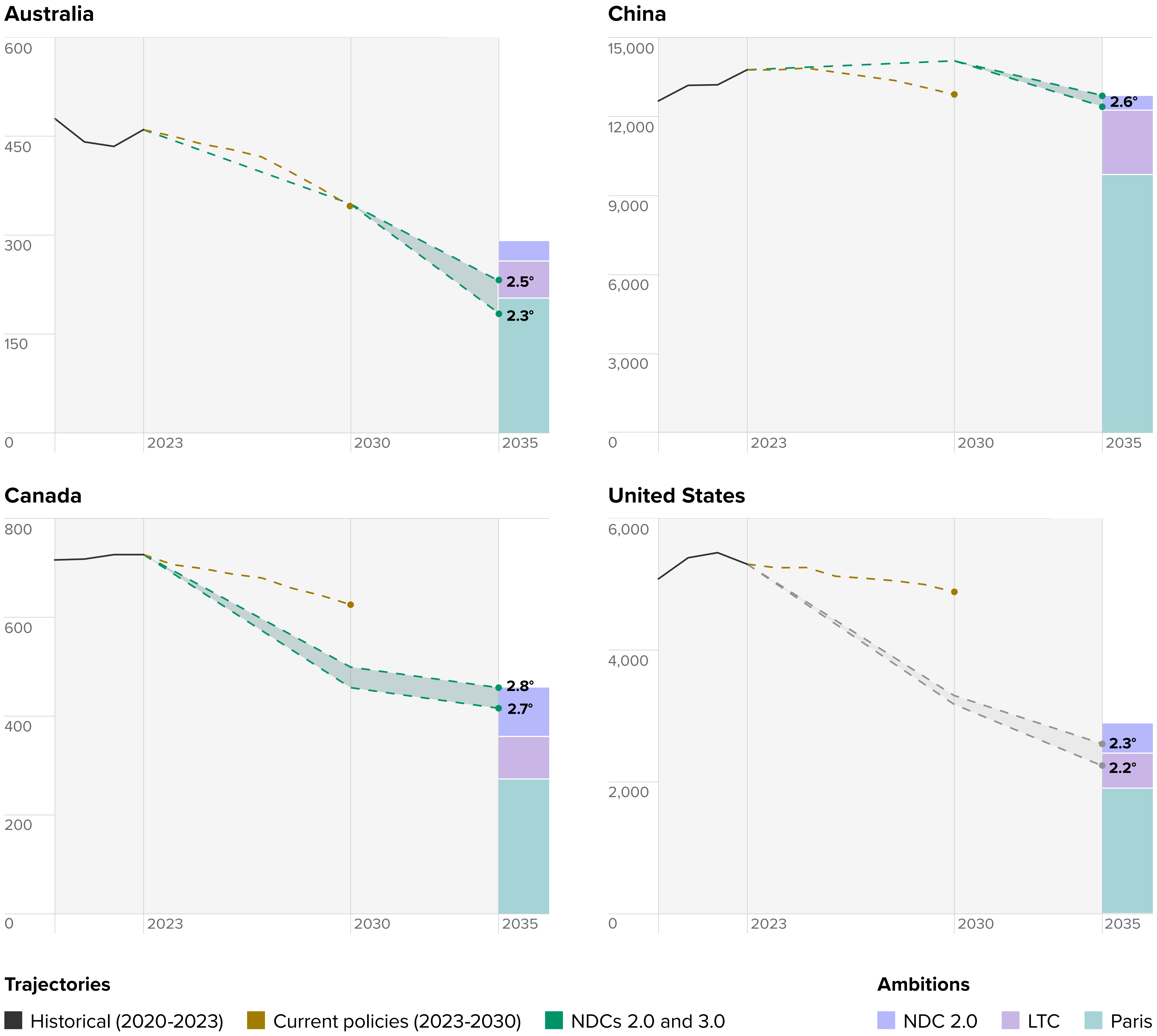
The 2035 NDCs for **China** and **Canada** align closely with the ambition levels previously expressed in their NDC 2.0 targets, with the former edging down slightly from 2.7°C to 2.6°C while the latter's ITR shows virtually no movement, at 2.7-2.8°C.

The **United States** has rescinded its NDC commitments, including its 2030 target that was aligned with 2.5°C. **Saudi Arabia**, which has not yet announced a 2035 NDC, has a 2030 NDC that aligns with 3.7°C.

Note: NDC 3.0 Ambition Scenarios are detailed on page 17

Figure 4. Emissions trajectories ($MtCO_2e$) and ITRs (°C) implied by announced NDCs

Source: LSEG

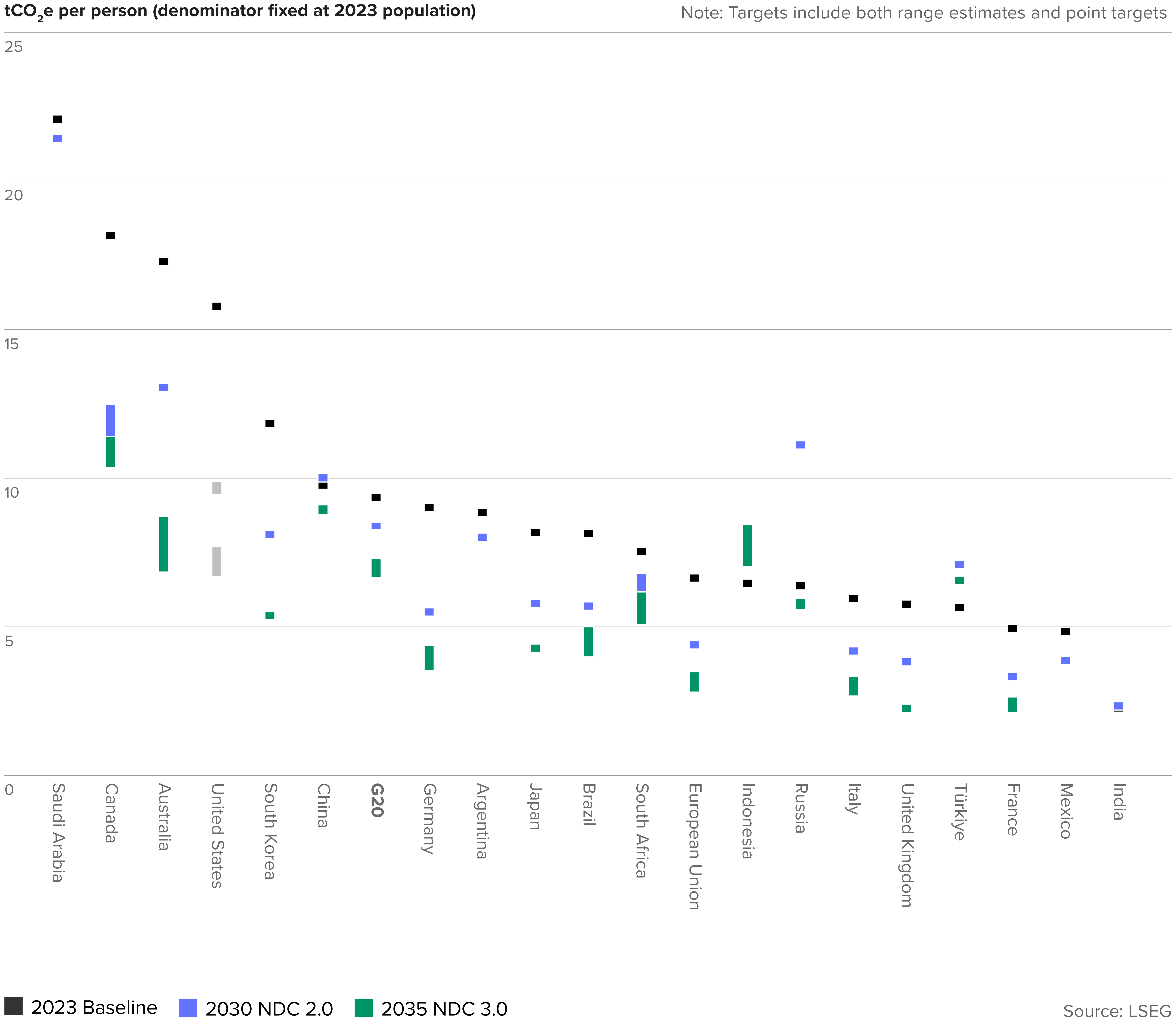


Per-capita emissions: Delivering 2030 and 2035 NDCs would narrow the spread across the G20.

Targets expressed as per-capita emissions levels provide a further useful alternative metric to help indicate where a country is on its decarbonisation journey. High values typically reflect fossil production or carbon-intensive power systems (e.g., Saudi Arabia, Canada, and Australia), whereas lower values can reflect modest energy use per person and less carbon-intensive economies.
On one hand, advanced economies have started trending down through targeted policy, cleaner power, and decarbonisation of their industry and transport sectors. On the other, many emerging economies show flat or rising paths as industrialisation, energy access, and population growth lift demand despite significant deployment of low carbon technologies.

As Figure 5 shows, among countries with 2035 targets, Canada and Australia currently sit highest (about 18 and 17 tCO_2 per person) and are likely to remain among the top per-capita emitters through 2035. For China, achieving its 2030 intensity goal would likely see a per-capita peak around 2030 and a decline by 2035 (from 10 to 9 tCO_2e per person) as the country moves to a less carbon intense energy mix. Lower-intensity advanced economies – the EU, UK, and Japan – project steady, incremental declines (to 2-4 tCO_2e per person), while rapidly developing economies such as India could still see increasing emissions in per capita terms.

Figure 5. G20 emissions per capita in 2023 and as implied by NDC 2.0 in 2030 and NDC 3.0s in 2035

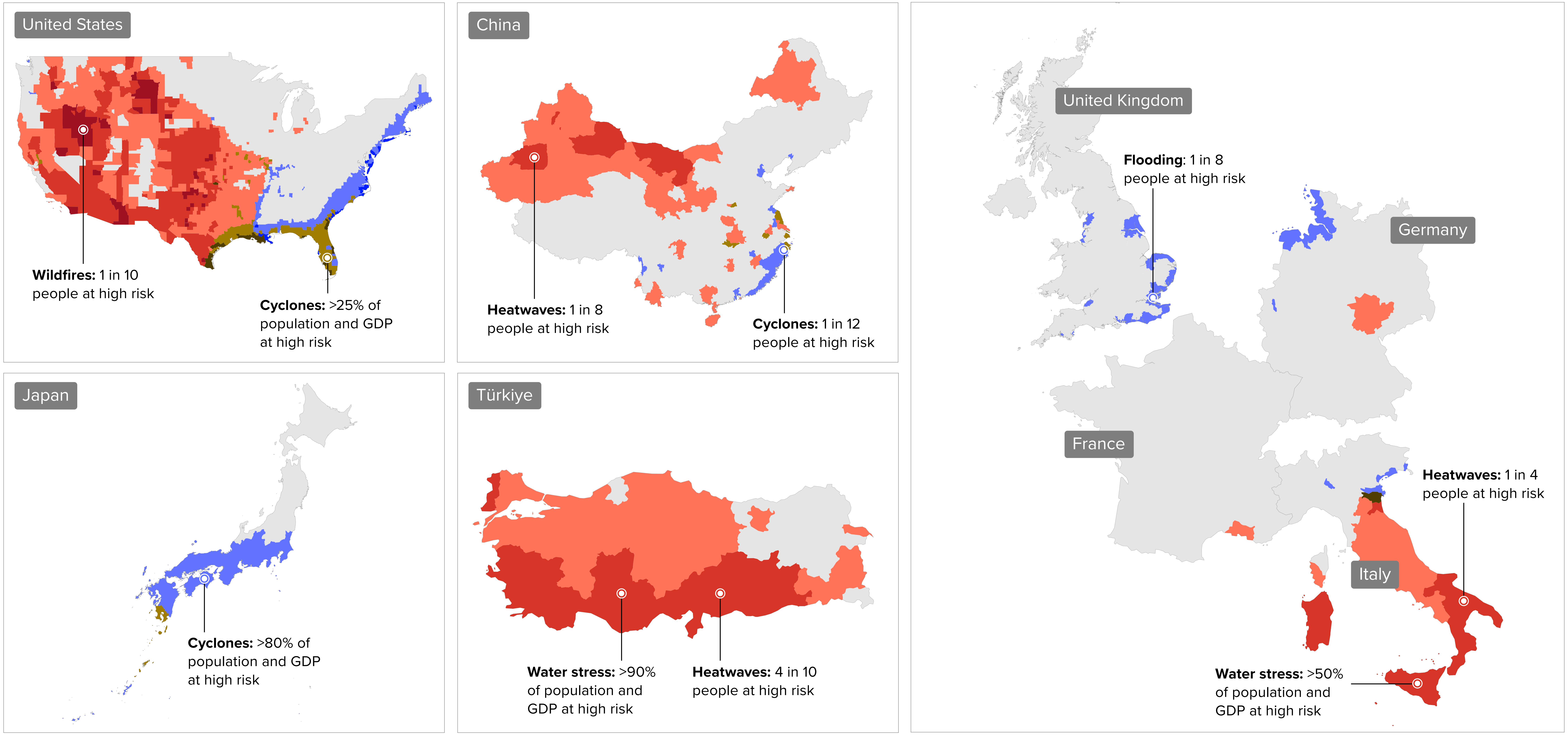


Source: LSEG

Chapter 2

Physical Risk

Figure 1. Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5) across eight G20 countries.



Heat-related hazards (heatwaves, wildfires, water stress)
1 hazard 2 hazards 3 hazards

Water and wind-related hazards (flooding and cyclones)
1 hazard 2 hazards

Overlapping heat, water, and wind-related hazards
2 hazards 3 hazards 4 hazards

Source: LSEG analysis on Sust Global risk projection datasets

Physical Risk

Weather-related losses rose in the first half of 2025.

In 2024, global average temperatures reached their highest level on record, driven by a combination of long-term warming trends and a powerful El Niño. And while heat records dominated headlines last year, insured losses from natural disasters in the first half of 2025 have already exceeded the highest annual total since records began in 1980 – with weather-related disasters accounting for 98% of the cost.[1,2]

Recent events – such as the LA wildfires in January 2025 that caused an estimated US$250 billion in economic losses and heavy monsoon rain in Pakistan in June that cost at least 300 lives – reflect the devastating potential of extreme weather for economies and human livelihoods and the need to build resilience through early warning systems, and physical and behavioral adaptations.[3,4,5]

No single extreme weather event can be attributed to climate change, however, global climate models consistently demonstrate that these extremes are no longer outliers but reflect an ongoing, broader transformation. As rising atmospheric concentrations of greenhouse gases drive higher average temperatures and greater weather extremes, physical climate risk intensifies and presents an increasingly systemic challenge, rather than a series of isolated shocks.

This year's Net Zero Atlas examines physical climate risk at the sub-national level across 4,416 regions in eight G20 economies.

Institutional investors increasingly recognise the challenge that physical climate risk is beginning to pose to markets and economies. What remains less clear is where and at what scale these risks will materialise; pinpointing exposure requires overlaying granular, hazard-specific mapping and projections with detailed local socio-economic data.

We expand our analysis of the shifting topography of climate risks facing major cities in the G20 in last year's Net Zero Atlas to a full, national scale analysis of physical climate risk across eight G20 economies where granular GDP and population data are most readily available. This includes 4,416 regions across the United States, China, Japan, Germany, the UK, France, Italy, and Türkiye, which are home to 2.2 billion people and generate US$63.9 trillion in GDP, or roughly 60% of the global economy.[6]

Understanding mid-century physical risk exposure

We assess exposure across five hazards – cyclones (known as hurricanes in the Atlantic and Caribbean and typhoons in the Pacific northwest), flooding, heatwaves, water stress, and wildfires based on data from Sust Global.

Our baseline projections to 2050 assume the SSP5-8.5 scenario.[7] In this scenario, rapid economic growth and limited mitigation efforts mean that the goals of the Paris Agreement are not achieved and emissions continue to increase beyond 2050. Global average temperatures warm by 2.4°C by 2050 compared to the pre-industrial average and continuing to increase further.[8] We note that future emission pathways and climate projections are subject to significant uncertainty margins, and the choice of scenario is not the main driver of climate uncertainty before 2050.

However, we believe that the conditions described in the report are broadly representative of the medium term physical risk landscape investors will face if emission reduction efforts are not substantially accelerated to achieve net zero emissions by the middle of the century. For example, in a "middle of the road" mitigation scenario (SSP2-4.5) – where global emissions stagnate at current levels and begin to gradually decline post 2050 – similar physical risk conditions would occur around 2070.[9]

Physical Risk

Across these eight economies, physical climate hazards could place an additional half a billion people and US$20 trillion in GDP at high risk by mid-century.

Across the eight G20 countries we assess, currently 549 regions with a combined population of 155 million (7% of the population of the eight countries analysed) and US$7.8 trillion in GDP face high risk exposure to at least one of the climate hazards we assess.

Our results show that risk exposure rises sharply by 2050 putting 839 million people and US$28.3 trillion at risk. This means that the share of high-risk regions in the eight G20 countries is projected to increase more than threefold – while the exposed population and economic activity quadruple.

Figure 2 shows the extent to which the eight countries are at high risk from different climate hazards – heatwaves, cyclones, flooding, water stress, and wildfires – measured by area, people, and GDP (see Physical Risk Annex Table 2 for definitions of severity thresholds). Each panel shows increases in exposed land, population, or economic activity from a historic baseline period (1980-2010) compared to projections for 2050.

Exposure to extreme heat and water stress is set to expand particularly rapidly, with 327 million people across the US, China, Türkiye, southern France and Italy facing temperatures above 35°C for more than a month per year (up from just 9.9 million today). In areas with dense vegetation, particularly the northwestern United States, growing wildfire risk will further compound these challenges.

For wind and water-related hazards, large urban areas such as New York, Tokyo and Shanghai will fall into high cyclone risk by 2050, with the at-risk population multiplying nearly fivefold compared to baseline conditions. Flooding, already ranked among the costliest hazards, is projected to increase in both frequency and severity – with the amount of GDP exposed almost tripling to US$4.5 trillion.

Physical climate risk confronts investors with increasingly complex, multi-dimensional risks.

The accelerating incidence of physical climate hazards is creating complex ramifications for financial markets, both in terms of risks and opportunities. For investors, this requires attention across several dimensions:

Measuring portfolio exposure. Physical risks are most obvious in sectors such as real estate and infrastructure, where asset values are tied to location. Municipal bonds are also exposed, as climate-related disasters can drive significant credit downgrades (as in the case of bonds from the LA Department of Water and Power after the wildfires in January 2025).[10]

Tracing knock-on effects across sectors and supply chains. The threat from climate hazards extend across sectors, putting critical trade routes, production facilities, data centers or logistics hubs at risk, often with global ripple effects. For example, in 2023 severe drought lowered water levels in the Panama Canal, reducing the number of ships able to pass through. Conversely major flooding in India's southern tech and auto hub of Chennai forced many manufacturing plants to close.[11,12]

Insurance markets for transferring physical climate risk are coming under strain. In highly exposed regions, greater uncertainty and rapidly shifting risk profiles are creating challenges around the availability and pricing of insurance. The global protection gap from natural disasters – the difference between total economic losses and what's covered by insurance – was 60% in 2024.[13] After repeated losses, insurers have in some cases retreated from high-risk areas, forcing homeowners to rely on government-backed insurers of last resort, or forgo insurance altogether.[14]

Evaluating resilience and adaptation measures. In addition to evaluating hazard exposure, investors also need to consider how resilient assets are to these risks today and adaptation efforts to increase resilience. Indeed, in a recent review of disclosures of 2,100 large and mid-cap listed companies, we found that 34% referred to taking some form of adaptation measures in their FY2024 reporting.[15]

Physical Risk

Figure 2a. Area facing high exposure to physical climate hazards.

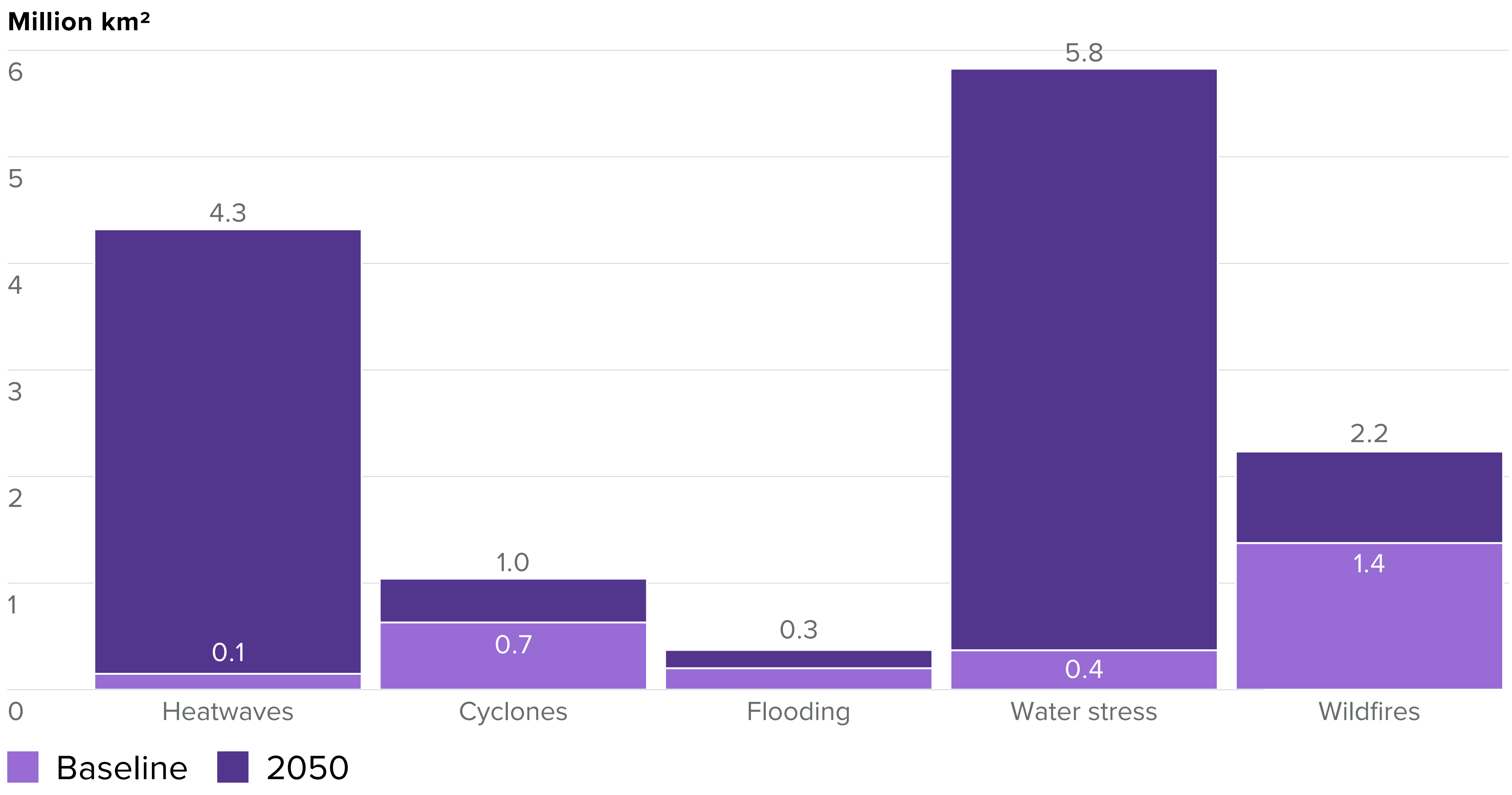


Figure 2b. GDP facing high exposure to physical climate hazards.

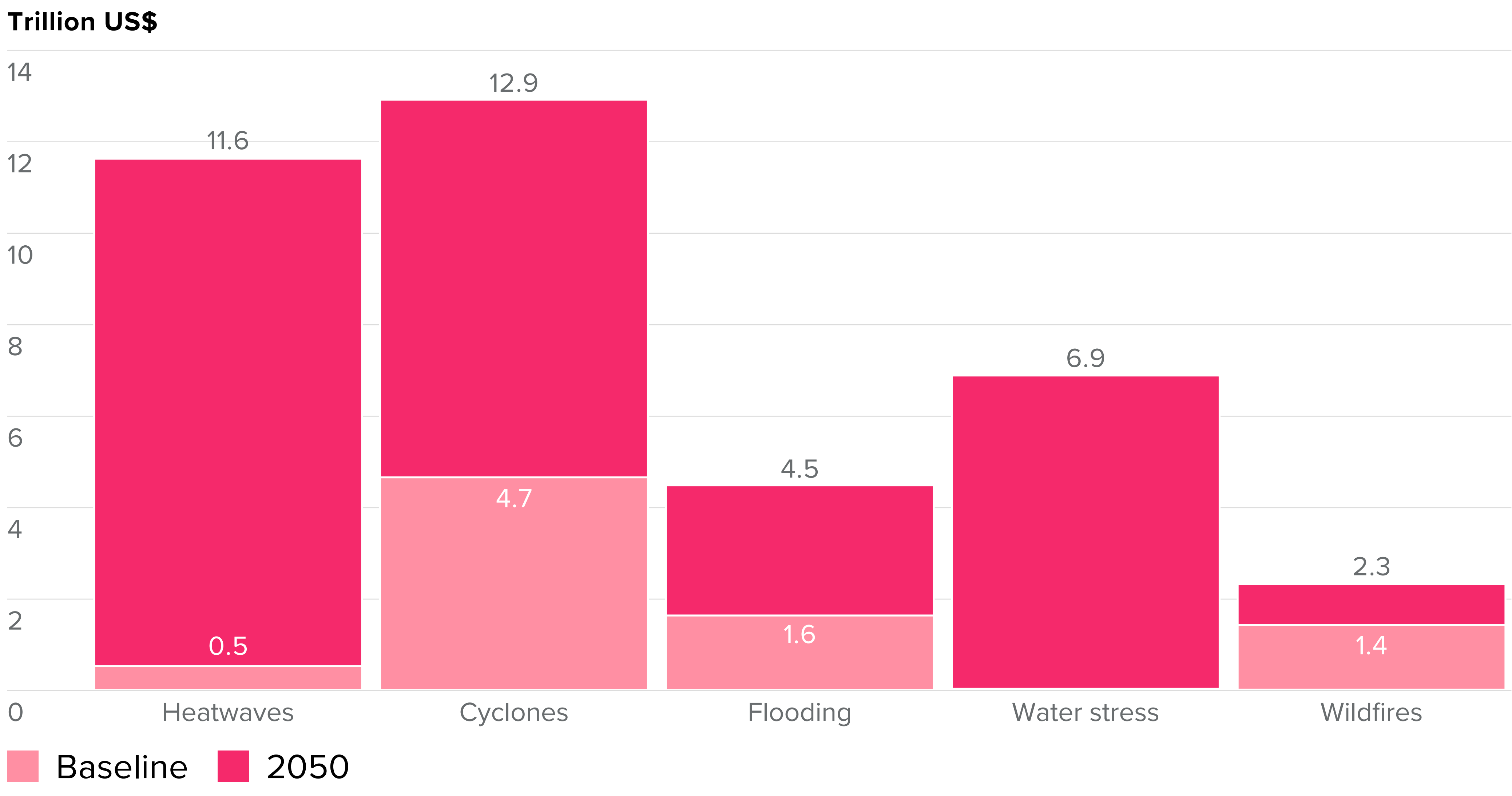
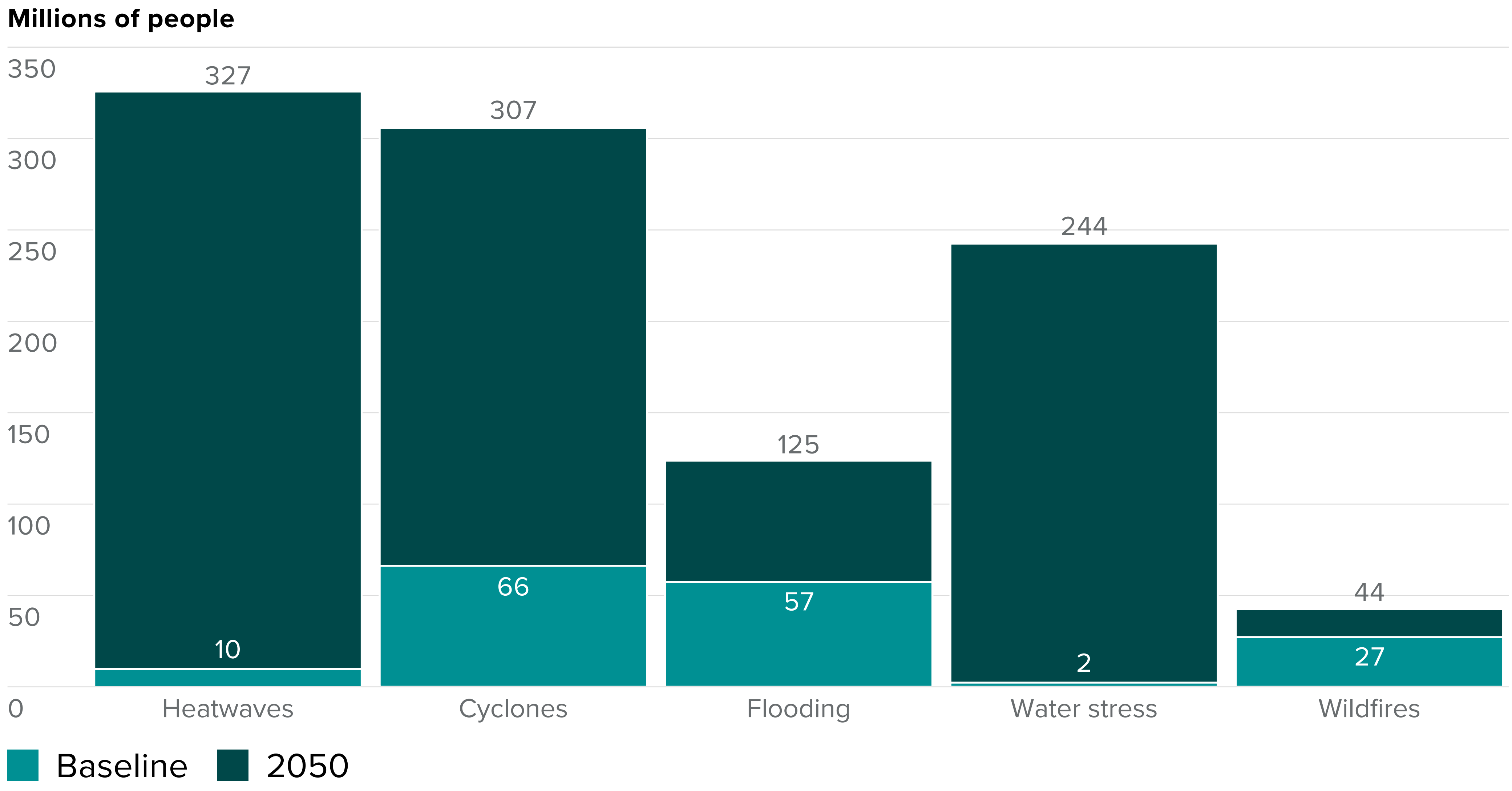


Figure 2c. Population facing high exposure to physical climate hazards.



Source: LSEG analysis on Sust Global risk projection datasets

Cyclones – one of the most destructive and costliest hazards – will spread well beyond current highly exposed regions.

Tropical cyclones, also known as hurricanes in the Atlantic and Caribbean and typhoons in the Pacific northwest, are among the most destructive and costliest climate hazards globally. Over the past 50 years, tropical cyclones have claimed approximately 780,000 lives and inflicted US$1.4 trillion in economic losses – the equivalent to 43 deaths and US$78 million in damages daily.[16] Beyond immediate destruction, cyclones can also trigger significant disruptions to global supply chains, compromising major economic centres or logistic hubs.[17]

However, due to the specific conditions required for major cyclones to arise (primarily related to water temperatures and wind patterns), areas exposed to high cyclone risk are relatively concentrated geographically. Across the eight G20 countries in our analysis, fewer than 8% of the 4,416 regions experience a cyclone once a decade or more, with material risks concentrated along the eastern seaboards of the US, Japan and China (see Figure 3).

The most exposed regions in our sample, Okinawa in Japan and Miami-Dade county in the US, experienced a cyclone once every 2.7 and 4.7 years, respectively, in the period from 1980-2010.

Recent events underscore the risks: Hurricane Ian (2022) for example, caused over US$112 billion in damage – the costliest in Florida's history – with 149 confirmed fatalities in the state alone.[18] In Japan, Typhoon Hagibis (2019) resulted in US$17 billion in nationwide losses, while in 2023, Typhoon Khanun left roughly one-third of Okinawa households without power.[19]

Florida-level cyclone risk is projected to spread to significant population centres.

With climate change, rising ocean temperatures are expected to make cyclones more frequent and more intense.[20] In our sample, the number of regions with high exposure (defined as facing a cyclone on average at least once every 10 years) is projected to increase by over a third from 345 to 472 by 2050. In some cases, cyclone risk is further compounded by sea level rise (like in the case of Tokyo) or even a combination of sea level rise and high flooding risk (like in the case of New York).

Emerging high-risk regions include China's southeast coast, the southern half of the Japanese archipelago, and the northeastern US coast. Because these regions include major population and economic centres, the share of people and GDP exposed to high cyclone risk is projected to rise 1.8-fold and 3.7-fold; from 66 million people and US$4.7 trillion today to 307 million people and US$12.9 trillion by 2050.

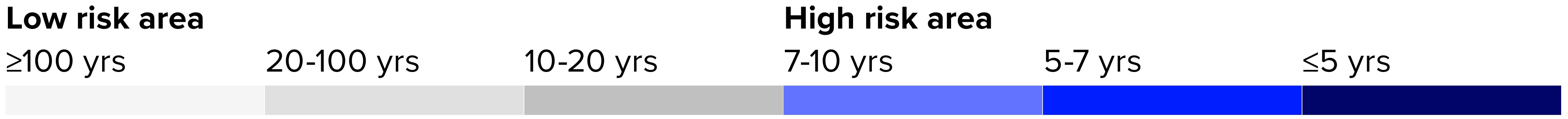
In **China** (where cyclone risk is moderate today) over 1,500 km of coastline south of Shanghai – home to 118 million people and almost 12% of China's GDP – will face a cyclone every decade or less. Regions like Ningbo and Wenzhou (each with populations near 10 million) are estimated to face cyclones every 5-7 years – matching Florida's historical rate.

In **Japan**, warming ocean temperatures in the Northwest Pacific are contributing to more favorable conditions for intense tropical cyclones.[21] By 2050, over 80% of both population and GDP will be exposed to a cyclone on average once a decade by 2050 – up from less than 5% today. Twenty-one of Japan's 47 prefectures, including Tokyo, Osaka, Kanagawa, and Aichi, will together place almost 100 million more people and US$3.5 trillion (84% of national GDP) at risk.

In the **United States**, even though hurricane frequency is projected to decline slightly in some of the worst affected counties in Florida (see Figure 3), on balance, an additional 25 million people and US$2.7 trillion in GDP will be exposed to a Category 1 cyclone or higher at least once a decade. The largest increase is in the North Atlantic, where the number of exposed counties north of Delaware more than doubles from 24 to 62 by 2050, including the New York and Philadelphia metropolitan areas.[22]

Figure 3. Average cyclone return period – how often a cyclone is expected to occur at a given location – for the 1980–2010 baseline period (top) and projected frequency in 2050 (bottom).

Source: LSEG analysis on Sust Global risk projection datasets



Physical Risk

Flooding – already ranked among the top climate hazards driving economic losses – is projected to increase in both frequency and severity globally.

In 2024, flooding drove more than US$109 billion in annual global losses, second only to tropical cyclones.[23] Yet the insurance protection gap (calculated as uninsured versus total losses), is approximately 75%, leaving flooding as one of the most underinsured hazards globally.[13]

Flood risks in our sample are concentrated along China's coastal deltas and inland river systems, the US East Coast and Mississippi Delta, and low-lying coastal regions of the United Kingdom, Germany and Italy – including urban centres such as Dongguan, Sacramento, New Orleans, Düsseldorf, and Venice. Currently, 2.8% of the over 4,400 regions we examine face high flood risk – defined as a significant flood event at least once every 30 years on average (a common threshold for flood risk used by government agencies and financial institutions like insurers, and mortgage providers).[24,25]

Losses from flooding are likely to increase, as hotter average temperatures drive more intense rainfall events due to increasing evaporation and the greater moisture carrying capacity of warmer air. While flood risks remain broadly concentrated in the same areas, the higher incidence of flood risks means that by 2050, 124.8 million people and US$4.48 trillion in GDP will be exposed to high flood risk, more than double today's values (Figure 4).[26]

Across the eight G20 countries we assess, growing flood risks are concentrated in China, the US and the UK.

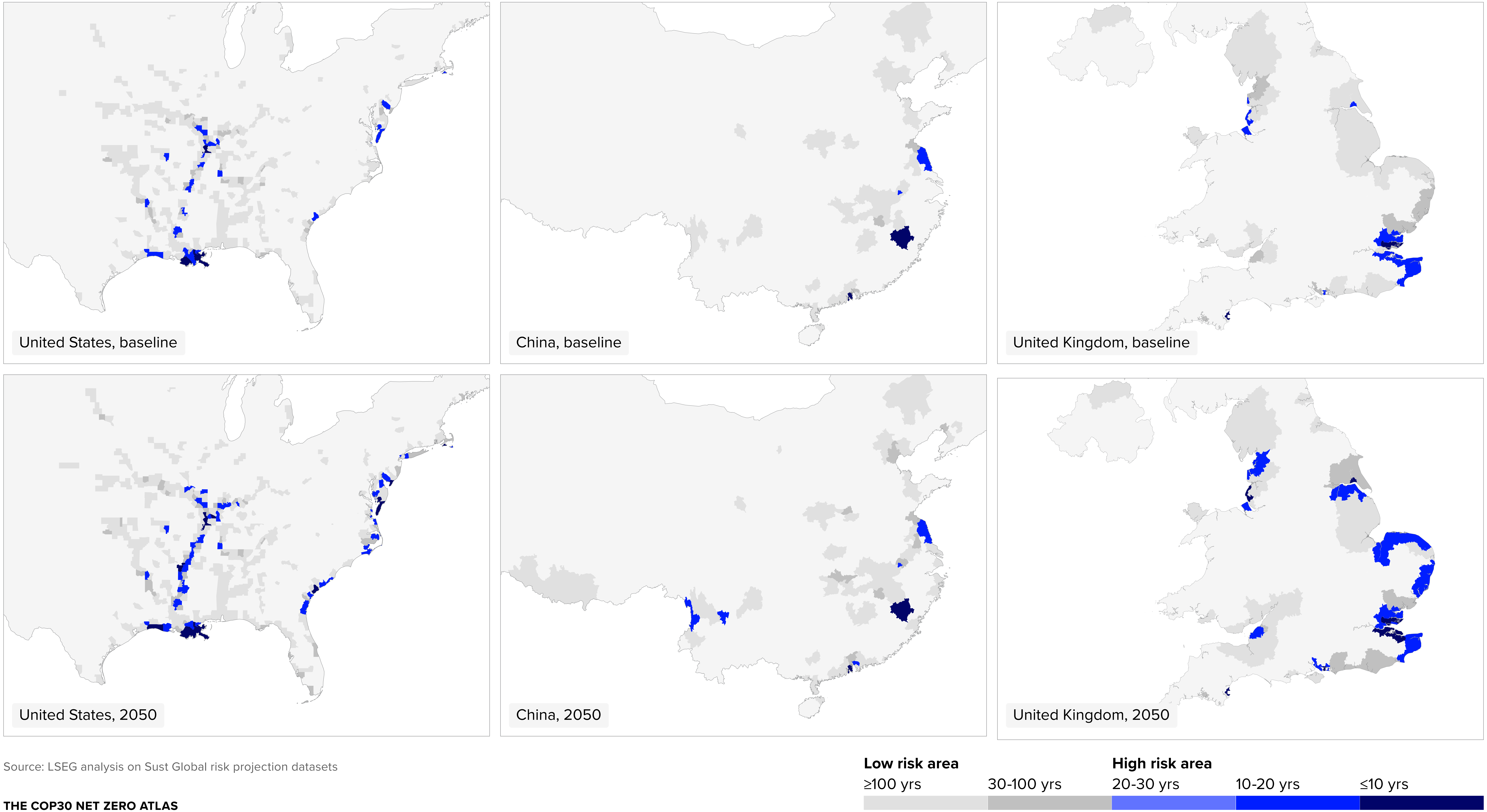
Taken together, China, the US and the UK account for over 90% of the additionally exposed population in our sample, and where in each the share of GDP exposed flooding risk is approaching 10% by 2050.

The **UK** is the most exposed country in our study by share of population and GDP at high flood risk. The Thames Estuary, near London, is already vulnerable, with 3 million people and US$100 billion in GDP at risk. By 2050, major flood frequency is expected to rise by over 20%, intensifying pressure on infrastructure like the Thames Barrier which protects the capital. By mid-century, over 8.3 million people and 9.7% of GDP will be exposed to high flood risk – up from 5.6 million and 6.2% of GDP today, with risks increasing materially for population centres near river estuaries like the Mersey and Humber, on the South Coast and low-lying Eastern areas.

In **China**, almost 53 million people and US$1 trillion in GDP will be newly exposed to high flooding risk by 2050. This includes industrial megacities like Guangzhou and Tianjin, along with inland hubs such as Jingzhou and Yangzhou on the Yangtze River.

In the **United States**, nearly 20 million people and US$2.4 trillion in GDP are projected to face high flood risk by 2050 – an increase of 158% and almost 300%, respectively, compared with baseline levels. Much of this is driven by growing risks in the New York metropolitan area, but also includes hubs such as Memphis along the Mississippi River.

Figure 4. Average flood return period for the 1980–2010 baseline period (top) and projected frequency in 2050 (bottom).



Source: LSEG analysis on Sust Global risk projection datasets

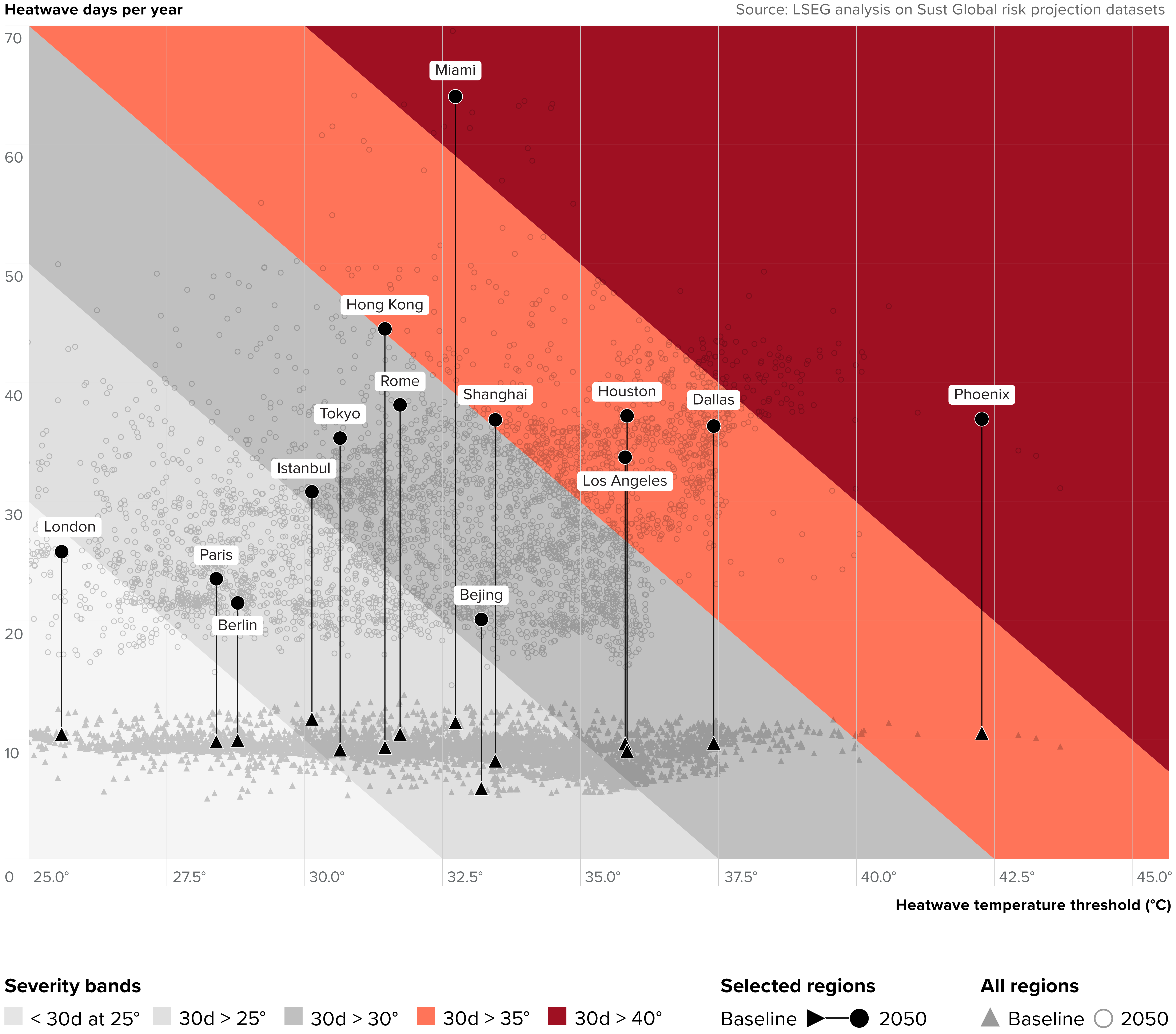
Extreme heat – among the fastest-rising and deadliest climate risks – is set to escalate sharply by mid-century.

Heatwaves are already among the most lethal natural hazards. In Europe, heat was linked to an estimated 47,000 deaths in 2023 and more than 60,000 in 2022, while record-breaking heat in China this summer affected about 200 million people and drove power demand to an all-time high.[27,28] According to Moody's estimates, labour-productivity losses already amount to about 1% of global GDP and could rise to rise to 3% by 2050.[29,30]

Across the eight G20 members we assess, 12 regions, home to just under 10 million people in the southwestern United States and southeastern Türkiye, experience intense heat conditions in our baseline period of 1980-2010 – defined here as an average of at least 30 days per year above 35°C (as shown in Figure 5).

By 2050 – as average temperatures increase globally and become more variable – areas affected by intense heat expand dramatically to over 1-in-5 of the 4,416 regions we cover. These regions are home to over 327 million people, including over 10% of China's population, over a quarter of the US population and almost 40% of Türkiye's population (see Figure 6), including megacities such as Shanghai, Hong Kong, Los Angeles, and Houston.

Figure 5. Threshold heatwave temperatures and the number of days exceeding them during the baseline period and under 2050 projections.



When it comes to extreme heat, defined as 30 days or more over 40°C (or 50 days or more over 35°C), 145 regions are projected to meet this threshold compared to none in our baseline period. This includes significant parts of Texas and Arizona; Zhanjiang and Hainan (China); southeastern Türkiye; and the Italian islands of Sardinia and Sicily.

In many cases heat exposure intensifies rapidly, with heatwave days (defined as number of days above each region's 1980-2010 98^{th} percentile annual temperatures) on average tripling across our sample. This creates challenges as populations in places unaccustomed to heat often lack the preparation – both behavioural and infrastructural – needed to cope with rising temperatures.[31]

Figure 6. Heatwave severity by region across the study sample. Colours correspond to the heatwave severity thresholds defined in Figure 5. Baseline (top) vs. 2050 (bottom).

Source: LSEG analysis on Sust Global risk projection datasets

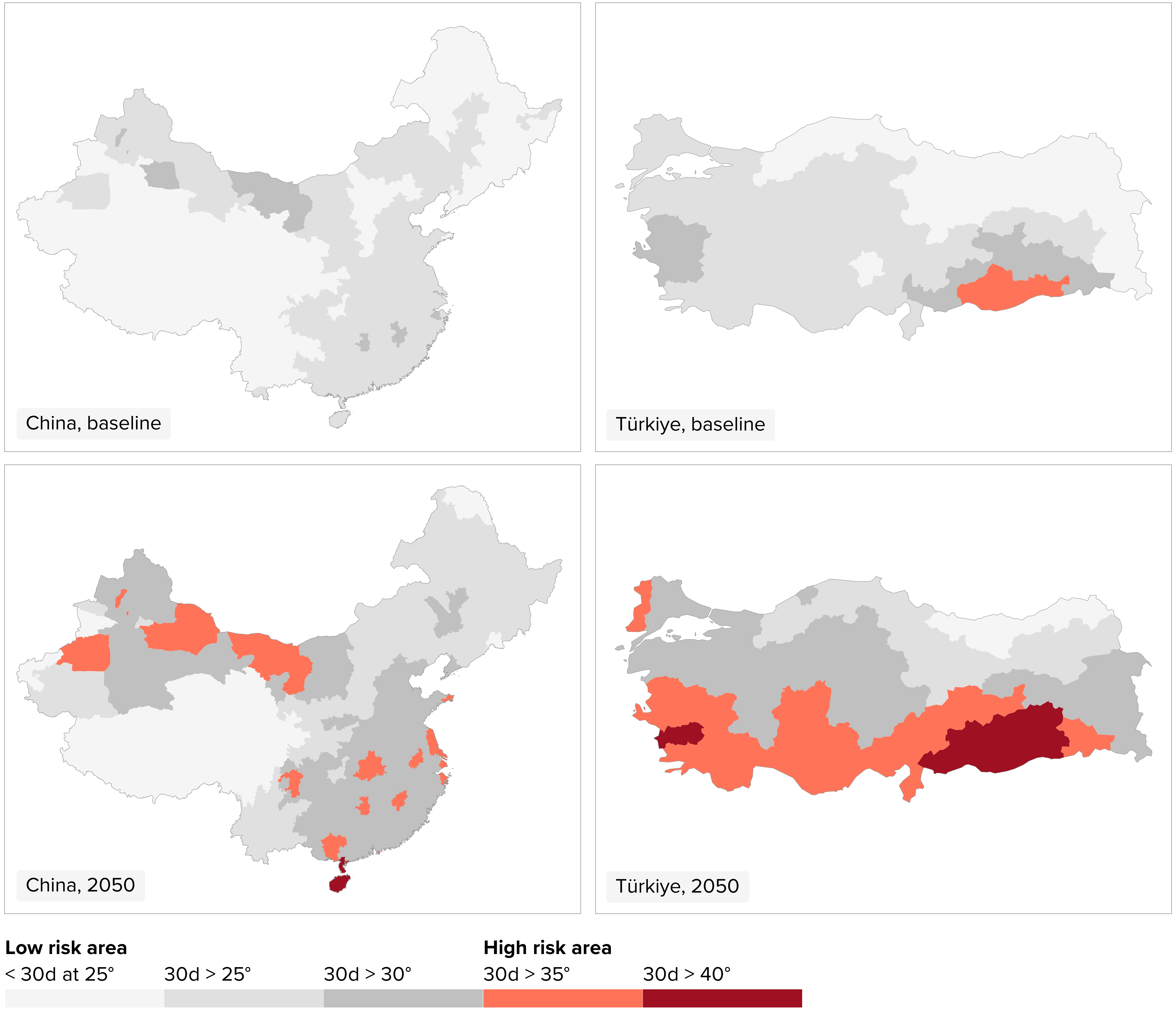


Figure 6. Heatwave severity by country across the study sample. Colours correspond to the heatwave severity thresholds defined in Figure 5. Baseline (top) vs. 2050 (bottom).

Source: LSEG analysis on Sust Global risk projection datasets

Heat, fire and water stress – converging hazards will strain regions.

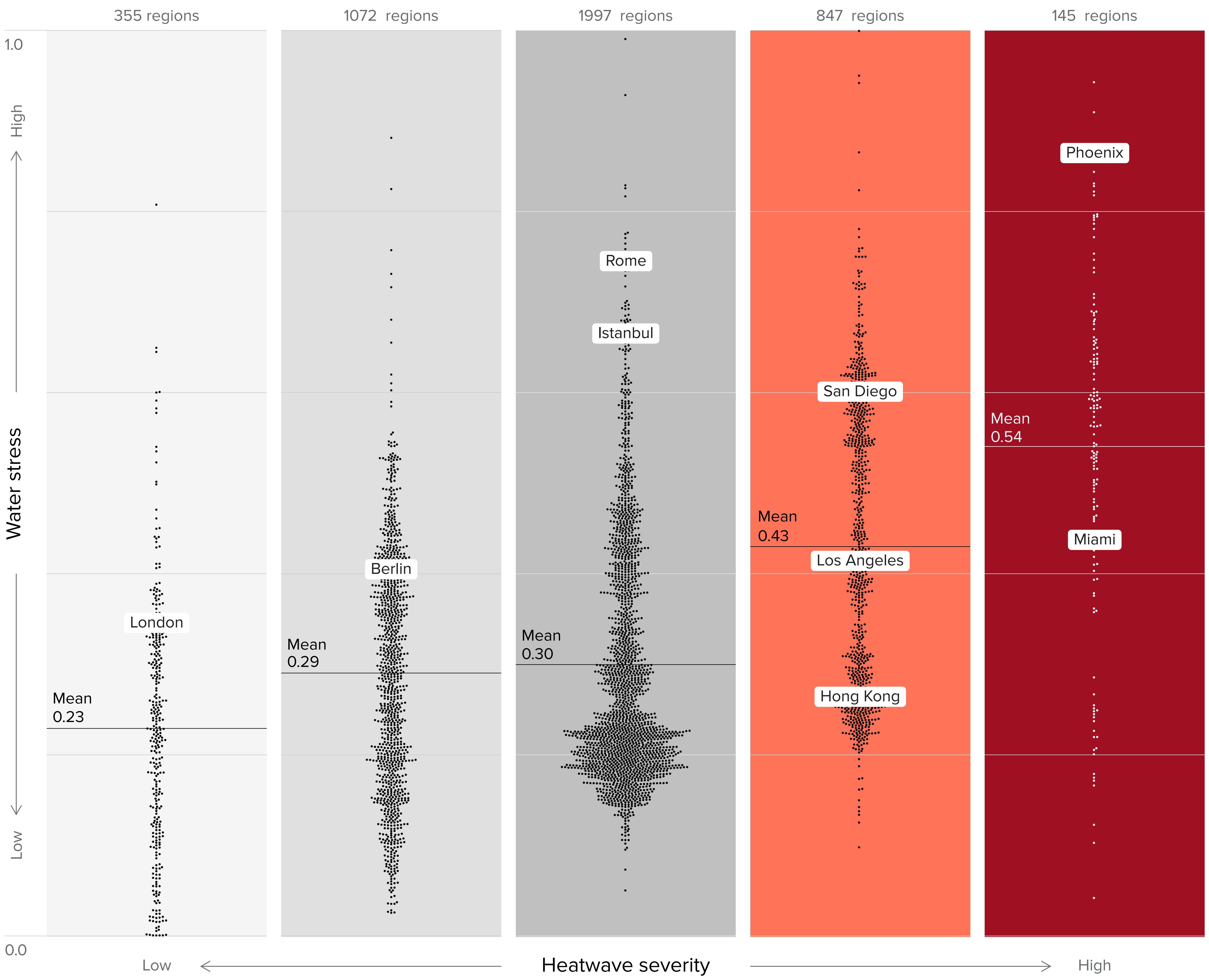
Beyond the direct physical and economic impacts of extreme heat, higher and more variable temperatures are expected to trigger cascading effects, notably exacerbating both water stress and wildfire risk.

In our sample, the number of people living in regions facing high water stress is projected to rise dramatically.[32] By 2050, extreme water stress is forecast to extend to 670 regions across northwest China, the southwestern United States, central and southern Italy, and most of central and western Türkiye. These regions today are home to nearly 244 million people and produce US$6.9 trillion in GDP.

The link between heatwaves and water stress is especially pronounced.

Of the 670 regions projected to experience high water stress by 2050, 424 are also expected to face high or severe heatwaves. This overlap highlights the compounding risks facing communities and economies already under strain (Figure 7).

Figure 7. Water stress plotted against heatwave severity.



Source: LSEG analysis on Sust Global risk projection datasets

Severity bands

< 30d at 25° | 30d > 25° | 30d > 30° | 30d > 35° | 30d > 40° | • Region

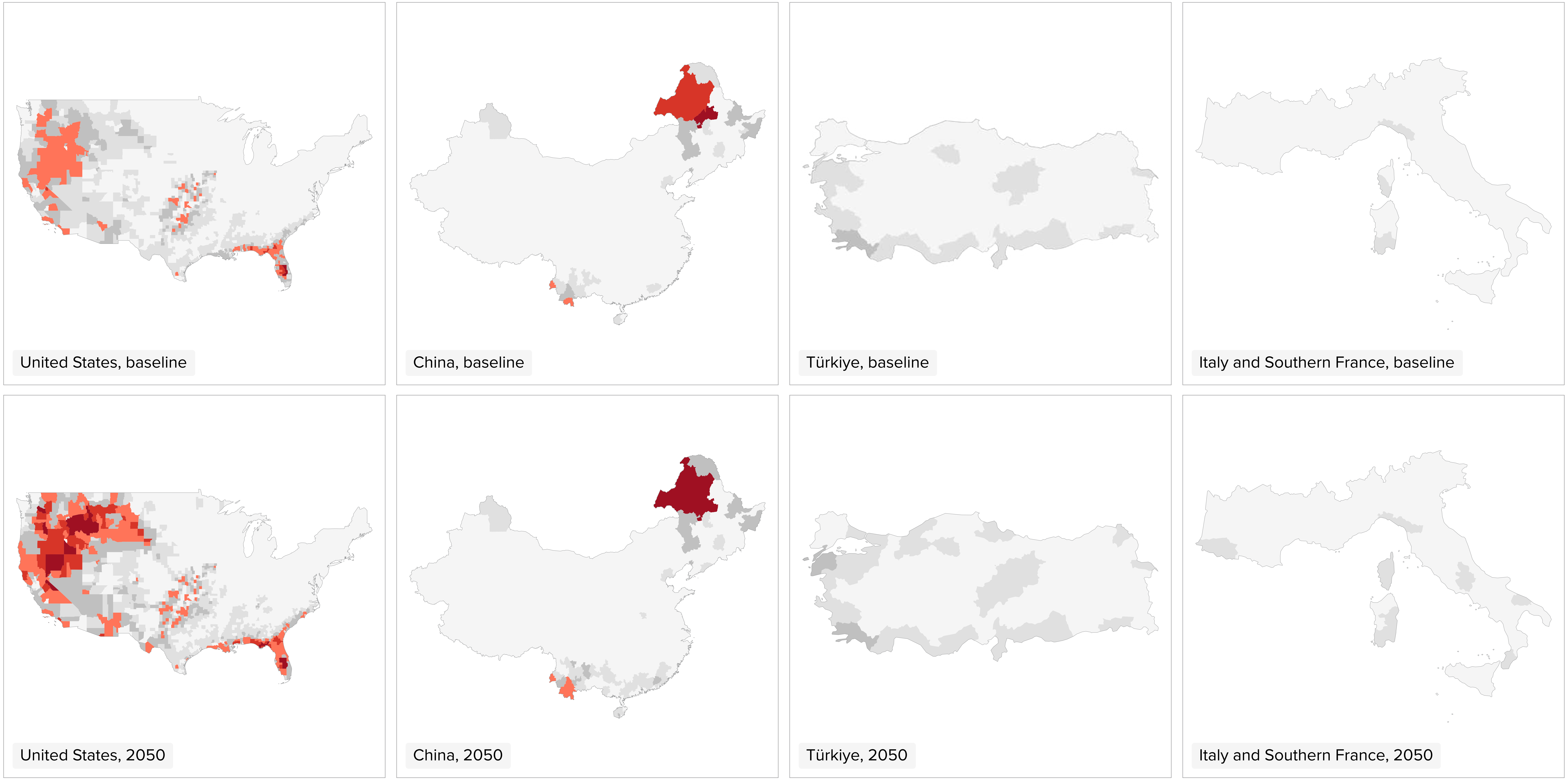
Wildfires – rising exposure in the United States.

Where heatwaves and drought intersect with dense vegetation cover, wildfires also pose increasing risks. In January 2025, wildfires on the outskirts of Los Angeles ranked among the most expensive natural disasters in US history, with total economic losses estimated at US$250-275 billion.[4] In 2025, Spain and Portugal suffered devastating wildfires that helped drive the EU's worst fire season on record, with roughly 1% of the entire Iberian Peninsula burned,[33] consistent with projections that rising global temperatures will drive more frequent and severe fires across southern and central Europe.[34]

Across our eight country sample, regions currently highly exposed to wildfires – defined as an average of 1% or more of a region being burned annually – are home to 27 million people and include significant parts of the western United States, Florida, China's boreal forest – grassland zones in the north, and the forested areas of Yunnan Province in the south (Figure 8). In California alone, some 9.5 million people and US$873 billion in GDP are exposed.

Our projections show that an additional 16.4 million people will be exposed to high wildfire risk. With the exception of China's Pu'er region, these areas are concentrated in the United States. Here large parts of Montana and Wyoming are projected to newly enter the high-risk group. Meanwhile, risk in existing highly exposed regions will continue to intensify, including in major population and economic hubs such as LA County, Orange County, San Diego County, and Santa Clara County (home to Silicon Valley). Counties in Florida, Montana, Nevada, and Idaho are also expected to reach severe exposure levels with over 3% of their surface area projected on average to be burned per year.

Figure 8. Average wildfire exposure for the 1980–2010 baseline period (top) and projected exposure in 2050 (bottom).



Source: LSEG analysis on Sust Global risk projection datasets

Low risk area
0.0–0.2%
0.2–0.5%
0.5–1.0%

High risk area
1.0–2.0%
2.0–3.0%
≥3.0%

Chapter 3

Country Profiles

Argentina

Argentina has not yet set an NDC3.0.

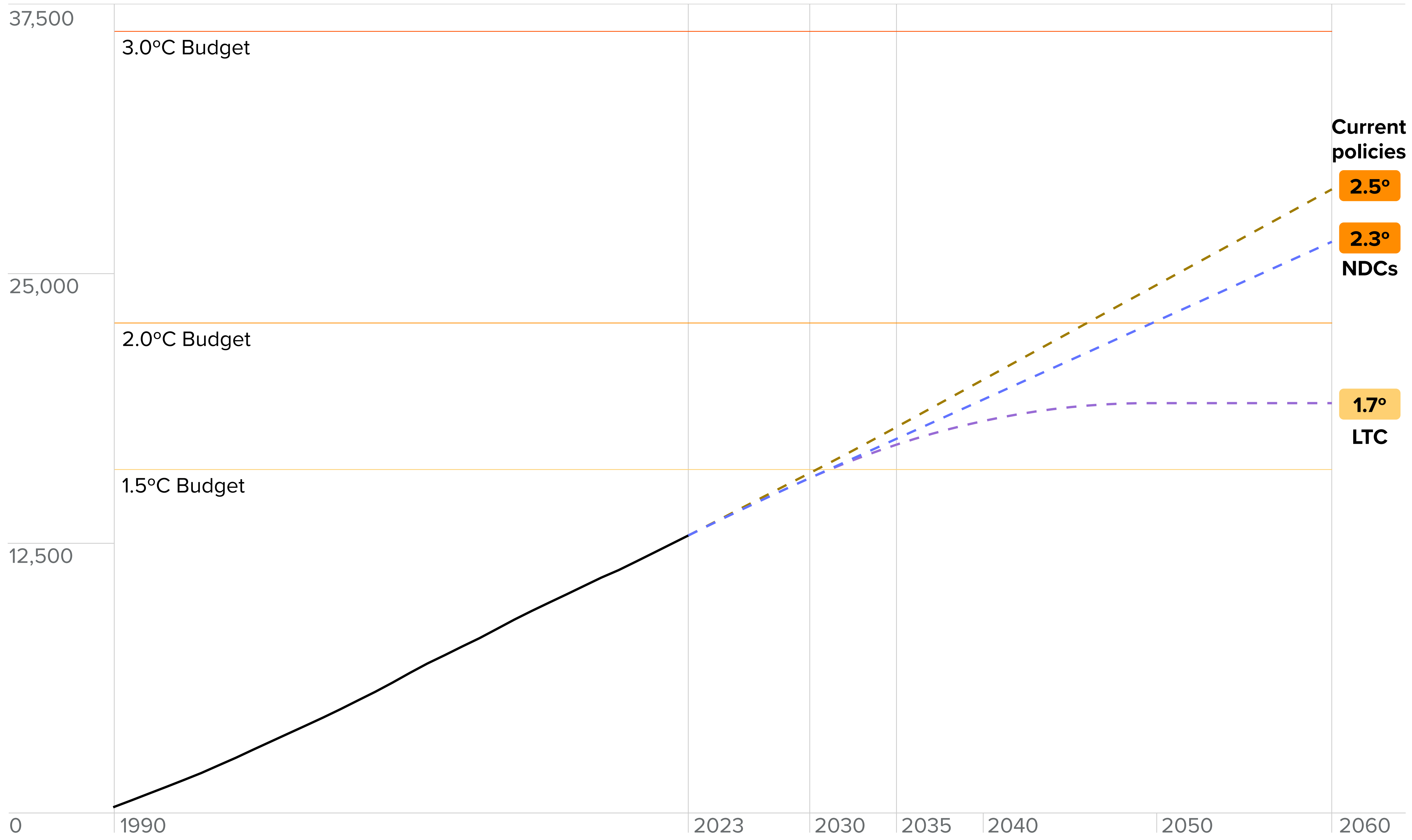
We estimate its 2030 target of 349 $MtCO_2e$ aligns with a 2.3°C pathway.

Current policy alignment

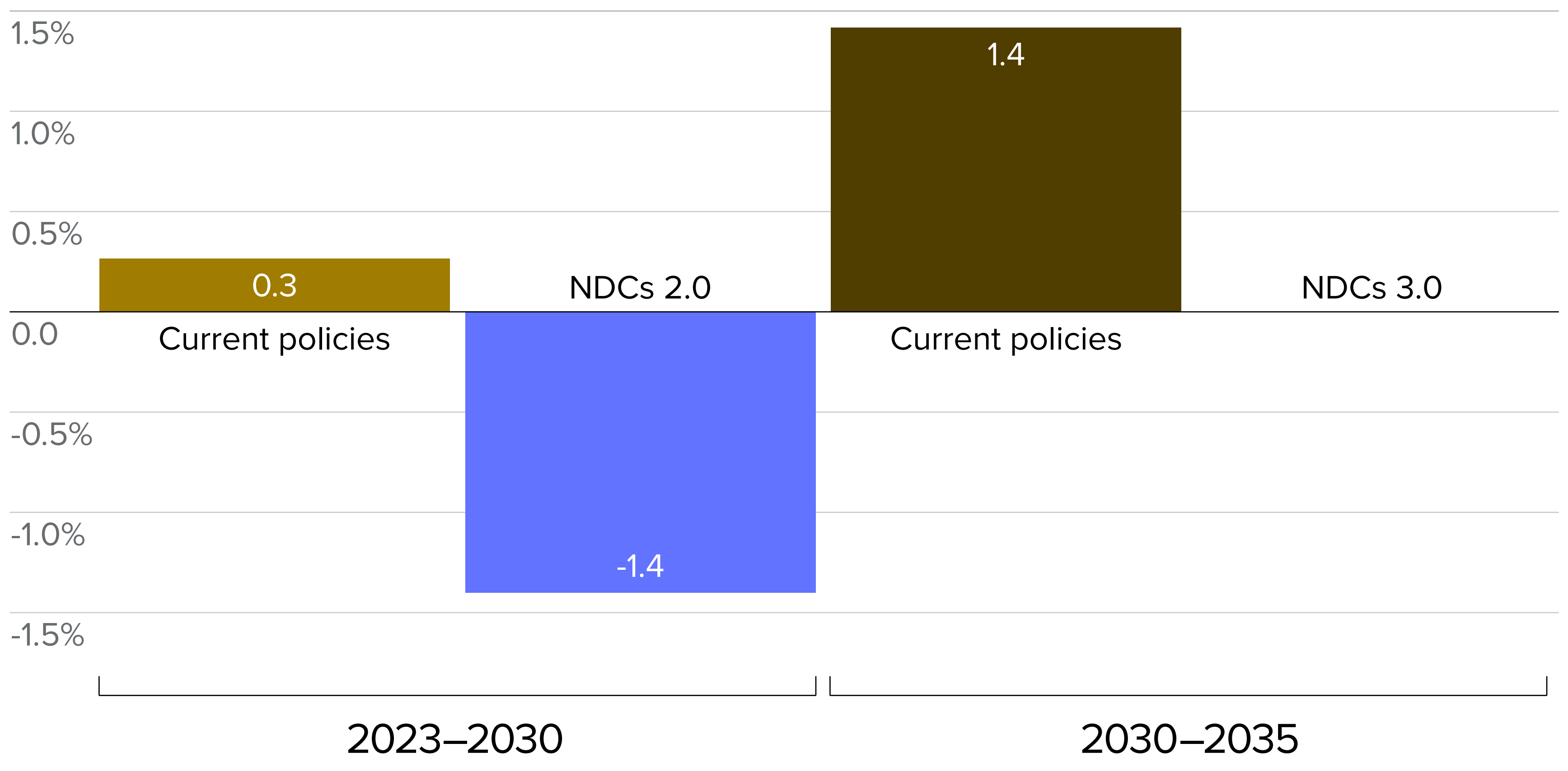
On track to meet 2030 target ⊗

We project that by 2030, Argentina's current policies will result in the country overshooting its NDC by 12% (or 45 $MtCO_2e$). This would result in Argentina surpassing its 1.5°C emissions budget by 2031.

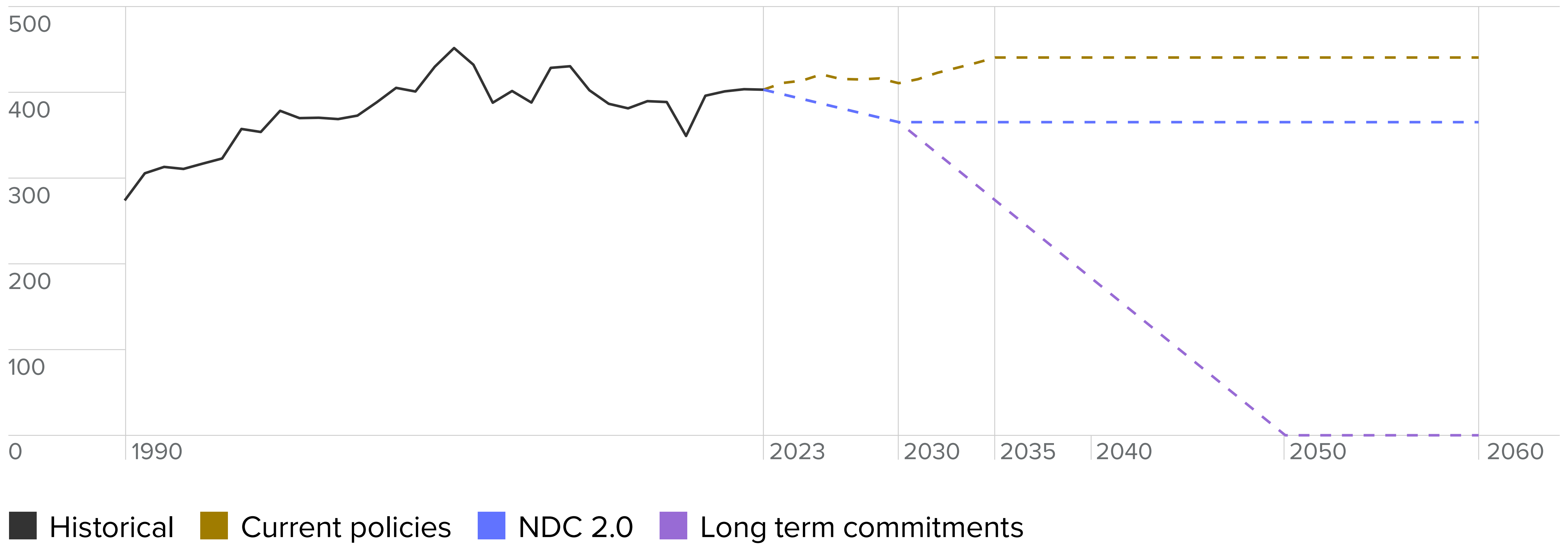
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Argentina

Policies overview

National adaptation plan[3] ✓

Regular published risk assessments[3]	✓
Monitoring and evaluating report[3]	✗
Part of a sovereign catastrophe risk pool	✗

Commited to fossil fuel subsidies phase out ✗

Annual amount spent on explicit fossil fuel subsidies as % of GDP	1.72% of GDP[2]

Carbon pricing system[1] ✓

% of GHG emissions covered by carbon price	38%
Covers at least 50% of national GHG emissions	✗
Carbon price ($/t$CO_2$e)	5.33
Aligned with the global carbon price corridor[2]	✗

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity

(Prospective energy capacity)

	MW/$bn GDP	G20 rank
Wind[5]	0.88	19th
Solar[4]	3.05	13th
Hydroelectric[7]	10.2	4th
Geothermal[6]	0	N/A

Australia

Australia has set an NDC3.0 of 62-70% below 2005 emission levels.

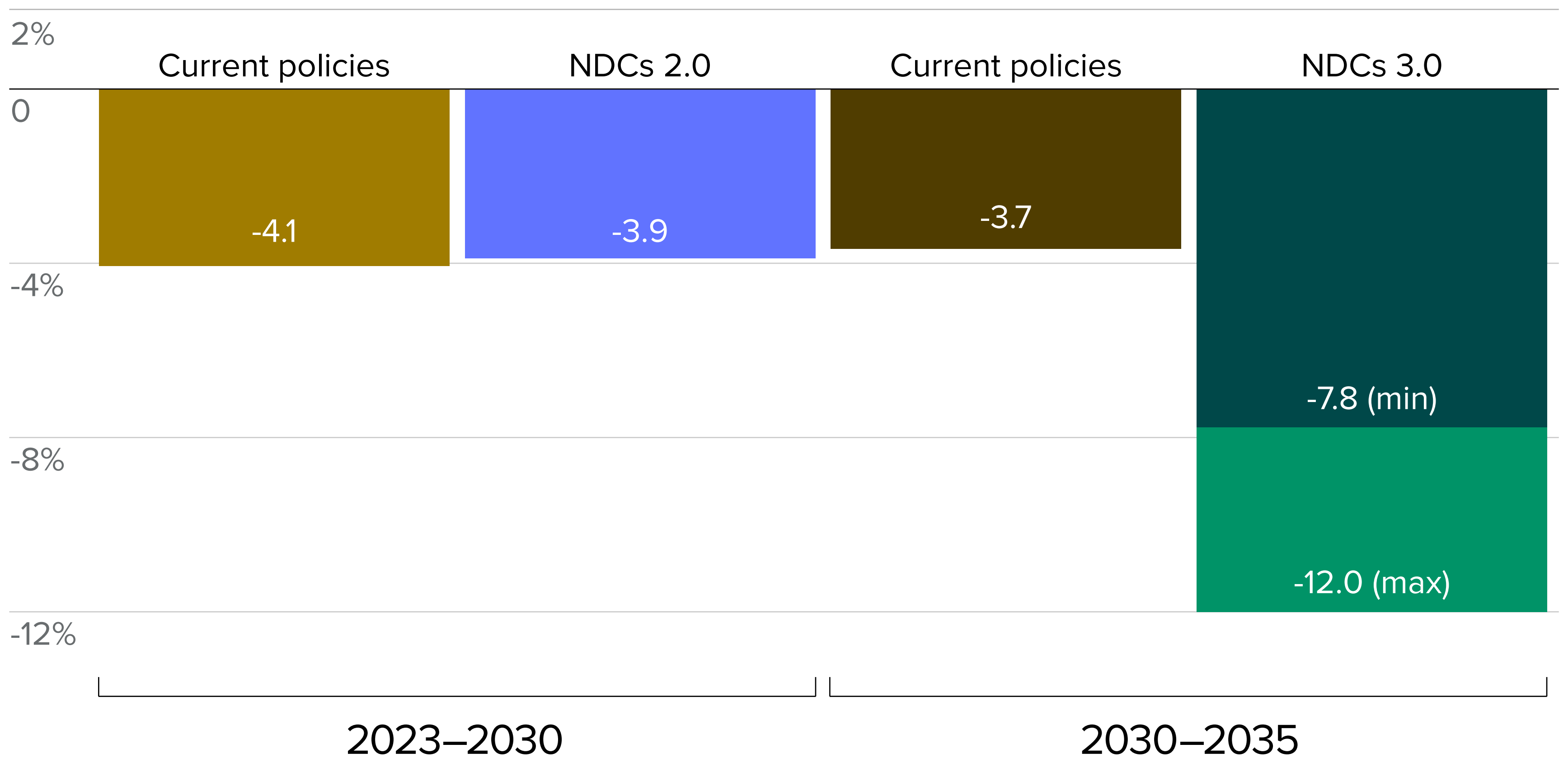
We estimate this to be 183-232 $MtCO_2e$ by 2035, aligning with a 2.3-2.5°C pathway.

Current policy alignment

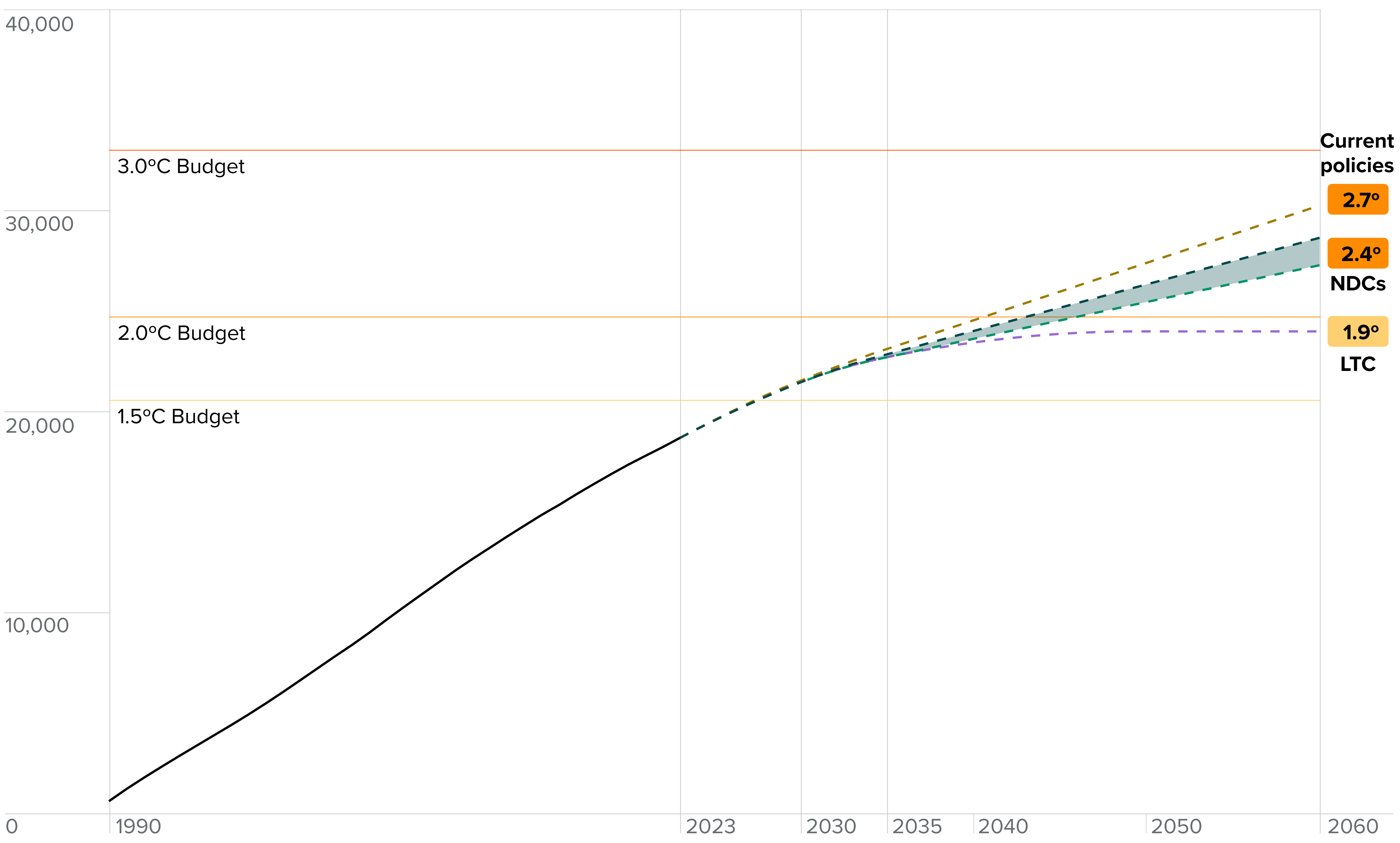
On track to meet 2030 target

We project that by 2030, Australia's current policies will result in the country meeting its NDC and come in 1% below it (or 4 $MtCO_2e$). This would result in Australia surpassing its 1.5°C emissions budget by 2028.

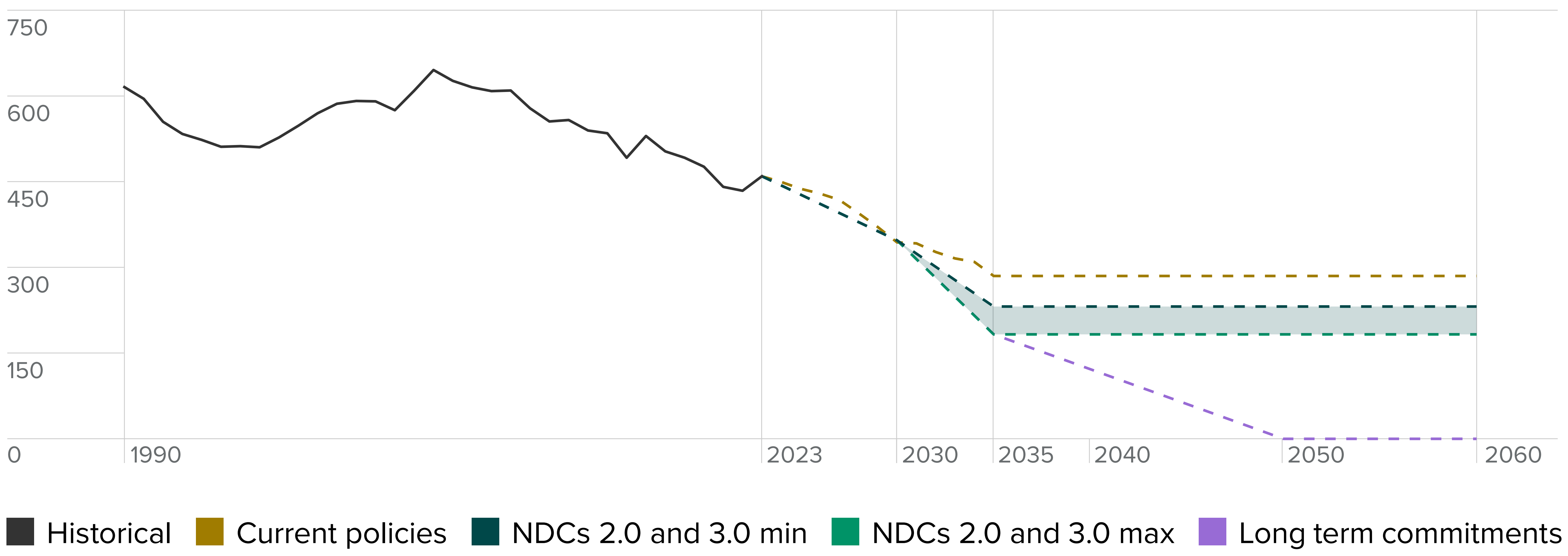
Projected annual decarbonisation rates



Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Historical and projected annual GHG emissions ($MtCO_2e$)



Australia

Policies overview

✓ National adaptation plan[4]

Regular published risk assessments[5]	✓
Monitoring and evaluating report	✗
Part of a sovereign catastrophe risk pool	Exempt

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies as % of GDP	0.17% of GDP[3]

✓ Carbon pricing system[1]

% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	26% ✗
Carbon price ($/t$CO_2$e) Aligned with the global carbon price corridor[2]	21.82 ✗

Climate finance

3-year average climate finance contribution as a % of GDP Proportional share of $100 billion global climate finance commitment[7]	0.02%[6] ✗
Targeted level of international climate finance contribution as a % of GDP Target to increase global climate finance contributions	0.02%[8] ✓

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[10]	146.94	1st
Solar[9]	65.15	1st
Hydroelectric[12]	8.67	6th
Geothermal[11]	0	N/A

Brazil

Brazil has set an NDC3.0 of 59-67% below 2005 emission levels.

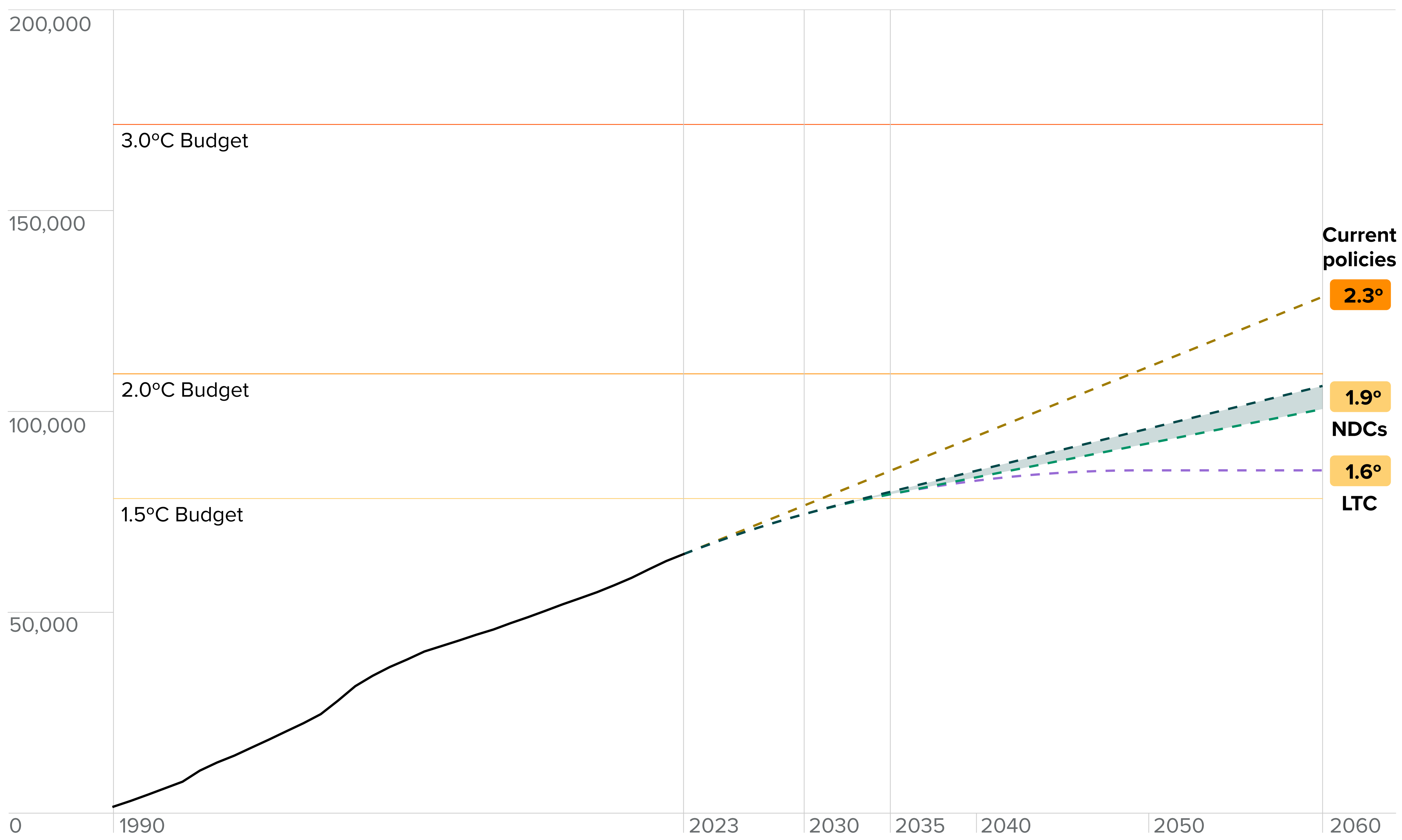
We estimate this to be 0.85-1.05 $GtCO_2e$ by 2035, aligning with a 1.9°C pathway.

Current policy alignment

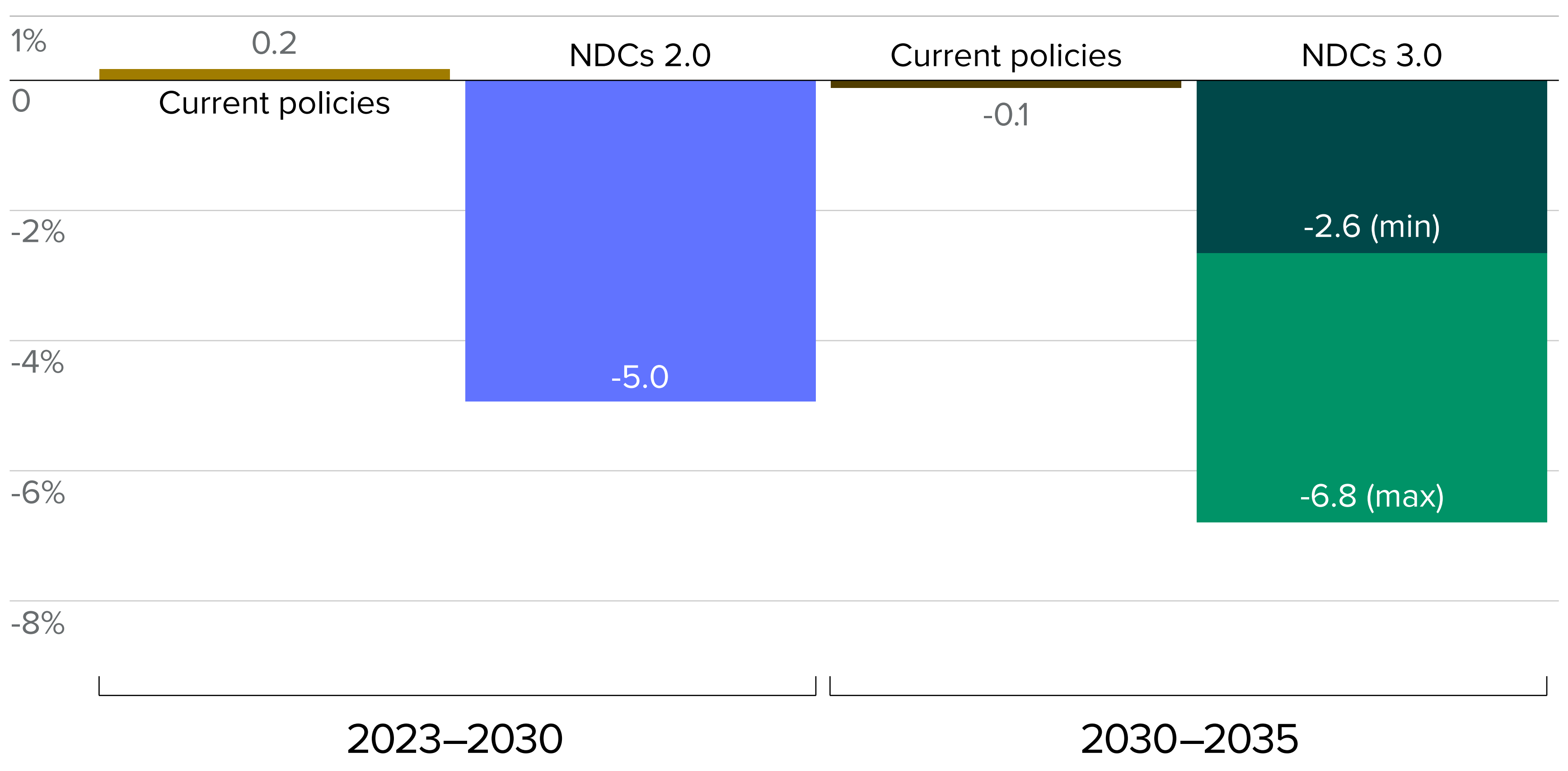
On track to meet 2030 target ⊗

We project that by 2030, Brazil's current policies will result in the country overshooting its NDC by 45% (or 536 $MtCO_2e$). This would result in Brazil surpassing its 1.5°C emissions budget by 2032.

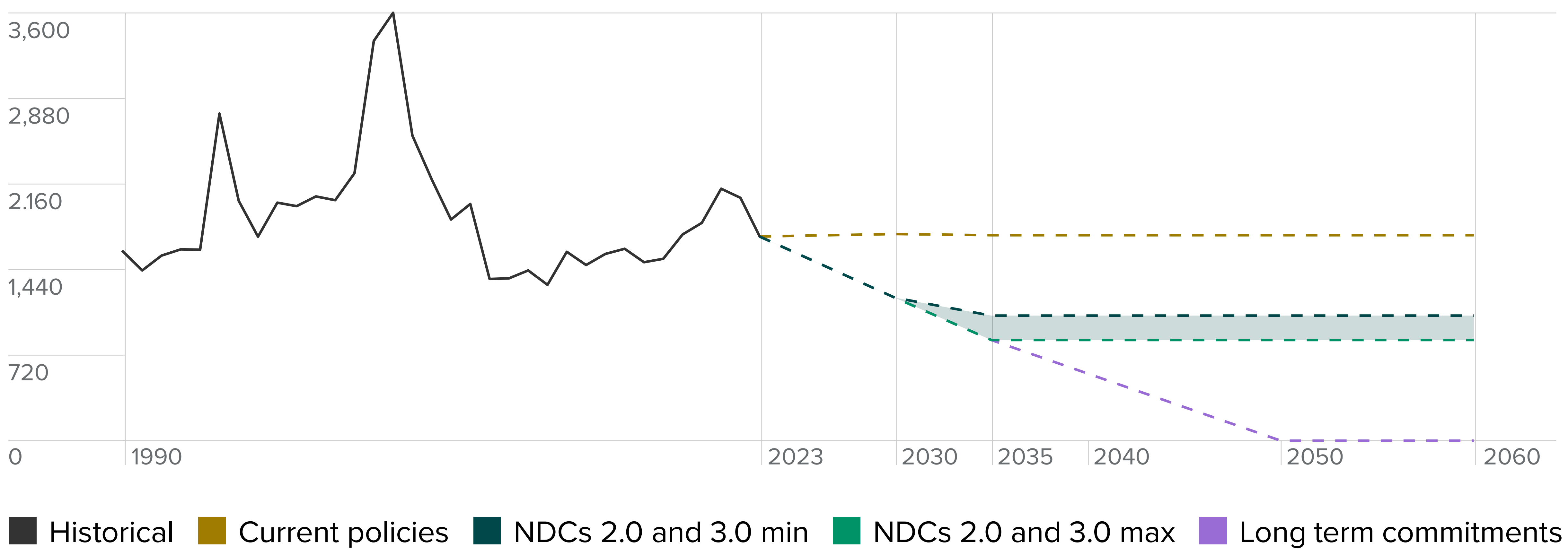
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Brazil

Policies overview

National adaptation plan[3] ✓

Regular published risk assessments[4]	✓
Monitoring and evaluating report[5]	✓
Part of a sovereign catastrophe risk pool	✗

Commited to fossil fuel subsidies phase out ✗

Annual amount spent on explicit fossil fuel subsidies as % of GDP[3]	0.12% of GDP[2]

Carbon pricing system[1] ✗

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[7]	127.7	2nd
Solar[6]	63.95	2nd
Hydroelectric[9]	9.12	5th
Geothermal[8]	0	N/A

Canada

Canada has set an NDC3.0 of 45-50% below 2005 emission levels.

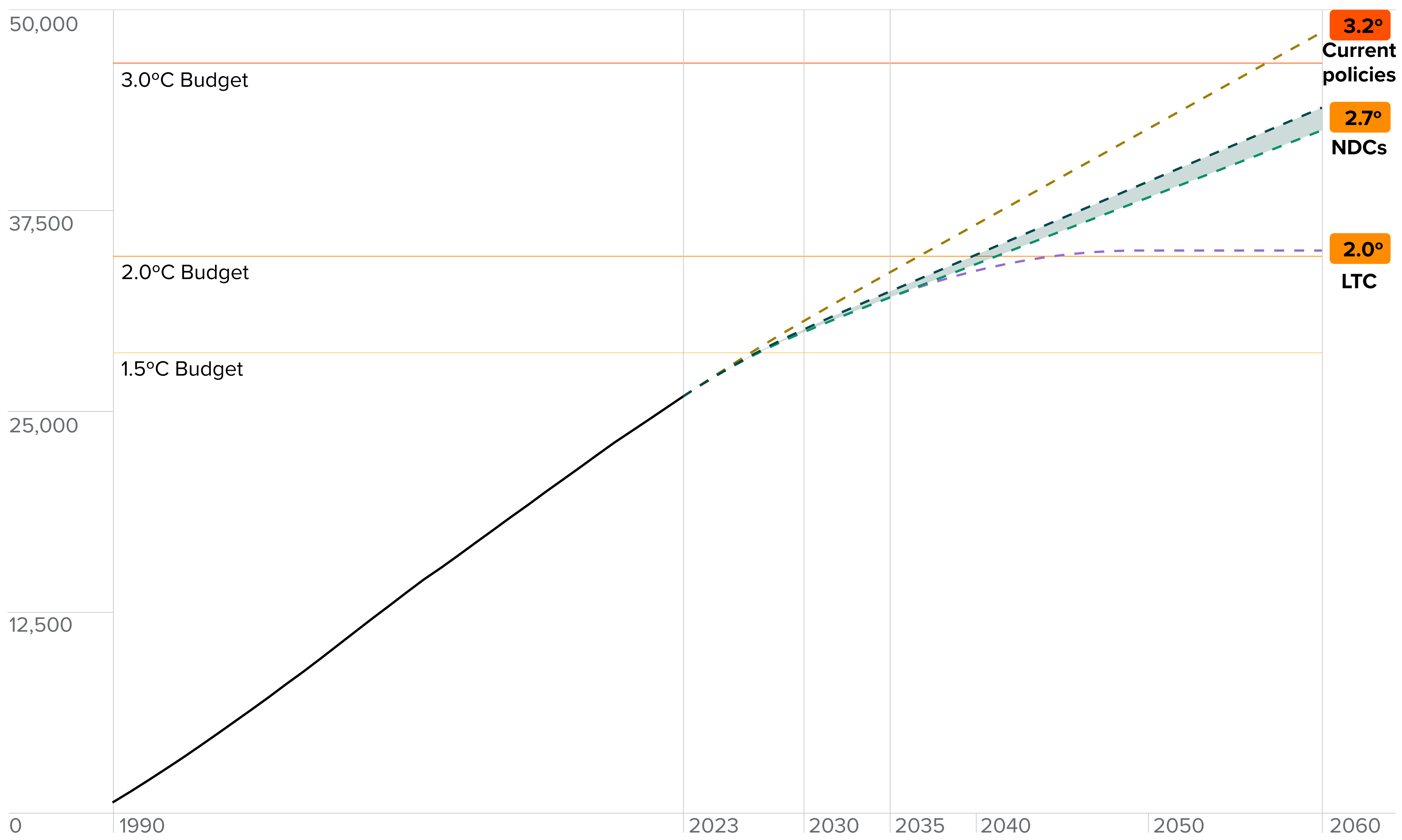
We estimate this to be 416-458 $MtCO_2e$ by 2035, aligning with a 2.7-2.8°C pathway.

Current policy alignment

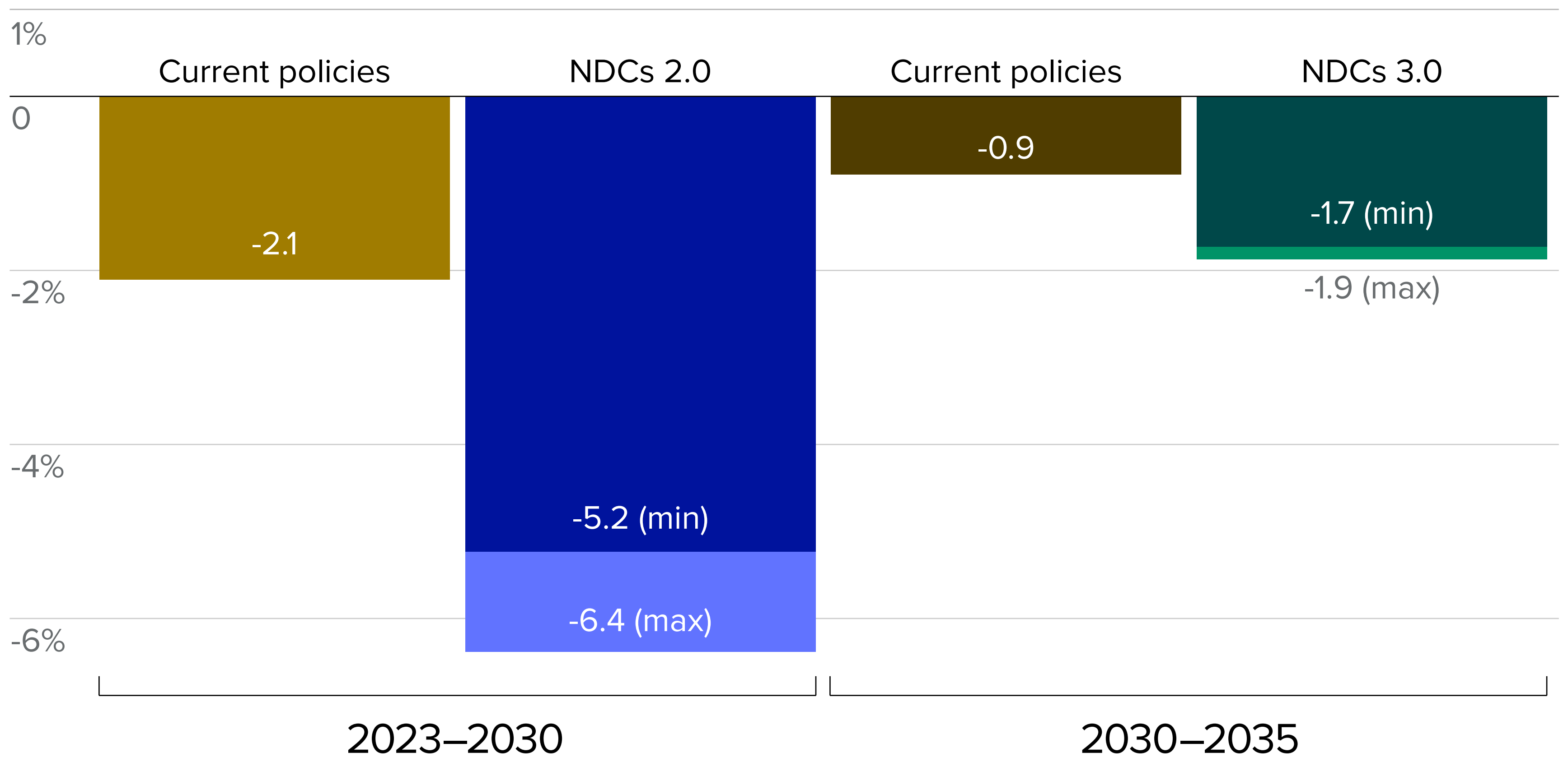
On track to meet 2030 target ⊗

We project that by 2030, Canada's current policies will result in the country overshooting its NDC by 25-37% (or 126-168 $MtCO_2e$). This would result in Canada surpassing its 1.5°C emissions budget by 2027.

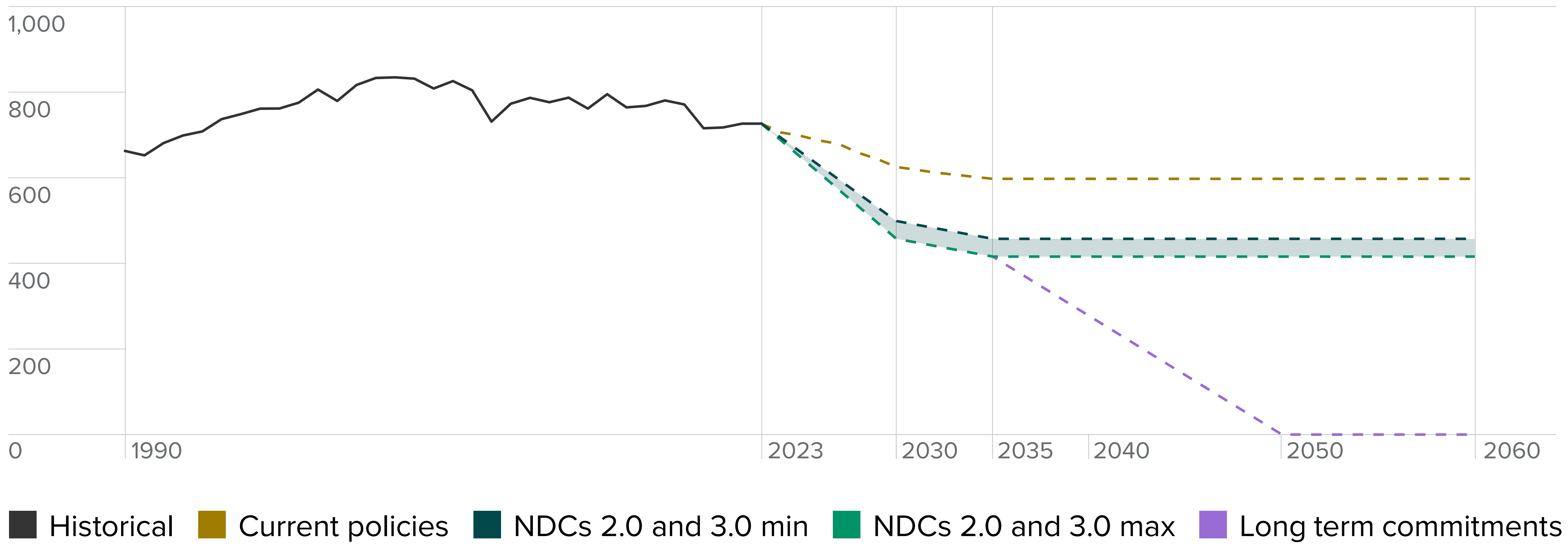
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Canada

Policies overview

✓ National adaptation plan[5]	
Regular published risk assessments[6]	✓
Monitoring and evaluating report	✗
Part of a sovereign catastrophe risk pool	Exempt

✓ Commited to fossil fuel subsidies phase out[3]	2023
Annual amount spent on explicit fossil fuel subsidies	0.08% of GDP[4]

✓ Carbon pricing system[1]	
% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	3% ✗
Carbon price ($/t$CO_2$e) Aligned with the global carbon price corridor[2]	66.21 ✓

Climate finance	
3-year average climate finance contribution as a % of GDP Proportional share of $100 billion global climate finance commitment[8]	0.04%[7] ✗
Targeted level of international climate finance contribution as a % of GDP Target to increase global climate finance contributions	0.04%[9] ✗

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[11]	7.64	9th
Solar[10]	3.60	12th
Hydroelectric[13]	2.76	9th
Geothermal[12]	0.15	3rd

China

Physical Risk

Between our baseline period (1980-2010) and 2050, China is projected to experience significant increases in exposure to physical climate hazards, particularly cyclones and heatwaves. Significant shares of the population and GDP move into high exposure, from none in the baseline period to 1 in 8 people at high risk from heatwaves and 1 in 12 from cyclones by 2050.

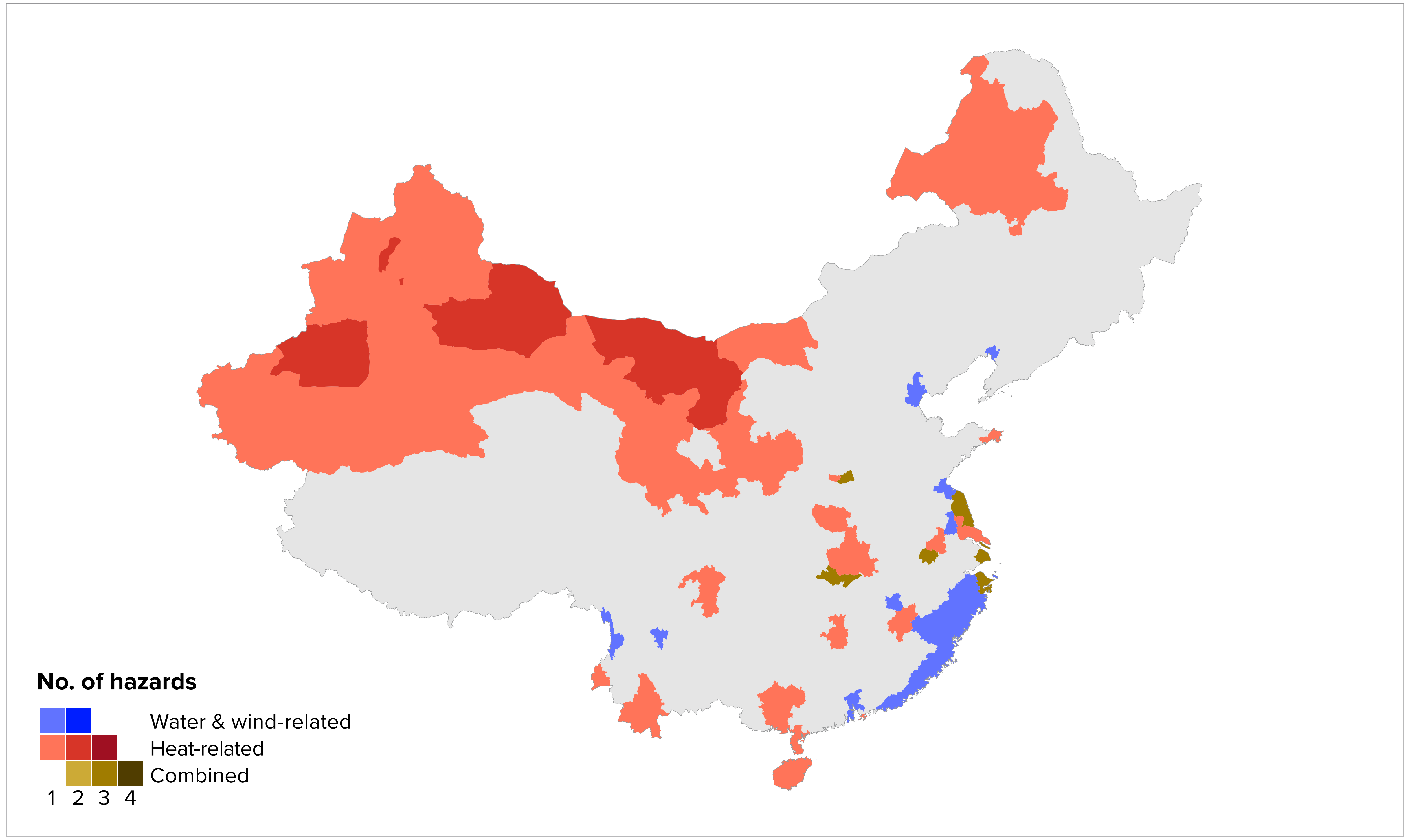
For **cyclones**, over 1,500 km of coastline south of Shanghai – home to 118 million people and US$2.2 trillion of GDP – face a cyclone every decade or less by 2050. Regions like Ningbo and Wenzhou (each with populations near 10 million) are estimated to face cyclones every 5-7 years – matching Florida's historical rate.

Heatwaves also intensify across densely populated and economically vital regions. In total, almost 180 million people and US$3.2 trillion are exposed, with Shanghai and the Special Administrative Region (SAR) of Hong Kong projected to face high heatwave exposure by 2050.

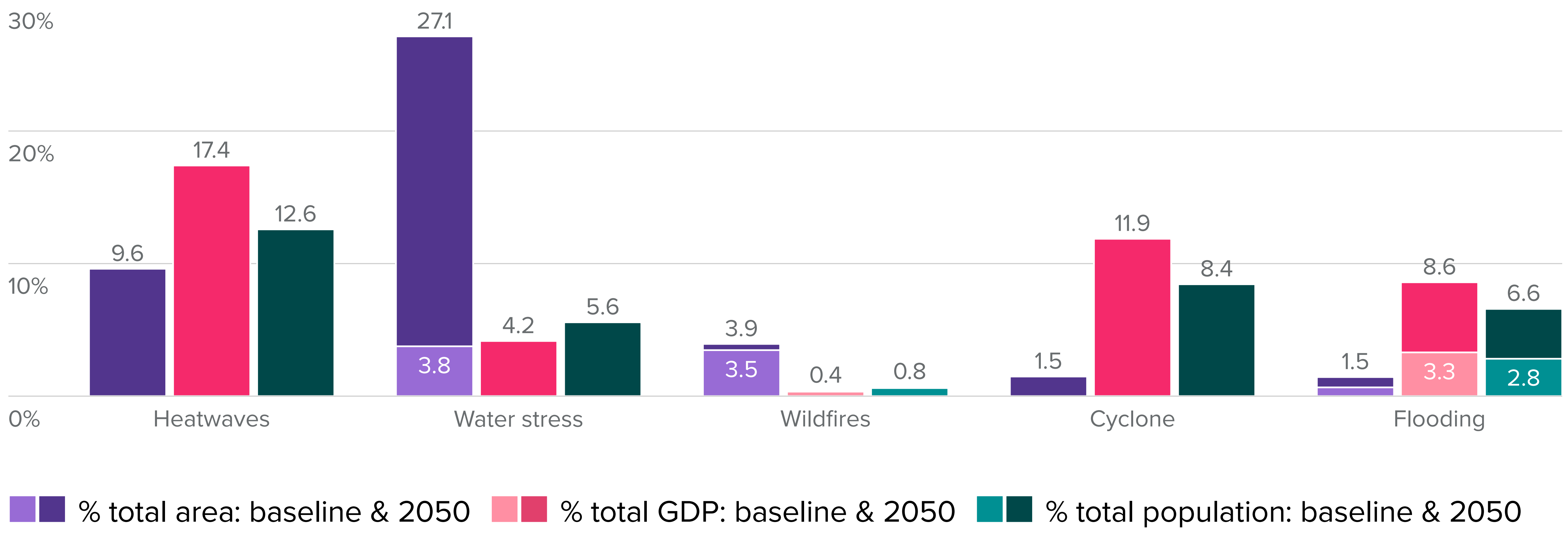
Flooding risk is projected to more than double the population and GDP at high exposure – going from 2.8% to 6.6% of total population and 3.3% to 8.6% of GDP. Key hubs at risk include low lying coastal or riverine areas such as Tianjin (14 million people and US$250 billion GDP) and Guangzhou (19 million and US$429 billion), projected to face high flooding exposure.

Several key economic hubs face compounding risks, notably Shanghai – home to almost 25 million people and over US$700 billion in GDP – has high exposure to both cyclones and heatwaves.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



China

China has signalled an NDC3.0 of 7-10% below peak emission levels.

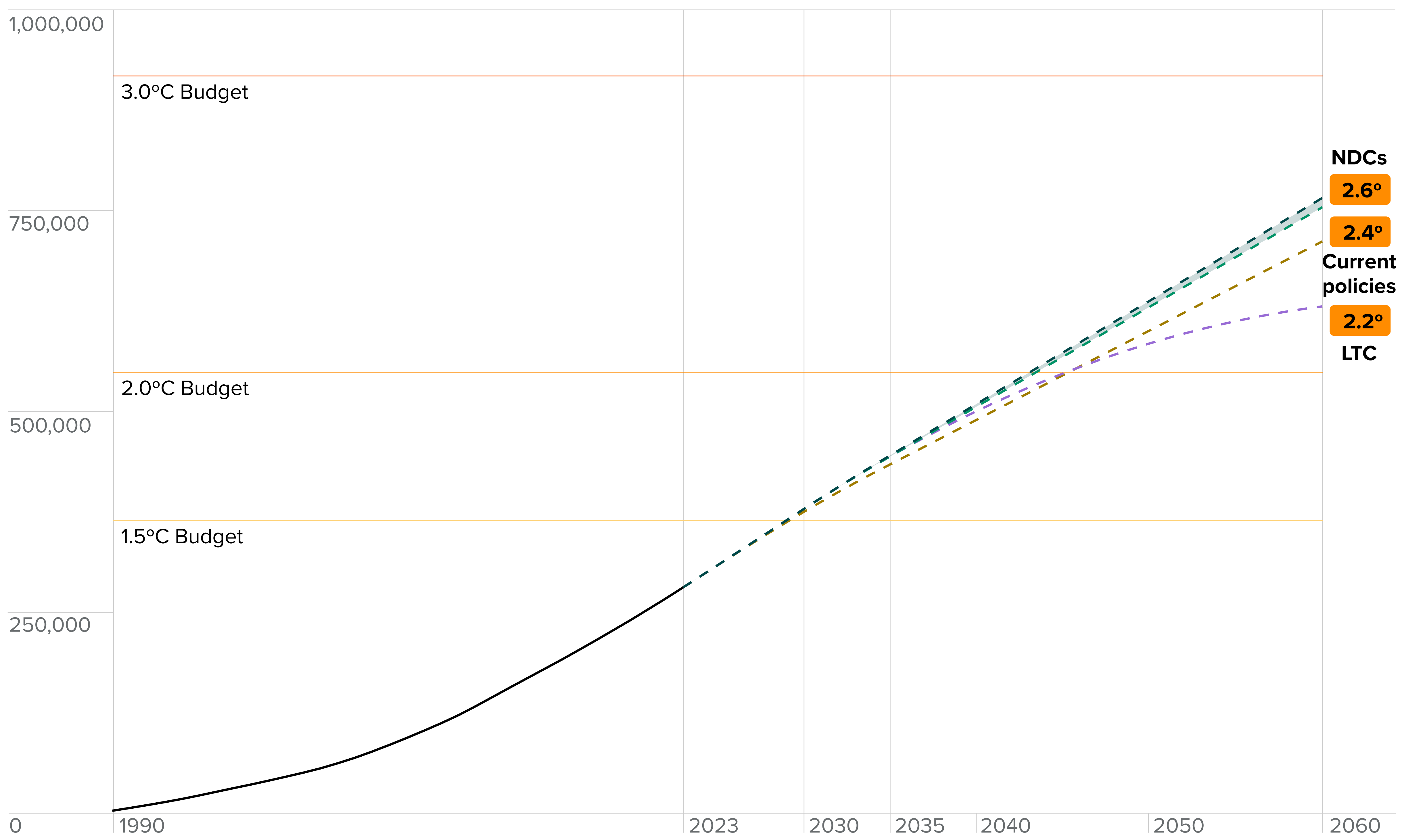
We estimate this to be 1.24-1.28 $GtCO_2e$ by 2035, aligning with a 2.6°C pathway.

Current policy alignment

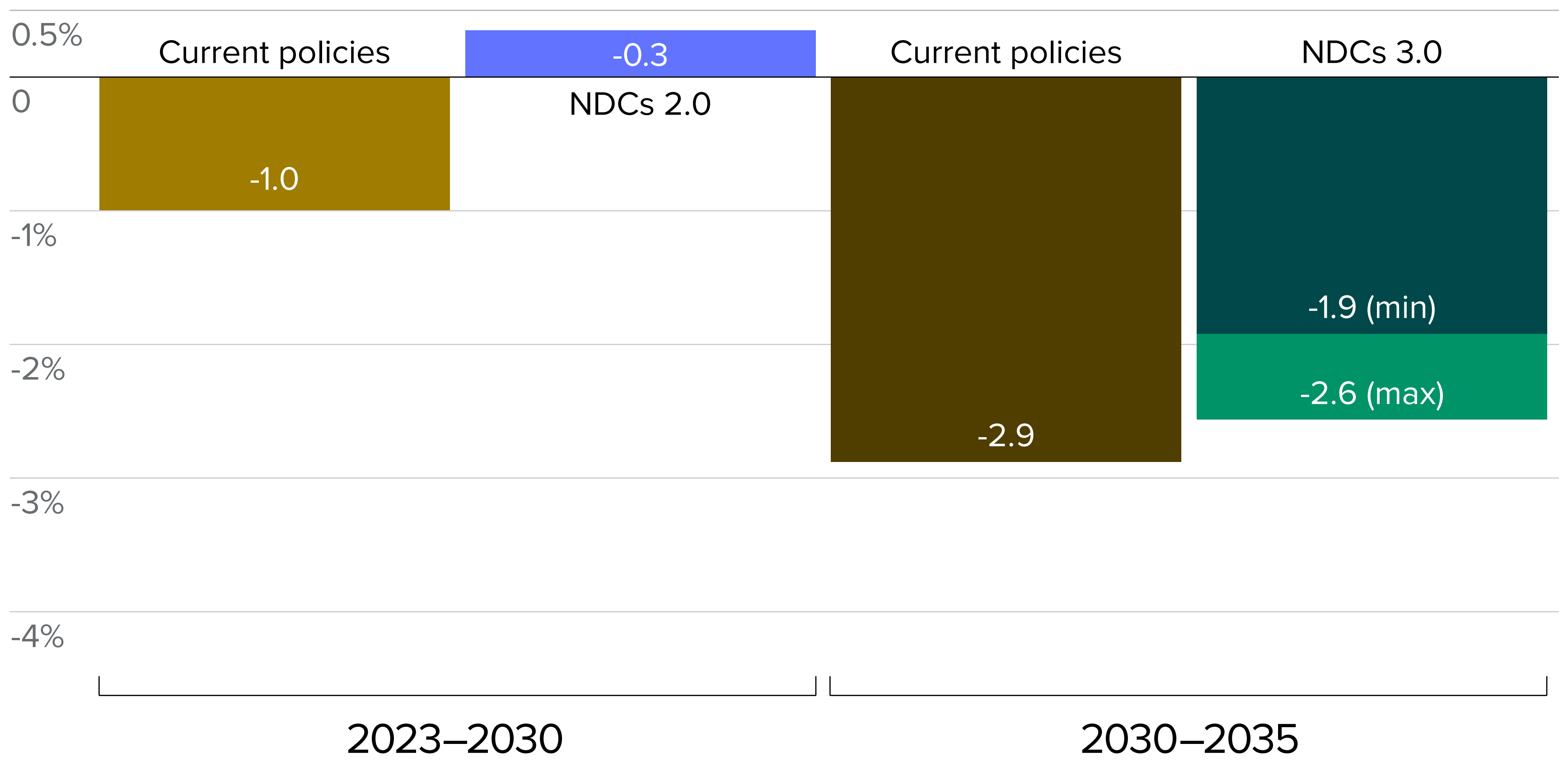
On track to meet 2030 target

We project that by 2030, China's current policies will result in the country meeting its NDC and come in 9% below it (or 1.27 $GtCO_2e$). This would result in China surpassing its 1.5°C emissions budget by 2030.

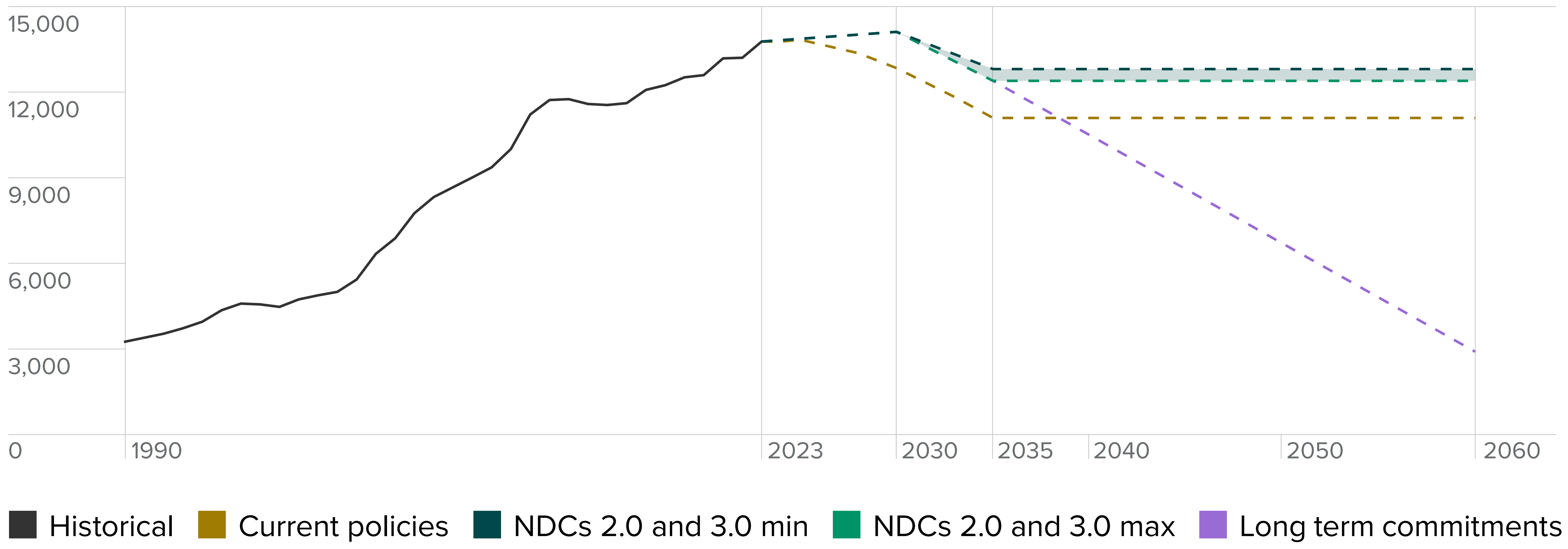
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



China

Policies overview

✔ National adaptation plan[4]

Regular published risk assessments[5]	✔
Monitoring and evaluating report[6]	✔
Part of a sovereign catastrophe risk pool	✖

✖ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies	0.42% of GDP[3]

✔ Carbon pricing system[1]

% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	51% ✔
Carbon price ($/t$CO_2$e) Aligned with the global carbon price corridor[2]	11.76 ✖

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Solar[7]	35.80	3rd
Hydroelectric[10]	30.79	1st
Wind[8]	29.05	4th
Geothermal[9]	0	N/A

France

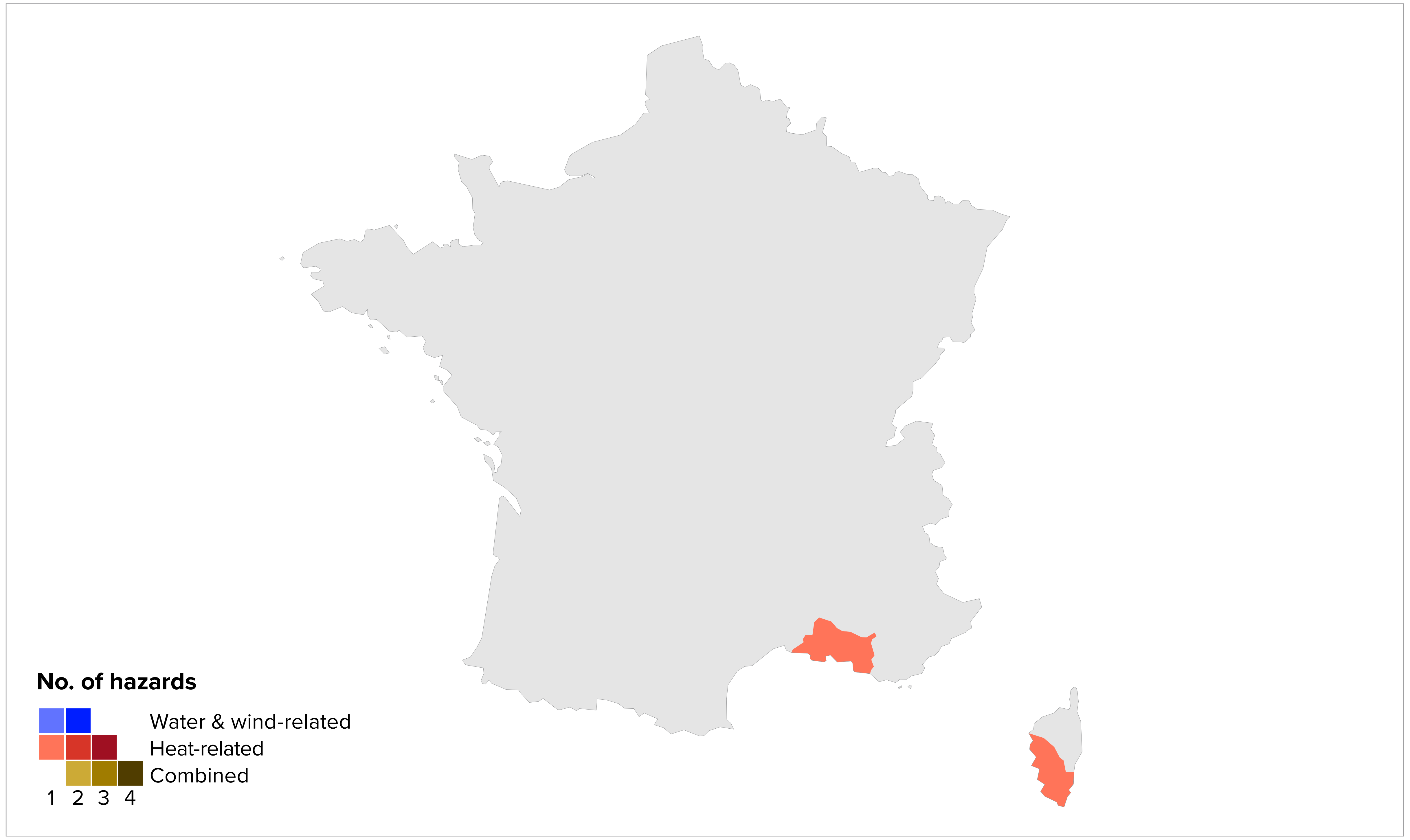
Physical Risk

By 2050, France is projected to experience a rise in high exposure to **heatwaves** – the only physical hazard showing significant increases across population, GDP, and land area. Nationally, the share of population at high risk from heatwaves is expected to rise from 0% over the baseline to approximately 5% of France's population and 7% of its GDP.

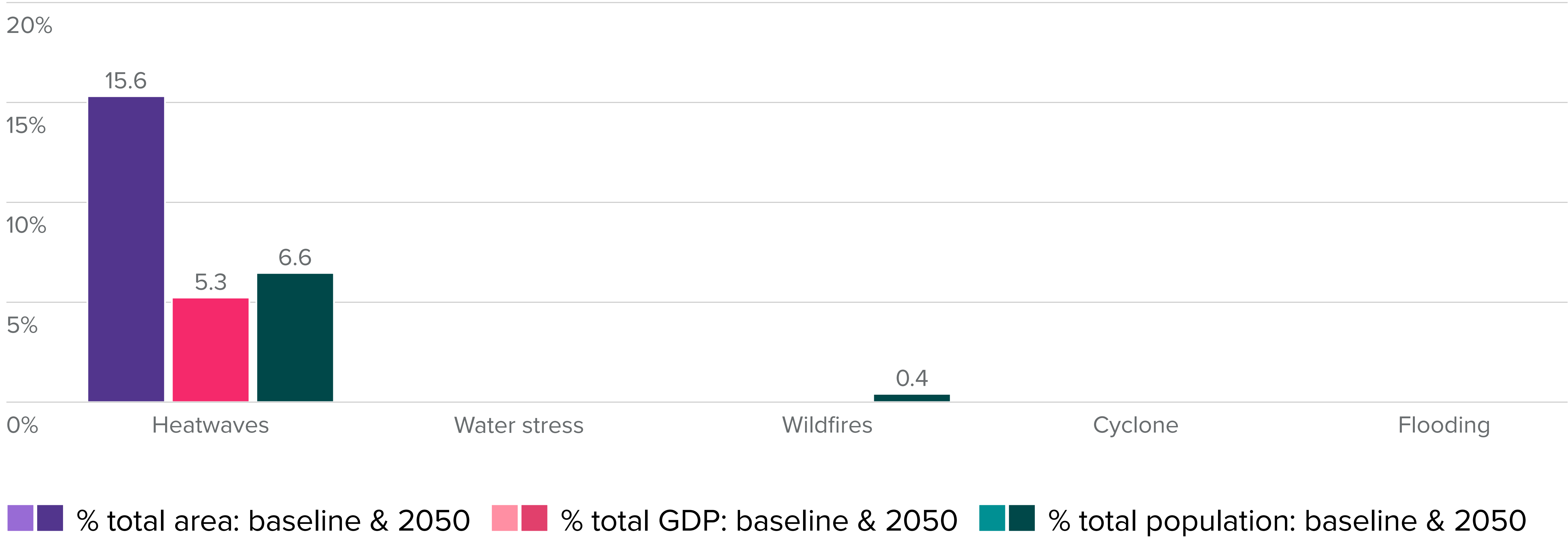
Bouches-du-Rhône (home to Marseille) stands out due to its large population and high GDP exposed to heatwaves, with over 2 million people and US$100 billion in GDP facing temperatures above 35°C for more than a month. Southern Corsica and the overseas territories of La Réunion in the Indian Ocean and Guadeloupe and Martinique in the Caribbean are also projected to face high exposure to heatwaves, underscoring their sensitivity to warming despite smaller populations and economic footprints.

By contrast, other hazards remain medium to low risk nationally, with no significant projected regional increases in the data.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



France

The EU has signalled an NDC3.0 of 66.25-72.5% below 1990 emission levels.

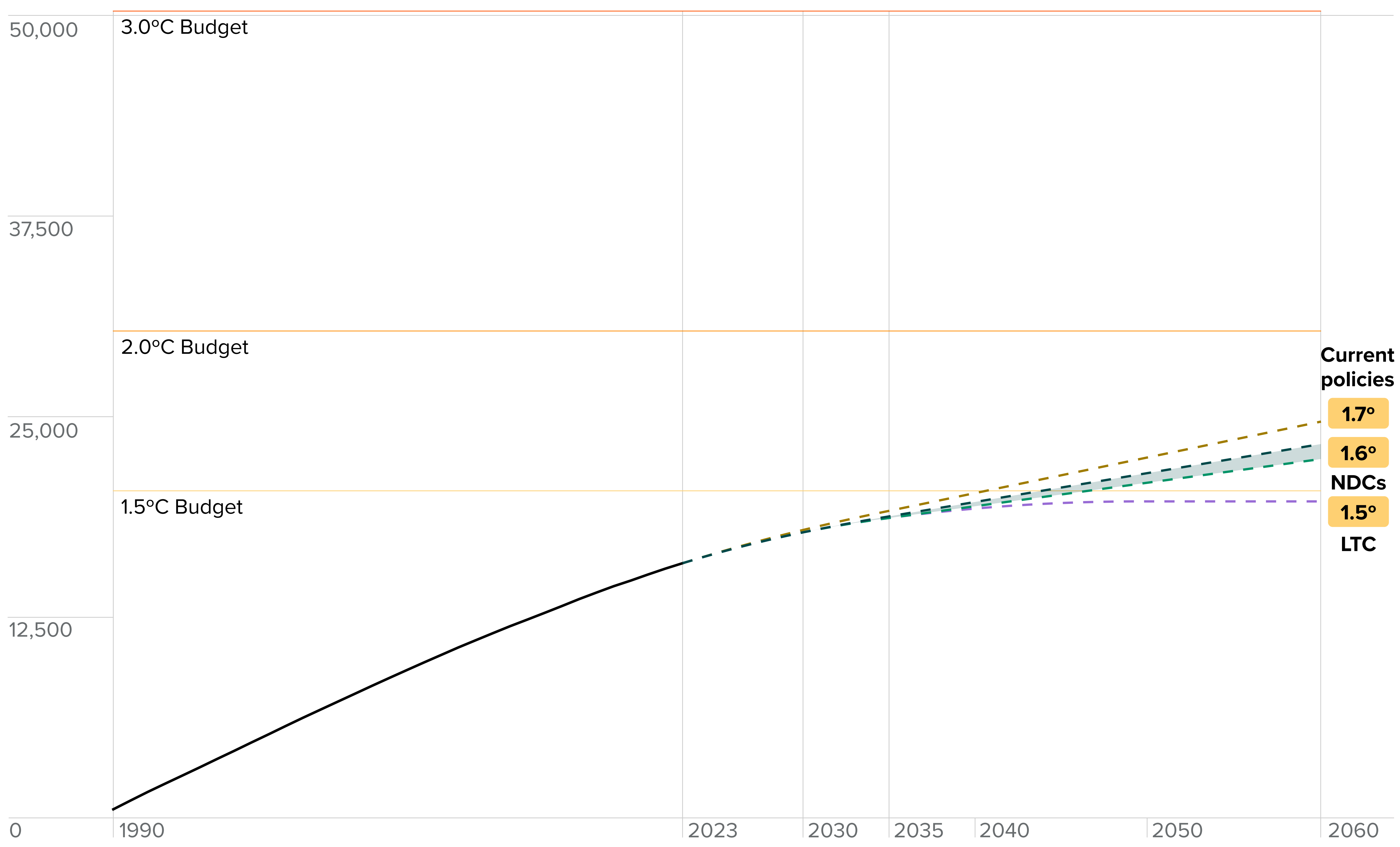
For France, we estimate this to be 147-180 $MtCO_2e$ by 2035, aligning with a 1.6°C pathway.

Current policy alignment

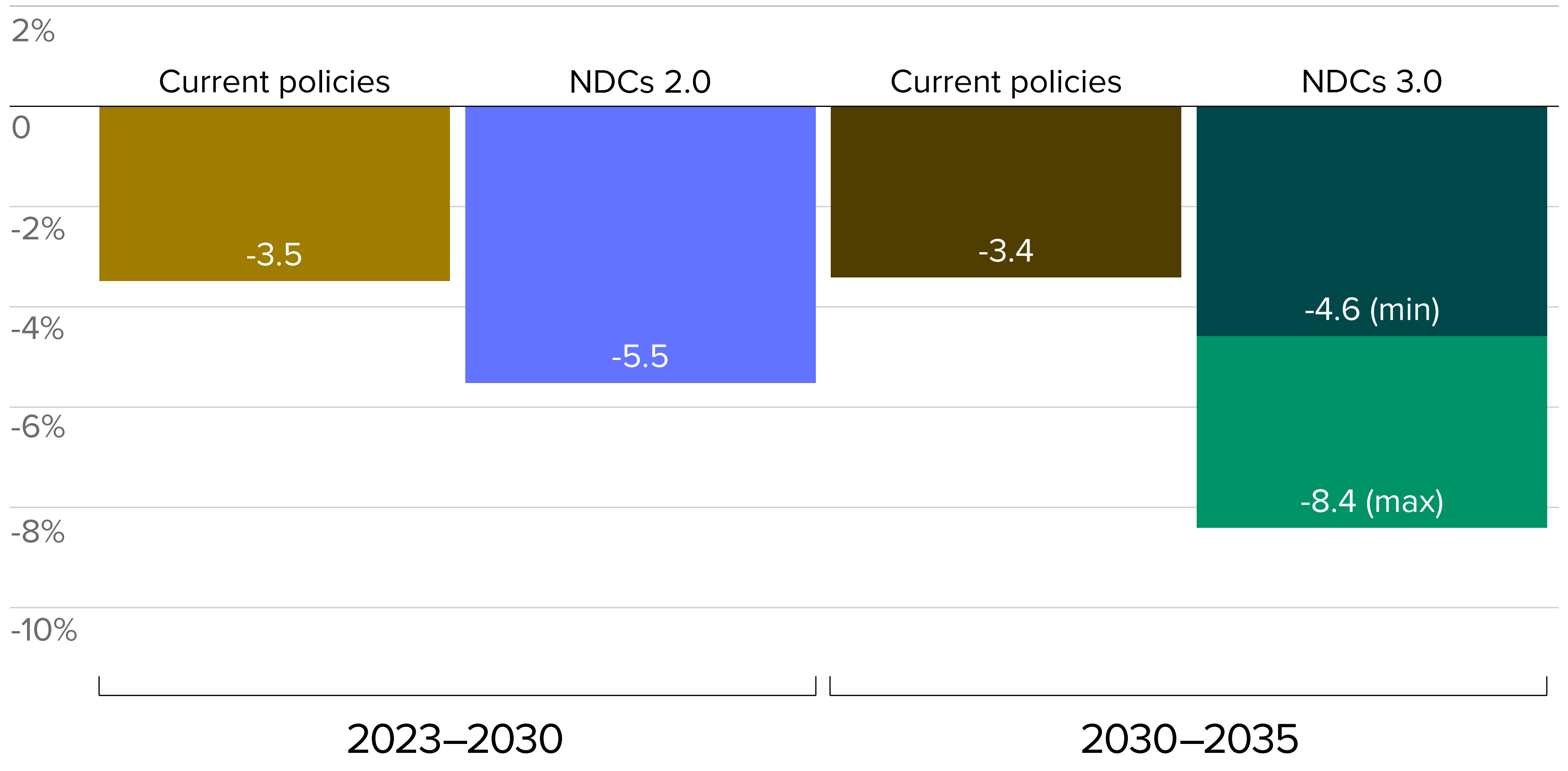
On track to meet 2030 target ✖

We project that by 2030, France's current policies will result in the country overshooting its NDC by 16% (or 37 $MtCO_2e$). This would result in France surpassing its 1.5°C emissions budget by 2041.

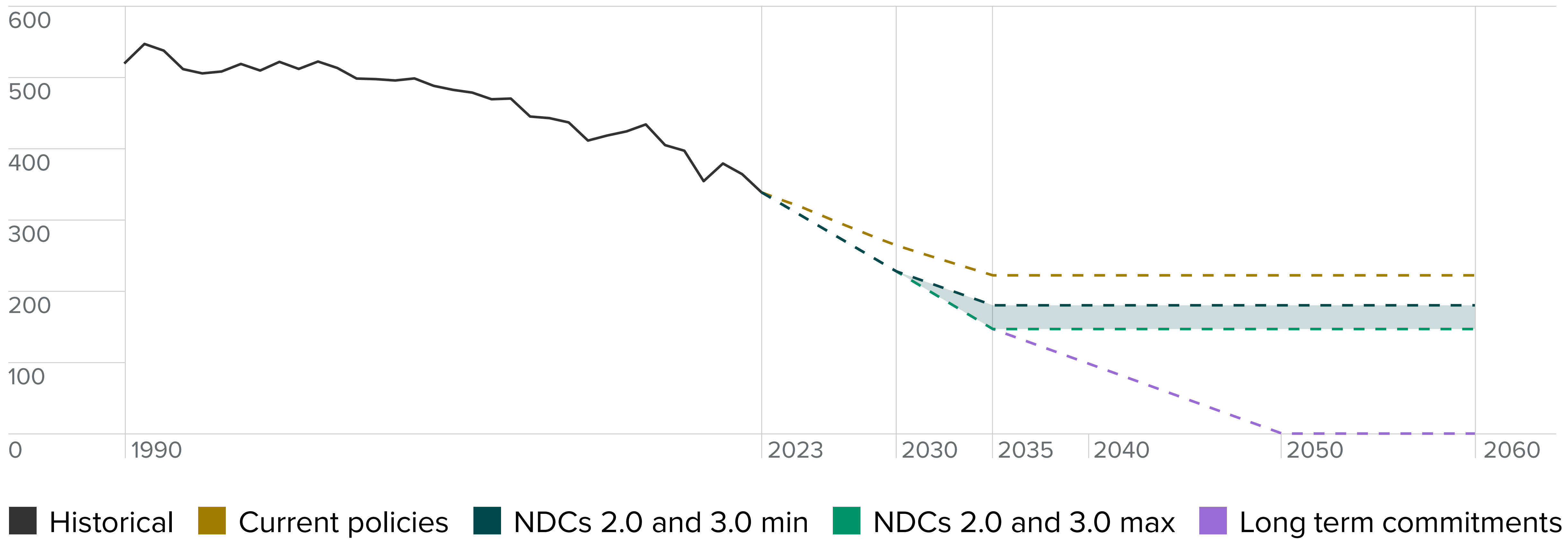
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



France

Policies overview

✓ National adaptation plan[5]

Regular published risk assessments[6]	✓
Monitoring and evaluating report[7]	✓
Part of a sovereign catastrophe risk pool	Exempt

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies as % of GDP[4]	0.14% of GDP[4]

✓ Carbon pricing system[2]

% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	41% ✗
Carbon price ($/t$CO_2$e) Aligned with the global carbon price corridor[3]	47.94 ✓

Climate finance

3-year average climate finance contribution as a % of GDP Proportional share of $100 billion global climate finance commitment[9]	0.29%[8] ✓
Targeted level of international climate finance contribution as a % of GDP Target to increase global climate finance contributions	0.20%[10] ✗

Energy opportunity

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[12]	5.94	11th
Solar[11]	0.89	18th
Hydroelectric[14]	0.02	18th
Geothermal[13]	0	N/A

Germany

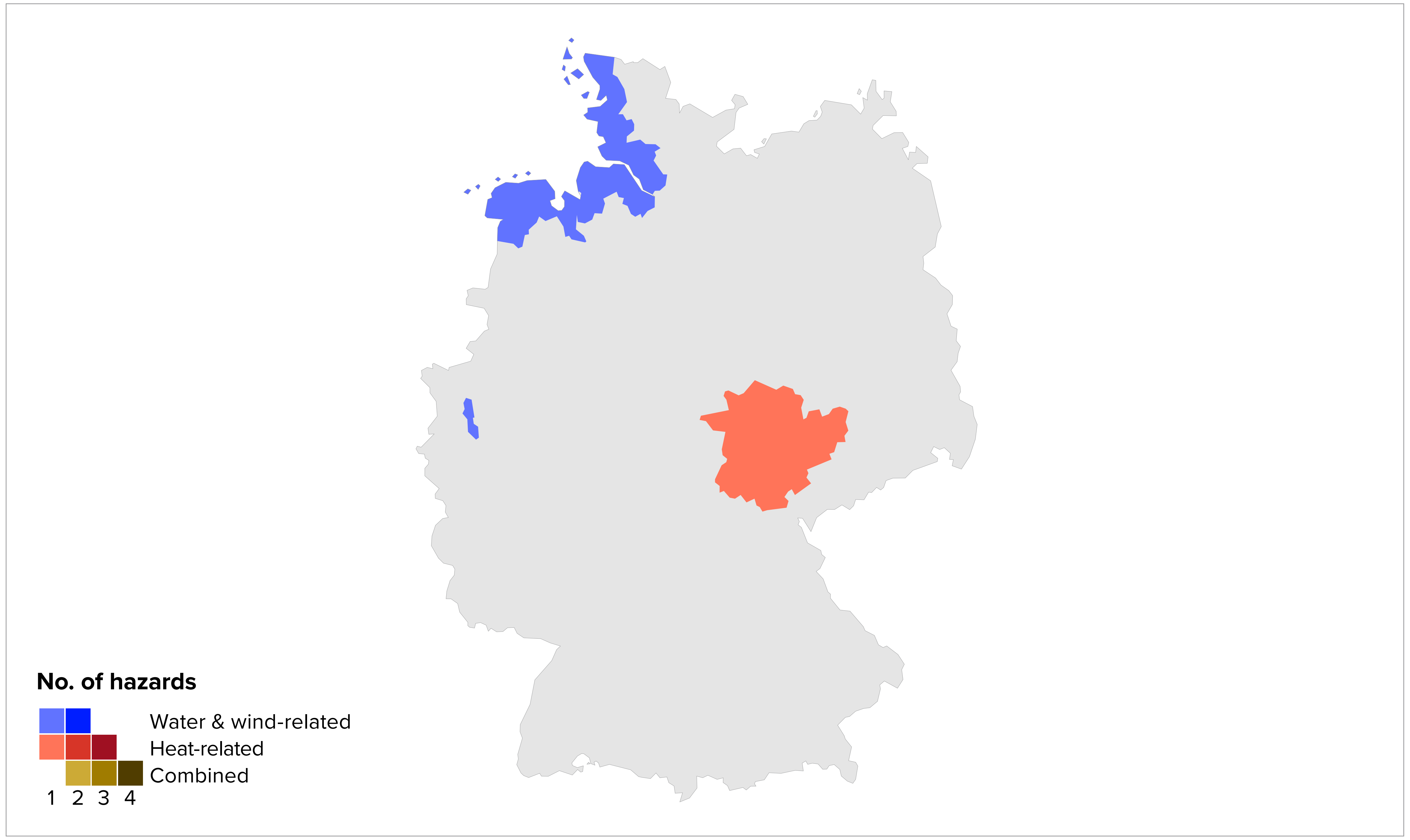
Physical Risk

Germany is projected to see modest but notable changes in exposure to physical hazards, with flooding remaining high in key regions and water stress emerging by 2050.

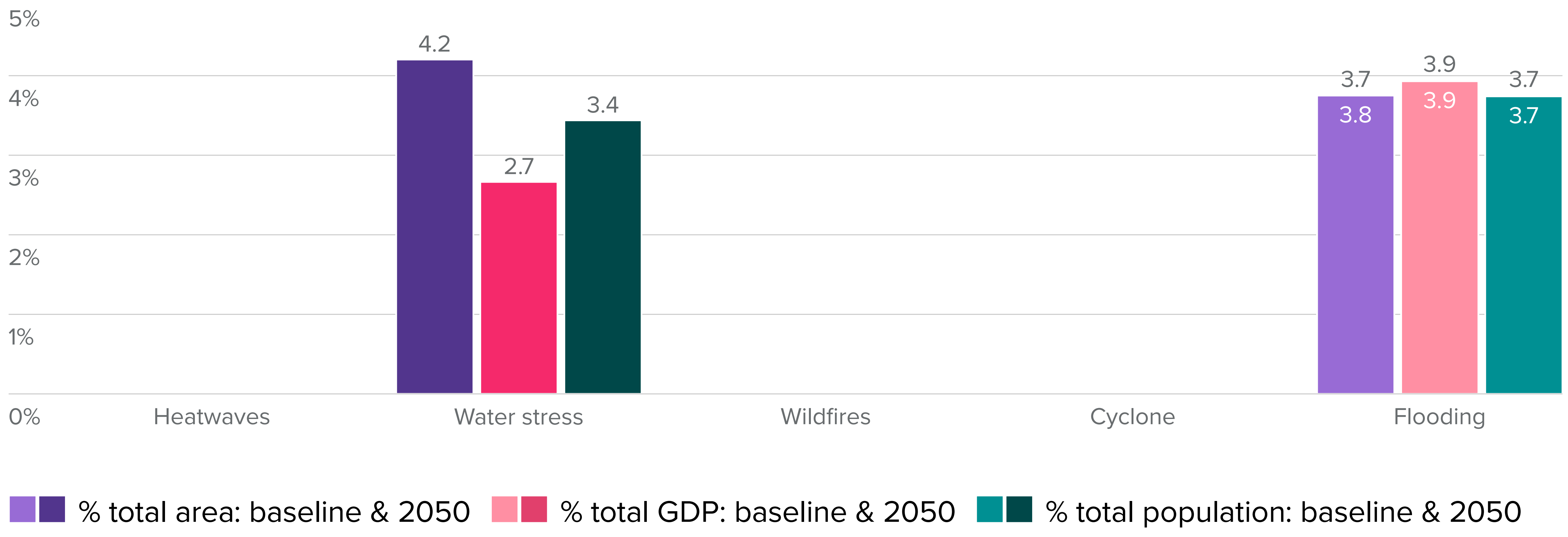
Flood risk stays regionally concentrated, 16 regions that are high risk over the baseline period remain so through 2050. Notable hubs on the Rhine including Düsseldorf (620,000 people and US$65 billion in GDP) and Duisburg (500,000, US$23 billion) remain highly flood prone. In the north, regions on the Elbe (e.g., Pinneberg, Stade) and low-lying coastal areas (e.g., Cuxhaven, Nordfriesland) are also projected to remain at high flood risk, with a combined population of 3.1 million and US$169 billion in GDP.

Water stress, medium to low in the baseline period nationwide, rises to be high risk for 3.4% of Germany's population and 2.7% of its GDP by 2050. High risk regions are concentrated in central and eastern Germany, including urban centres such as Leipzig (600,000 people and US$27.9 billion in GDP), Erfurt and Halle.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



Germany

The EU has signalled an NDC3.0 of 66.25-72.5% below 1990 emission levels.

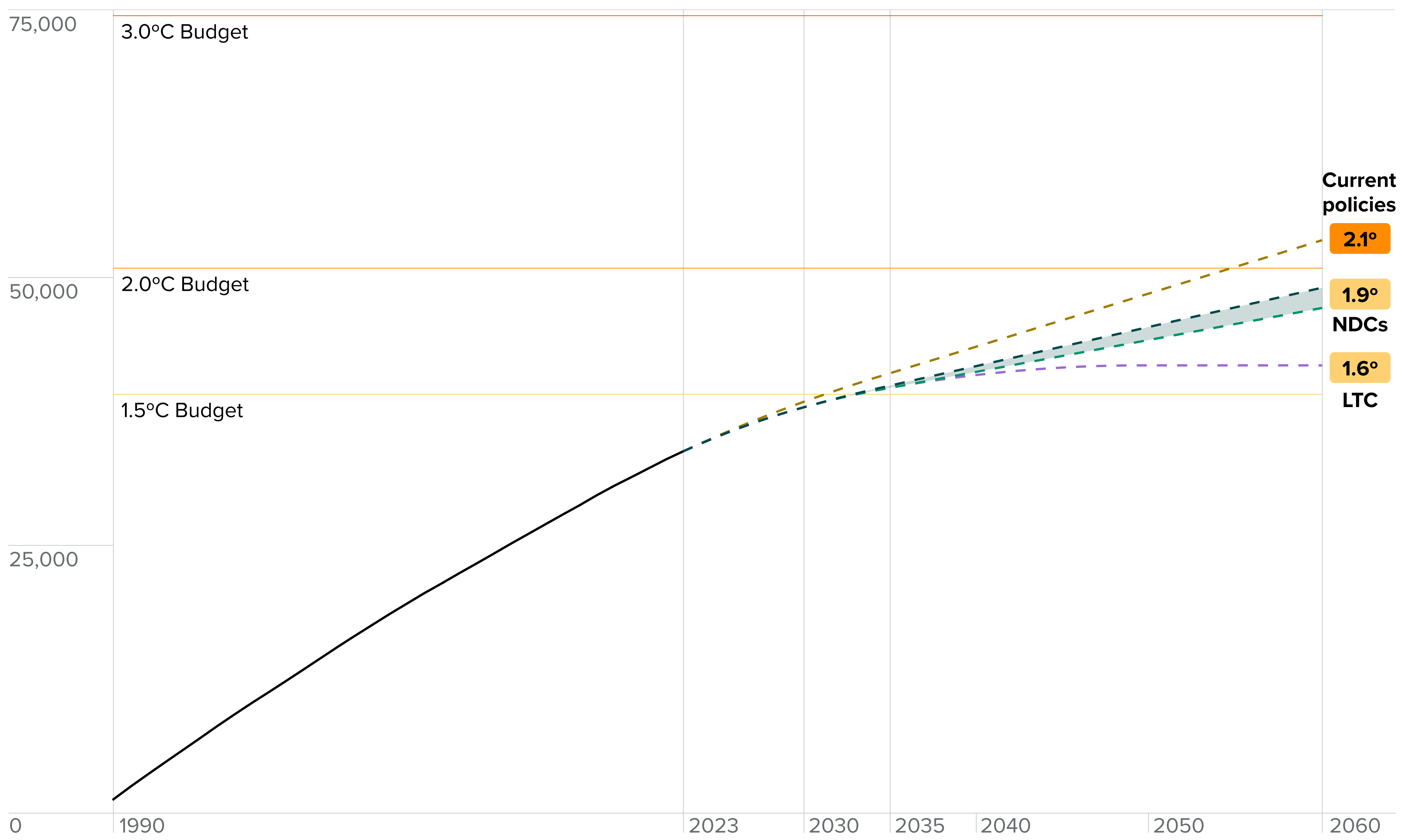
For Germany, we estimate this to be 298-365 $MtCO_2e$ by 2035, aligning with a 1.8-1.9°C pathway.

Current policy alignment

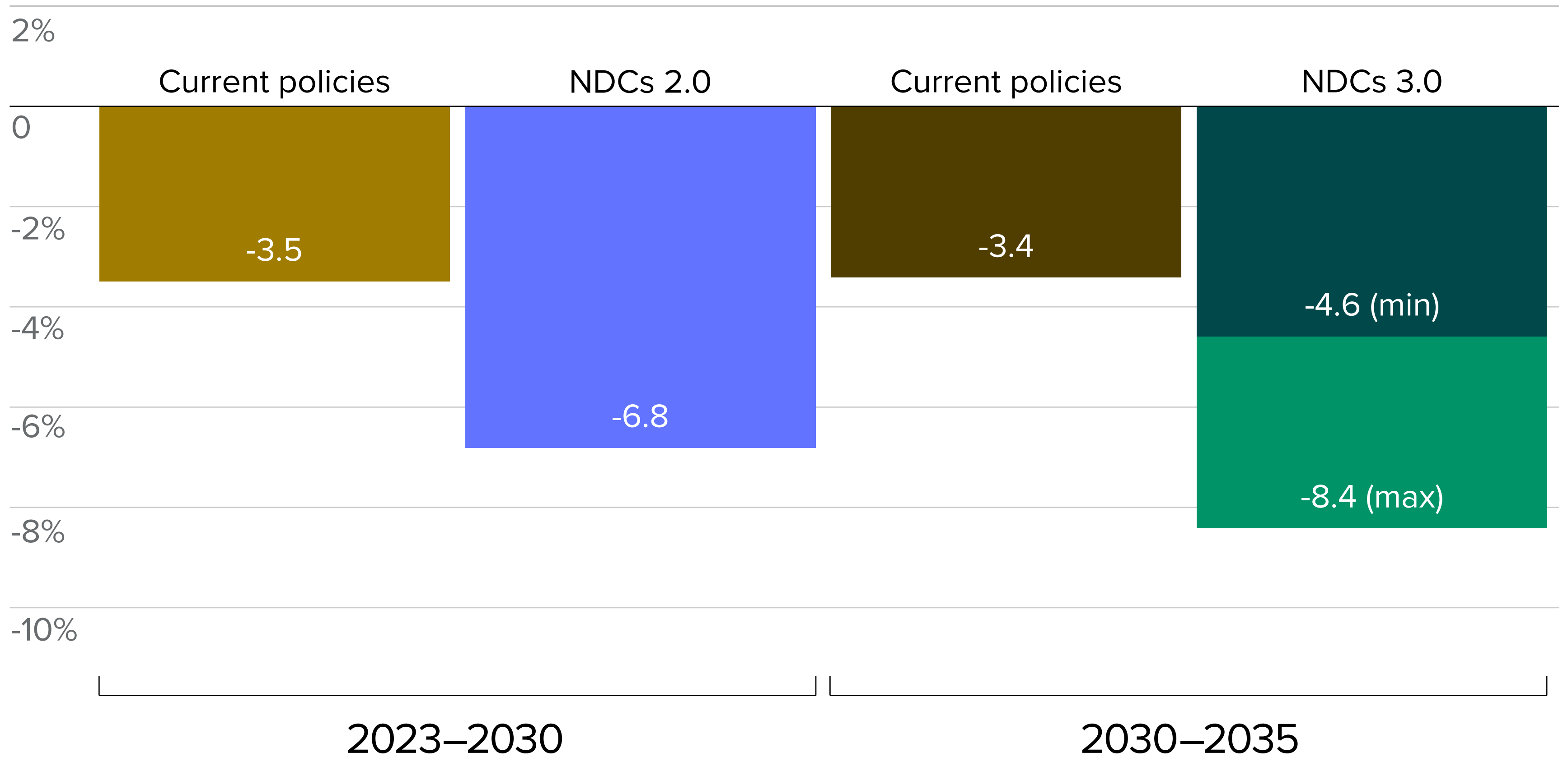
On track to meet 2030 target

We project that by 2030, Germany's current policies will result in the country overshooting its NDC by 28% (or 128 $MtCO_2e$). This would result in Germany surpassing its 1.5°C emissions budget by 2032.

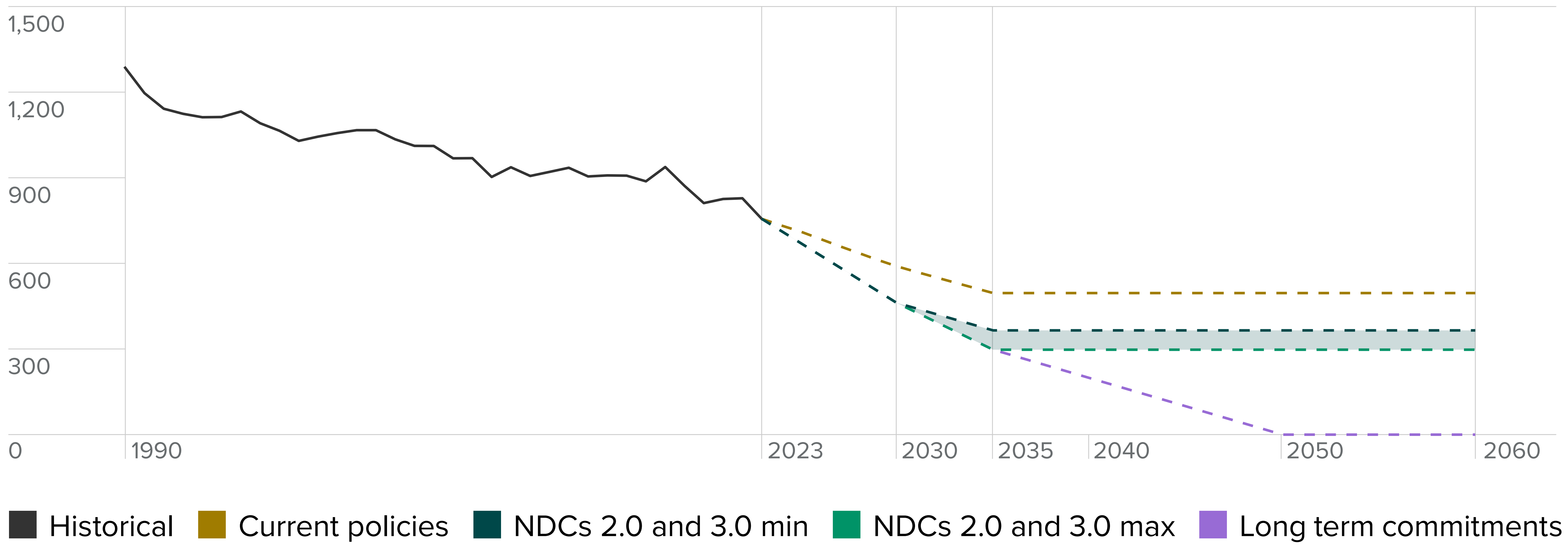
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Germany

Policies overview

✓ National adaptation plan[6]

Regular published risk assessments[7]	✓
Monitoring and evaluating report[8]	✓
Part of a sovereign catastrophe risk pool	Exempt

✓ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies as % of GDP[4]	0.51% of GDP[5]

✓ Carbon pricing system[2]

% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	39% ✗
Carbon price ($/t$CO_2$e) Aligned with the global carbon price corridor[3]	48.55 ✓

Climate finance

3-year average climate finance contribution as a % of GDP Proportional share of $100 billion global climate finance commitment[10]	0.24%[9] ✓
Targeted level of international climate finance contribution as a % of GDP Target to increase global climate finance contributions	0.14%[11] ✗

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[13]	3.03	14th
Solar[12]	1.91	15th
Hydroelectric[15]	0.02	16th
Geothermal[14]	0	N/A

India

India has not yet set an NDC3.0.

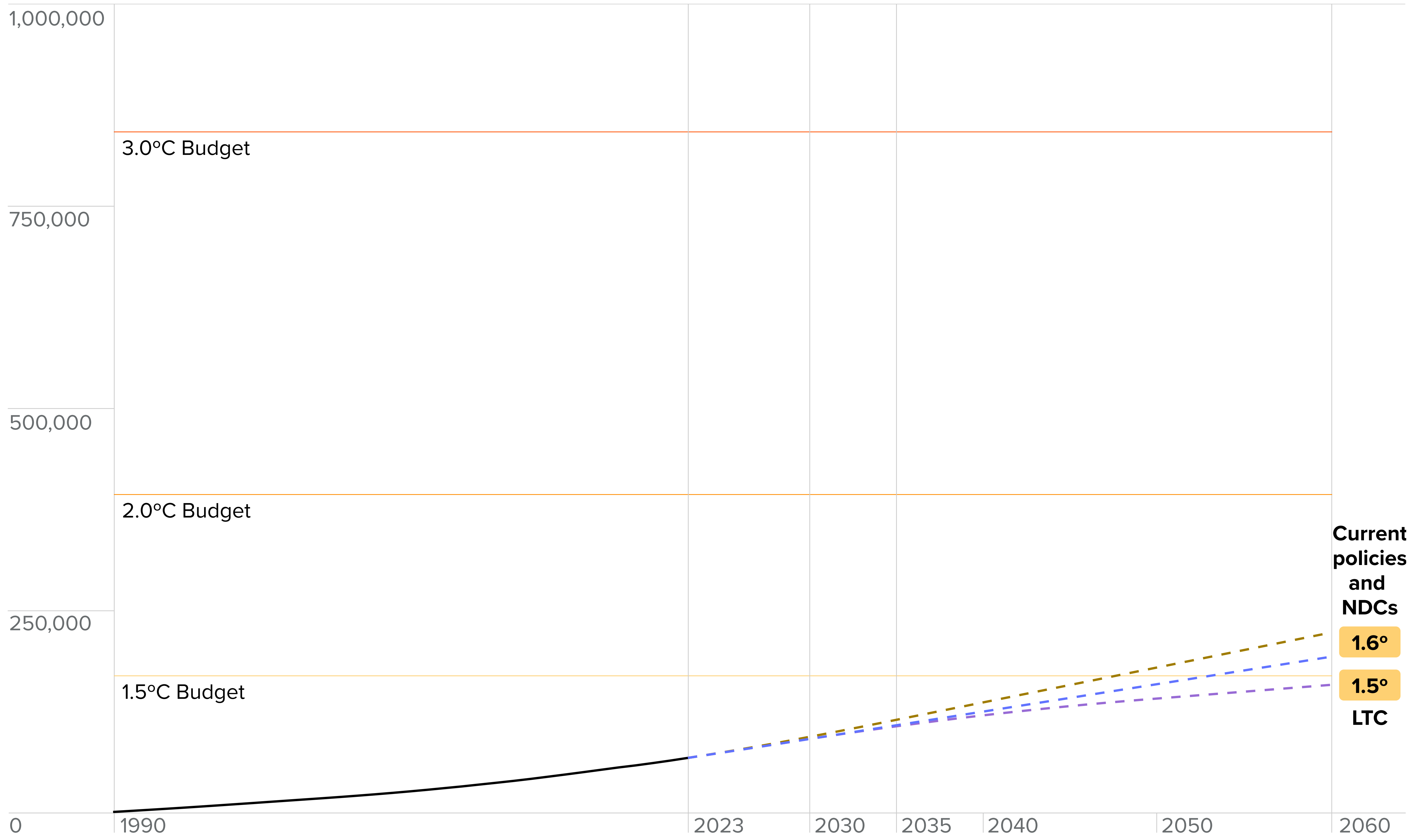
We estimate its 2030 emissions intensity target of 45% below 2005 aligns with a 1.6°C pathway.

Current policy alignment

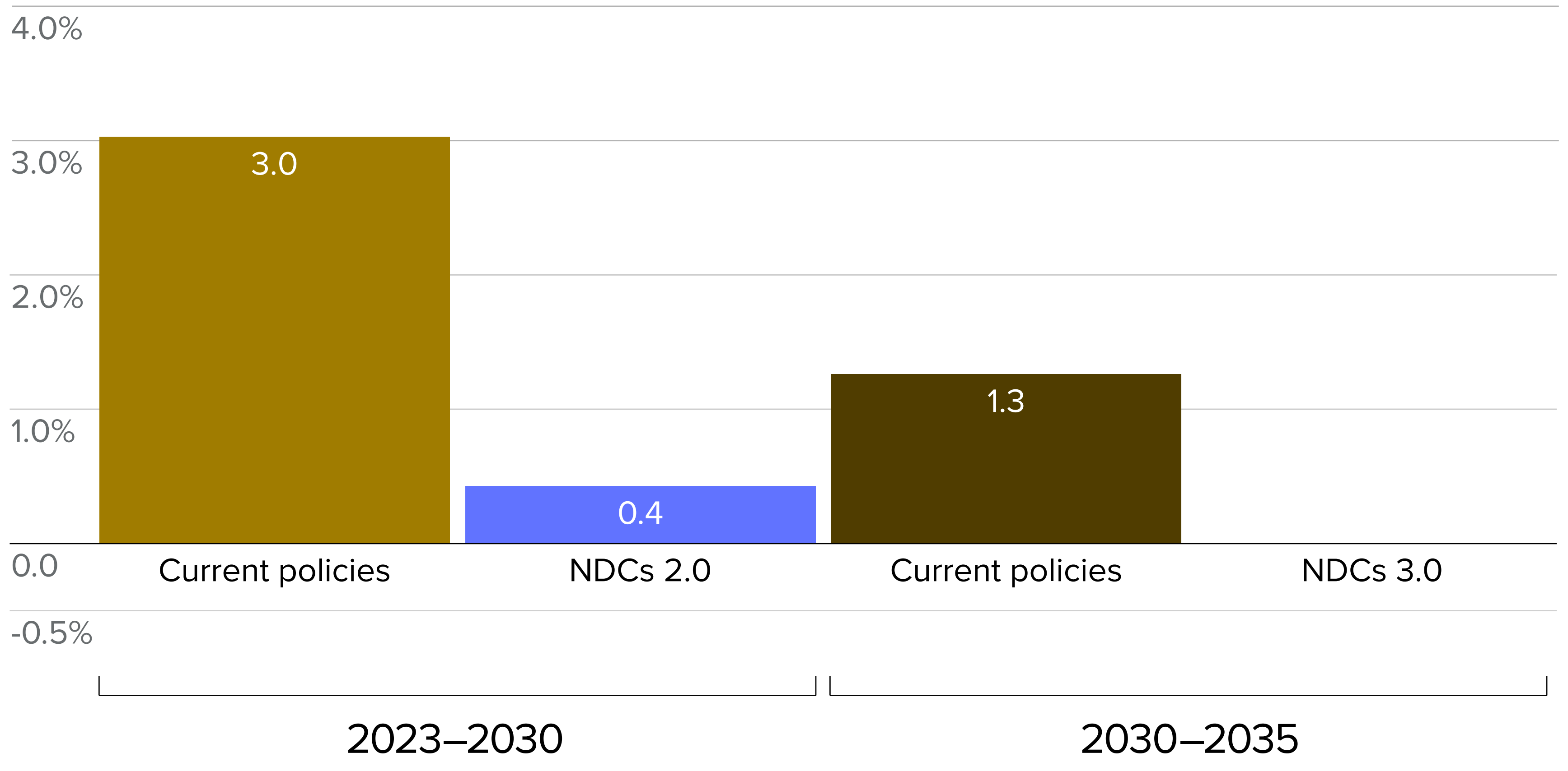
On track to meet 2030 target

We project that by 2030, India's current policies will result in the country overshooting its NDC by 20% (or 663 $MtCO_2e$). This would result in India surpassing its 1.5°C emissions budget by 2048.

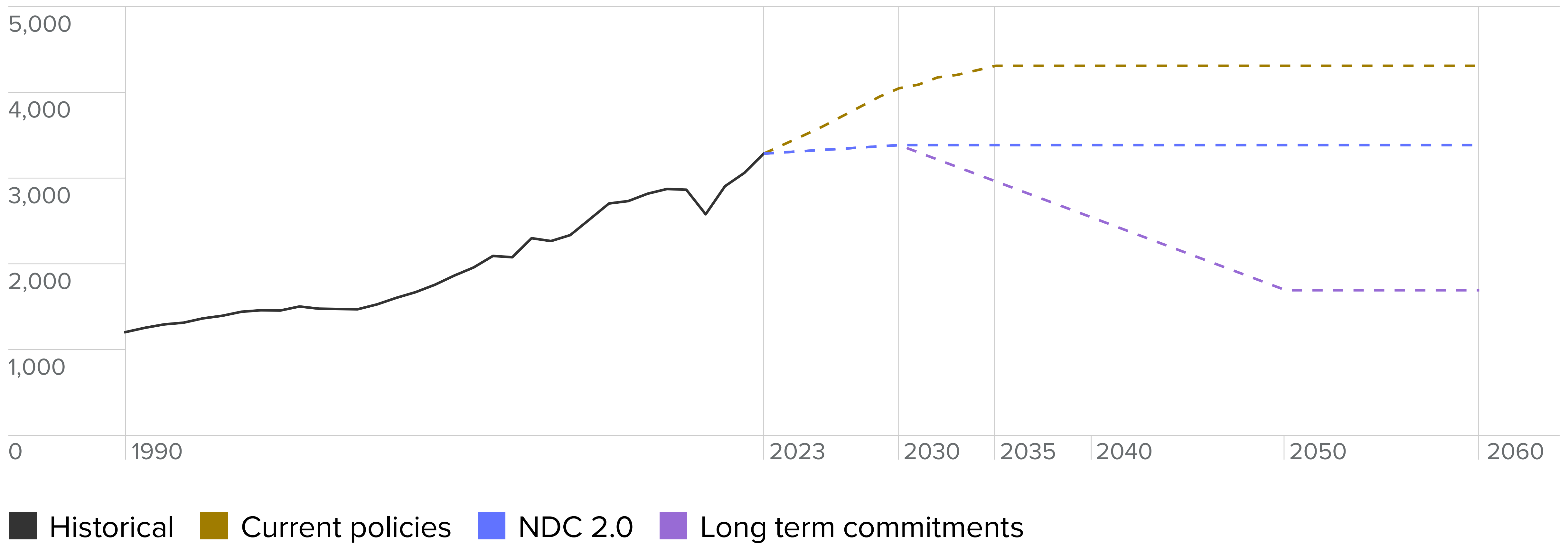
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Policies overview

✖ National adaptation plan

Regular published risk assessments	✖
Monitoring and evaluating report	✖
Part of a sovereign catastrophe risk pool	✖

✖ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies as % of GDP	0.98% GDP[1]

✖ Carbon pricing system

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[3]	5.02	20th
Solar[2]	25.16	4th
Hydroelectric[5]	29.30	2nd
Geothermal[4]	0	N/A

Indonesia

Indonesia has set an NDC 3.0 of 9.8-30% above 2019 emission levels.

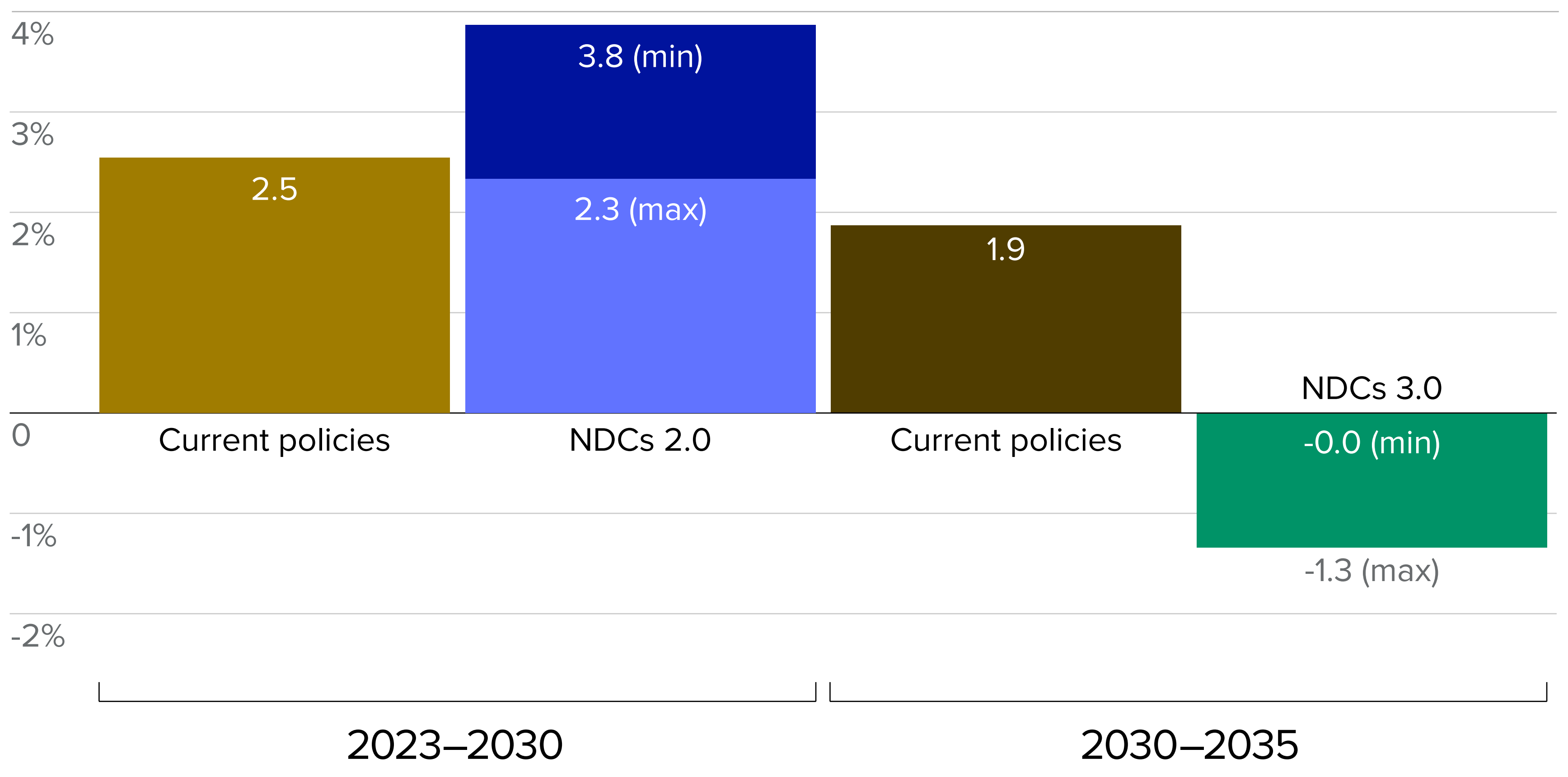
We estimate this to be 1.99-2.35 $GtCO_2e$ by 2035, aligning with a 2.1-2.3°C pathway.

Current policy alignment

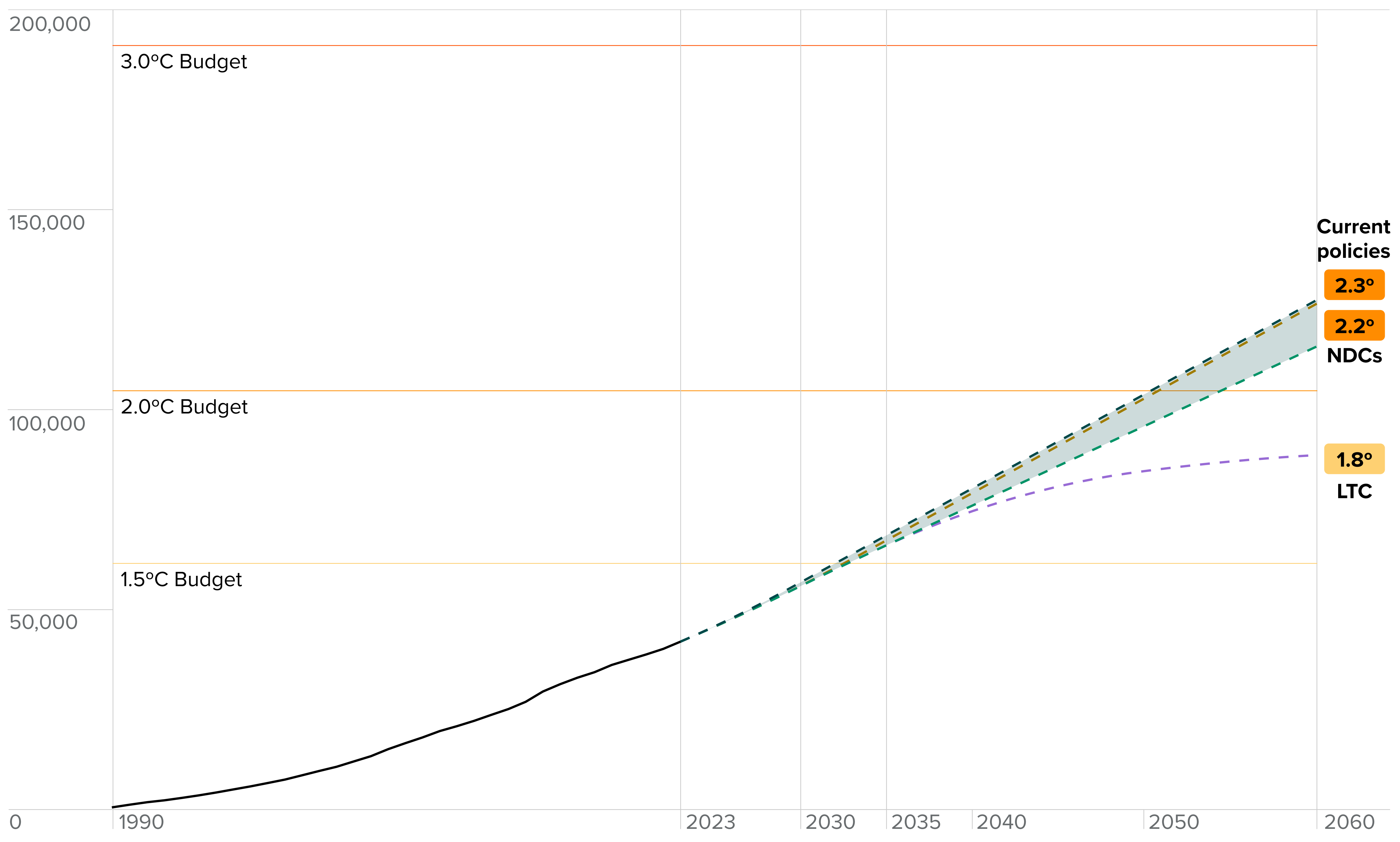
On track to meet 2030 target

We project that by 2030, Indonesia's current policies will result in the country meeting its NDC and come in 1% below the minimum of its NDC range (or 31 $MtCO_2e$). This would result in Indonesia surpassing its 1.5°C emissions budget by 2033.

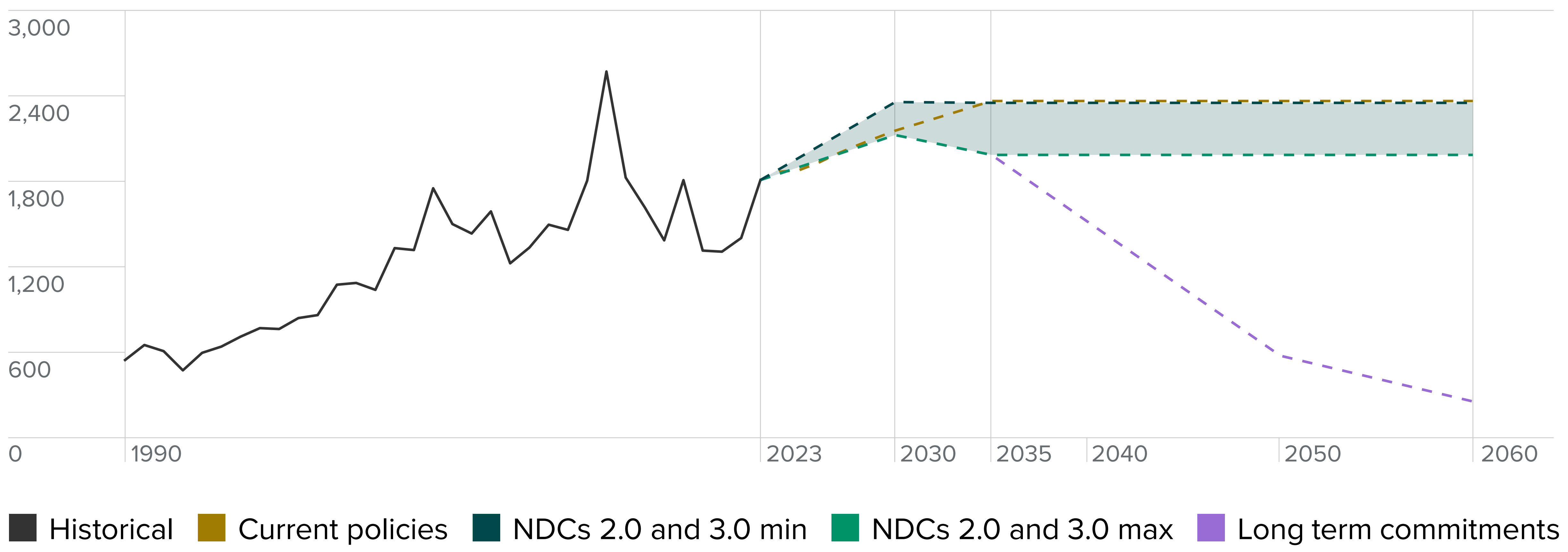
Projected annual decarbonisation rates



Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Historical and projected annual GHG emissions ($MtCO_2e$)



Indonesia

Policies overview

National adaptation plan[4] ✔

Regular published risk assessments[5]	✔
Monitoring and evaluating report	✔
Part of a sovereign catastrophe risk pool	✖

Commited to fossil fuel subsidies phase out ✖

Annual amount spent on explicit fossil fuel subsidies as % of GDP[3]	3.41% of GDP[3]

Carbon pricing system[1] ✔

% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	24% ✖
Carbon price ($/t$CO_2$e) Aligned with the global carbon price corridor[2]	0.72 ✖

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[8]	1.09	14th
Solar[7]	10.58	15th
Hydroelectric[10]	12.71	16th
Geothermal[9]	2.25	N/A

Physical Risk

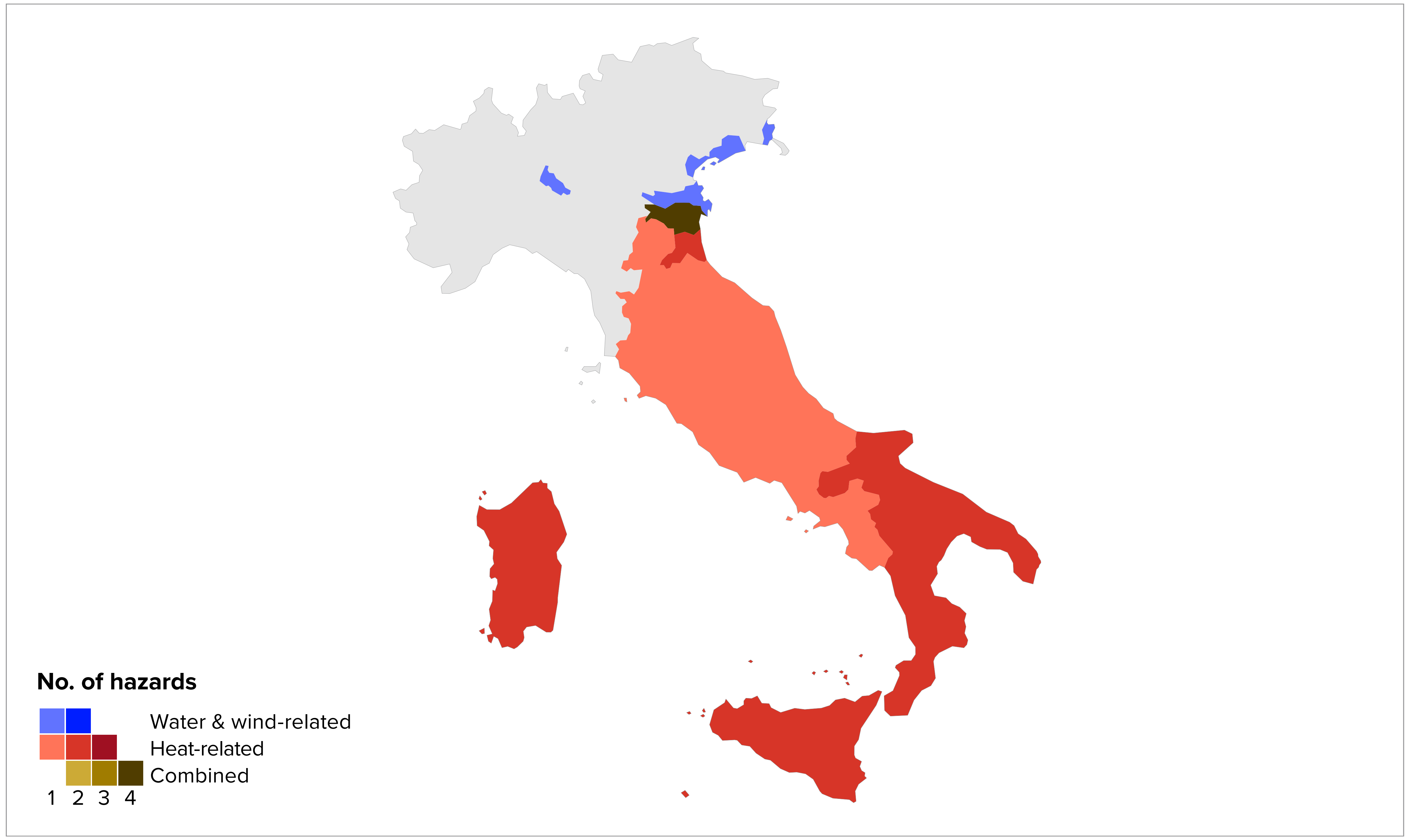
By 2050, Italy will face high exposure to multiple physical hazards, with water stress, heatwaves, and flooding all posing significant threats.

For **water stress**, national-level projections show that over 55% of Italy's population and 46% of its GDP will be exposed to high water stress risk. **Heatwaves** are the second most impactful hazard, affecting 23.2% of the population and 15.4% of GDP. Both hazards are expected to intensify in frequency and severity, especially in southern and coastal regions.

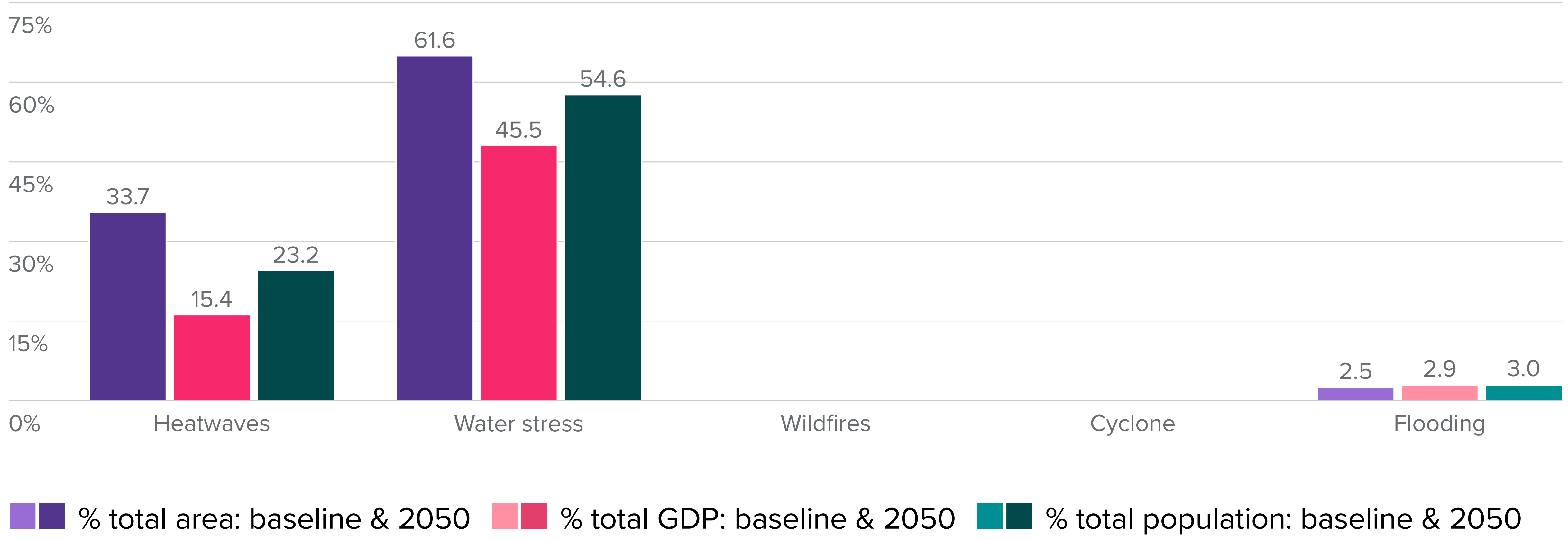
At the regional level, several key economic and population centres are highly exposed to both heat related hazards. Rome, Italy's capital, stands out with a population of 4.2 million and a GDP of US$205 billion, facing high risk from both heatwaves and water stress. Naples, with nearly 3 million residents and a GDP of US$72 billion, is similarly vulnerable. Other notable regions exposed to both hazards include Bari, Palermo, and Catania, each with over a million residents.

Flooding, while less widespread, still threatens 3% of the population and 2.9% of GDP, particularly in low-lying coastal or riverine areas. The historic city of Venice – renowned for flooding – is projected to see a significant flooding events increase by about 30% compared with the baseline period. Regions along the Po River basin, with a total population of 800,000 and US$25 billion in GDP, are also highly exposed.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



Italy

The EU has signalled an NDC3.0 of 66.25-72.5% below 1990 emission levels.

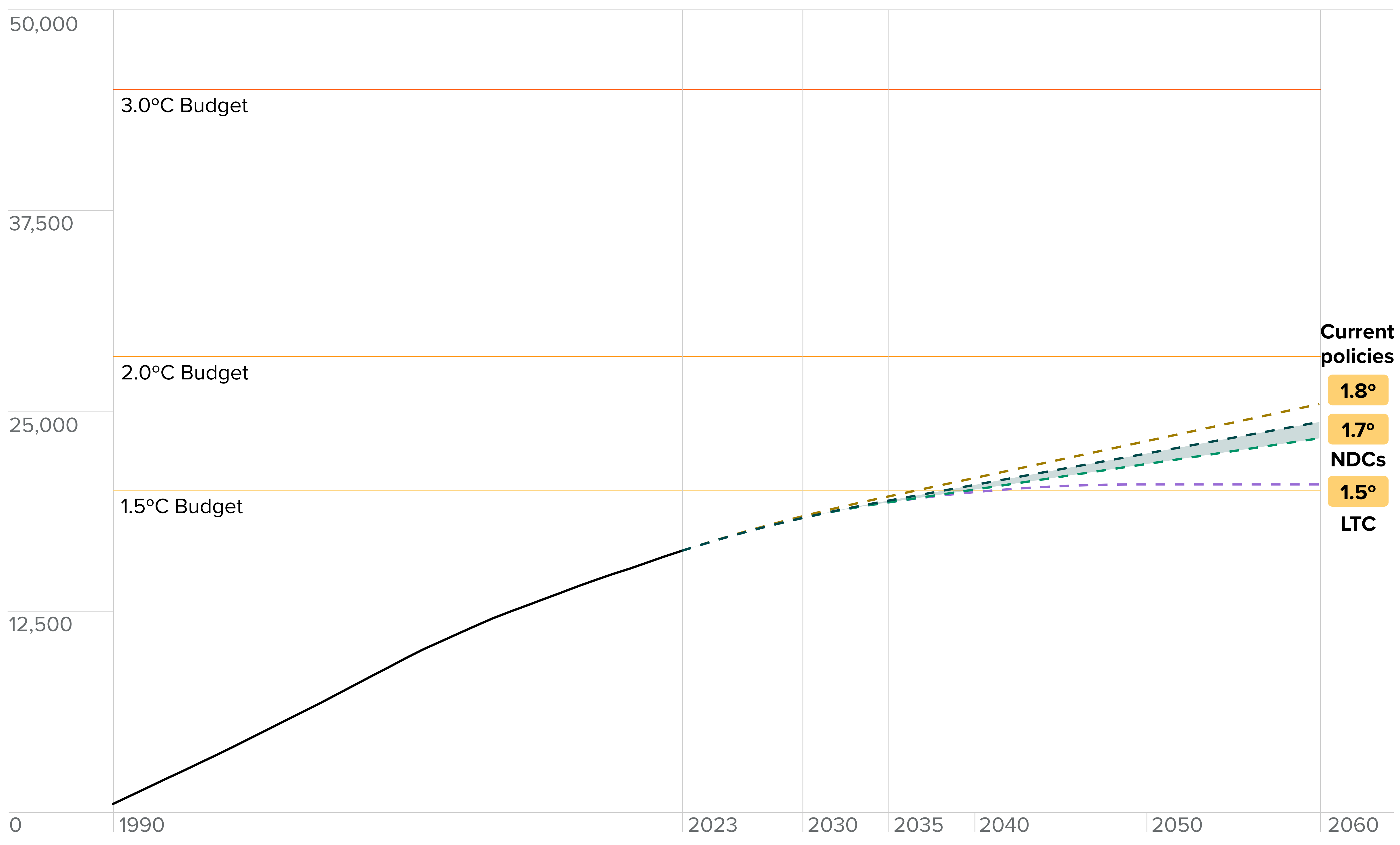
For Italy, we estimate this to be 160-196 $MtCO_2e$ by 2035, aligning with a 1.8-1.9°C pathway.

Current policy alignment

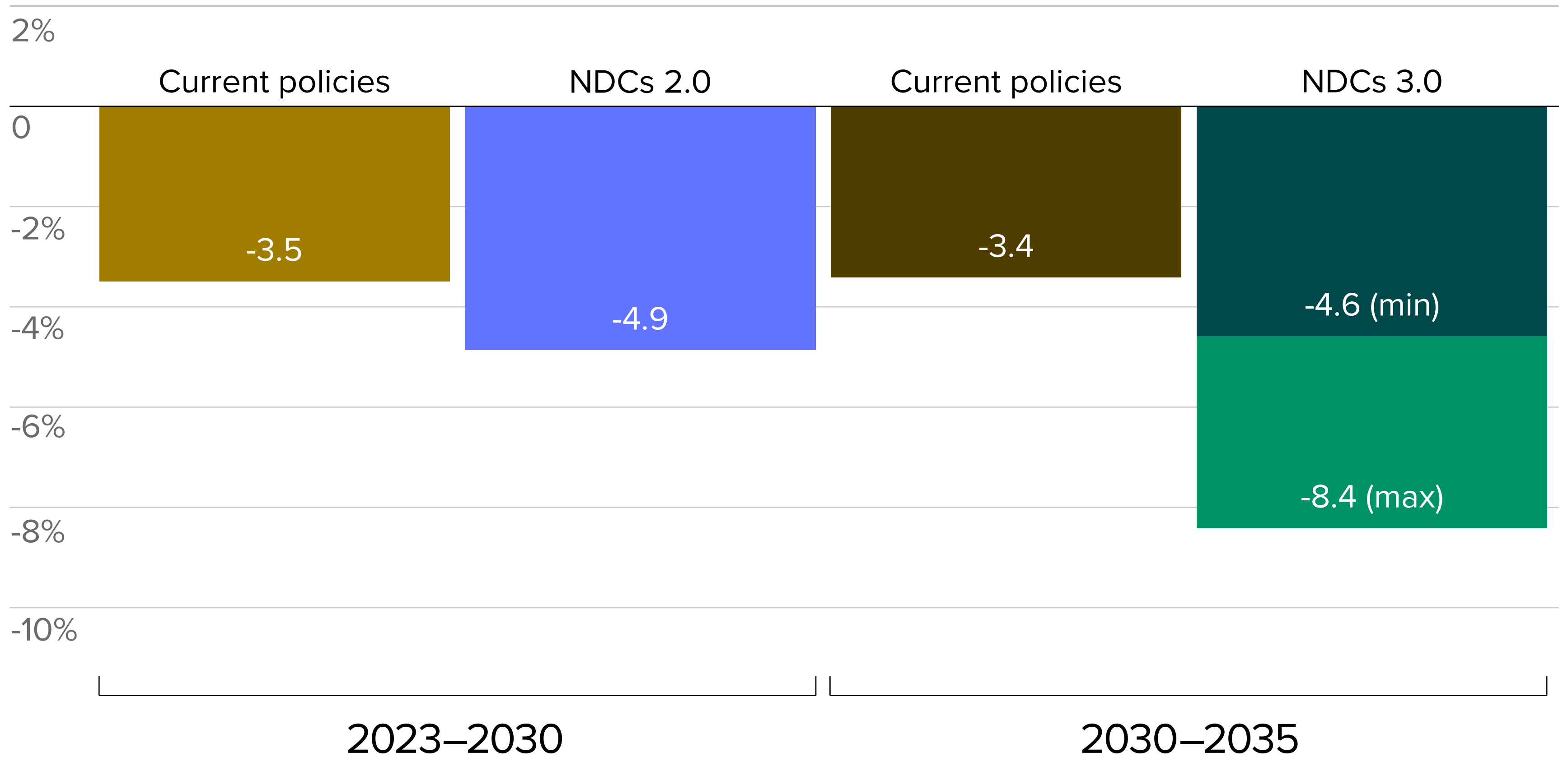
On track to meet 2030 target

We project that by 2030, Italy's current policies will result in the country overshooting its NDC by 11% (or 26 $MtCO_2e$). This would result in Italy surpassing its 1.5°C emissions budget by 2037.

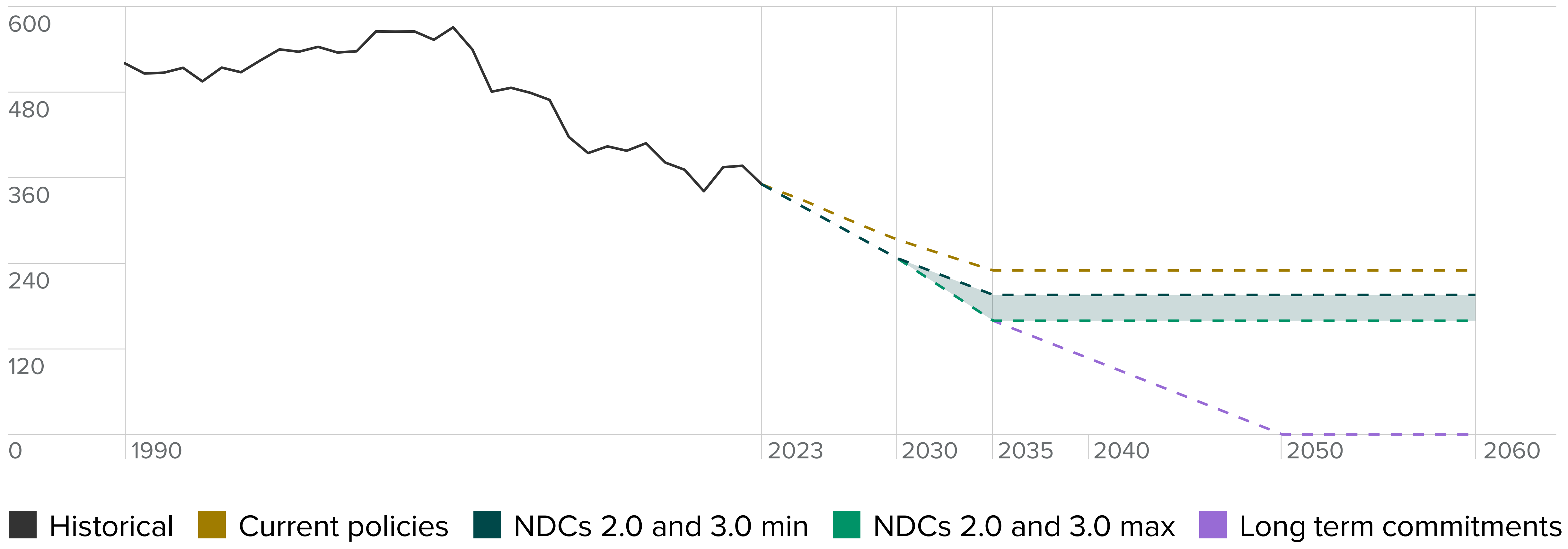
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Italy

Policies overview

✓ National adaptation plan[4]

Regular published risk assessments[5]	✓
Monitoring and evaluating report	✗
Part of a sovereign catastrophe risk pool	Exempt

✓ Commited to fossil fuel subsidies phase out[2]

Annual amount spent on explicit fossil fuel subsidies as % of GDP	0.18% GDP[3]

✓ Carbon pricing system[1]

% of GHG emissions covered by carbon price	40%
Covers at least 50% of national GHG emissions	✗
Carbon price ($/t$CO_2$e)	70.37
Aligned with the global carbon price corridor[2]	✓

Climate finance

3-year average climate finance contribution as a % of GDP	0.04%[6]
Proportional share of $100 billion global climate finance commitment[7]	✗
Targeted level of international climate finance contribution as a % of GDP	0.06%[8]
Target to increase global climate finance contributions	✓

Energy opportunity

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[10]	19.45	7th
Solar[9]	1.77	16th
Hydroelectric[12]	0.16	17th
Geothermal[11]	0	N/A

Japan

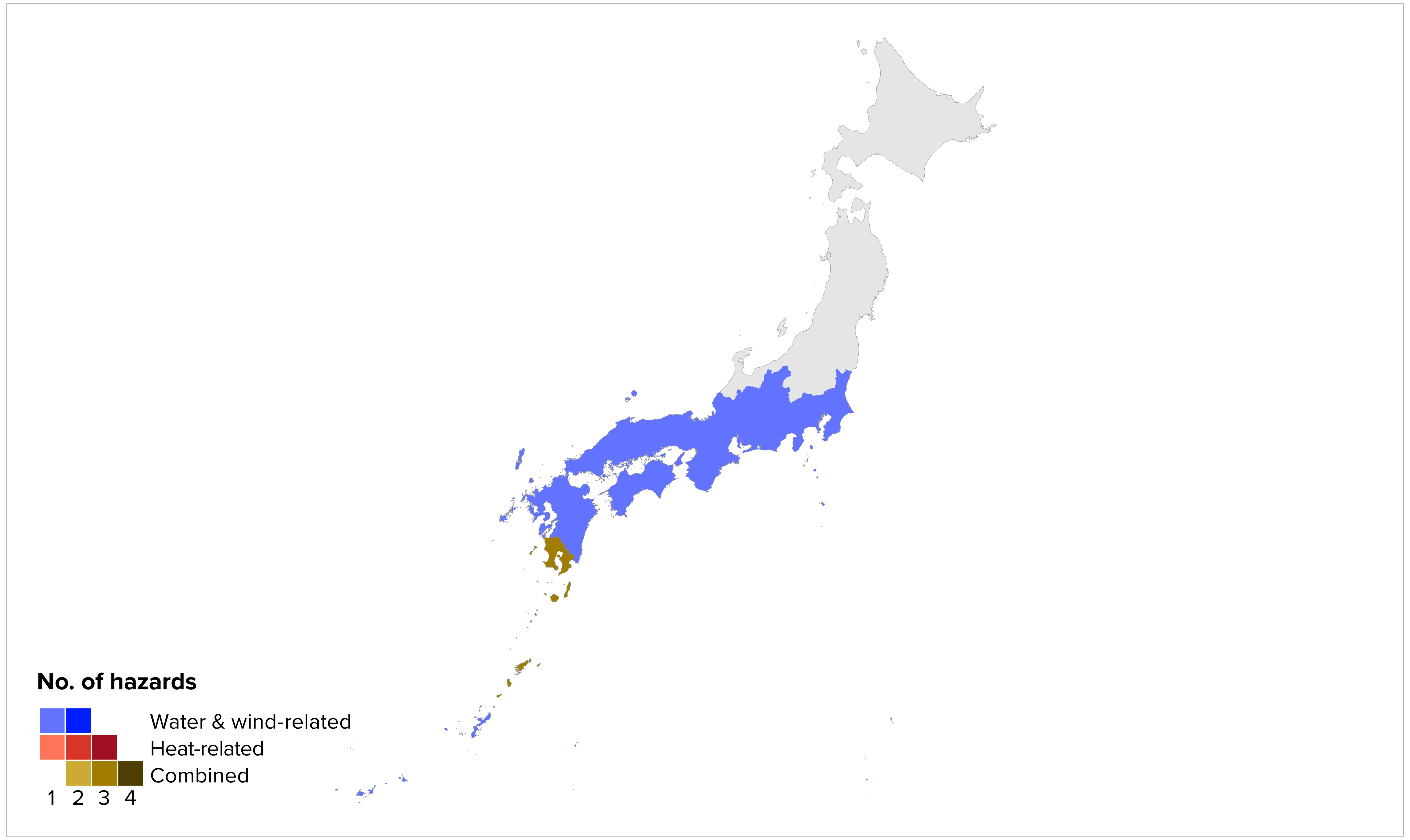
Physical Risk

By 2050, Japan is projected to face a dramatic increase in exposure to **cyclones** (locally called typhoons), making it one of the most exposed countries in our physical risk analysis. The share of the population at high risk from typhoons is expected to surge from 4.6% to over 82%, while GDP exposure rises from 3.5% to nearly 84%. This sharp escalation reflects the intensifying impact of these destructive storms on Japan's densely populated coastal regions.

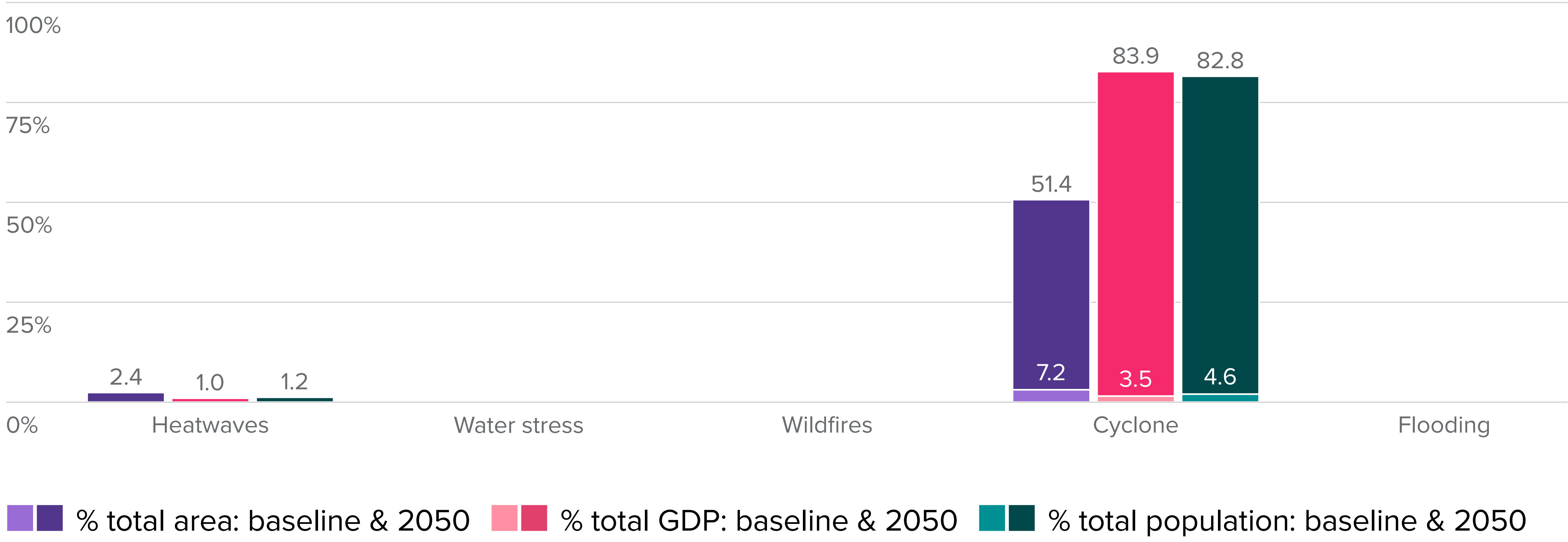
Regions most affected include Japan's economic and demographic powerhouses – Tokyo, Osaka, Kanagawa, Aichi, and Fukuoka – which combine high GDP and population density with elevated cyclone risk in 2050. Additional vulnerable regions include Chiba, Saitama, Hyōgo, Hiroshima, Shizuoka, and Ibaraki. Their exposure underscores the concentration of risk in urban and coastal zones.

Flooding, water stress, and wildfires remain negligible in terms of projected national exposure. **Heatwaves** show a modest increase, with population exposure rising to 1.2% and GDP to 1%, indicating wider spread but limited overall impact on population and economic output. Kagoshima, with a population of 1.6 million and US$42 billion in GDP, faces compounding high exposure to both cyclones and heatwaves.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



Japan

Japan has set an NDC3.0 of 60% below 2013 emission levels.

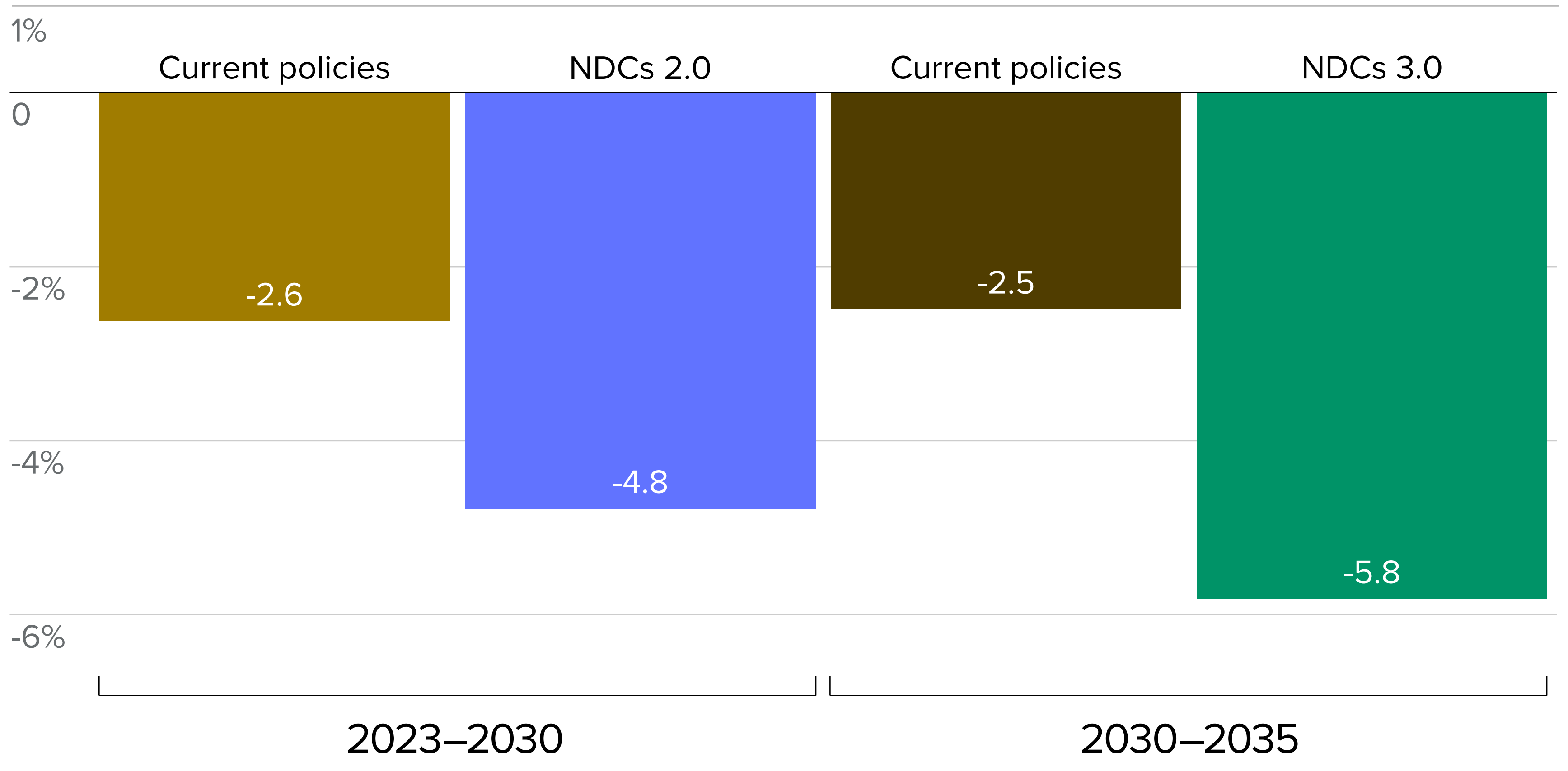
We estimate this to be 535 $MtCO_2e$ by 2035, aligning with a 1.9°C pathway.

Current policy alignment

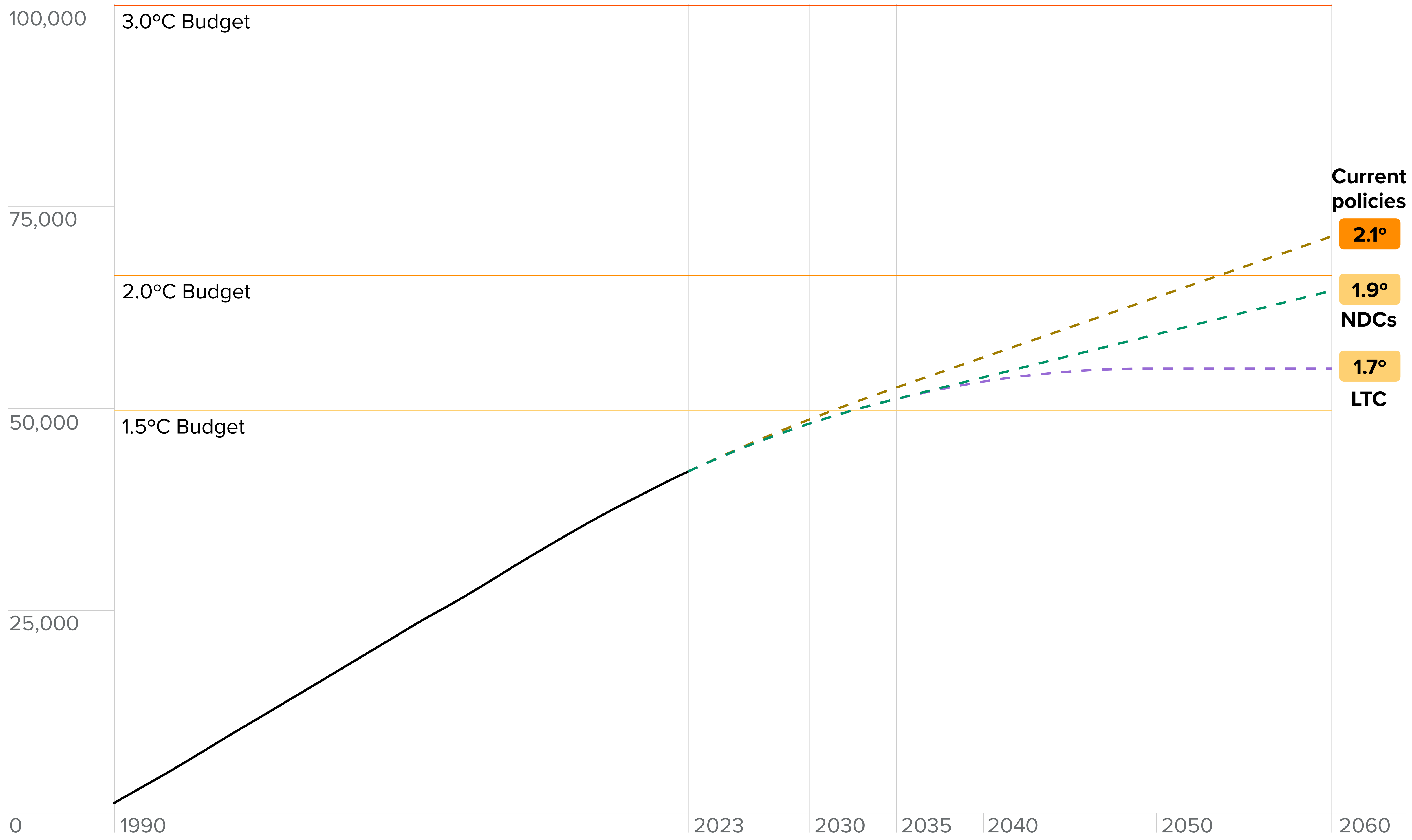
On track to meet 2030 target

We project that by 2030, Japan's current policies will result in the country overshooting its NDC by 17% (or 126 $MtCO_2e$). This would result in Japan surpassing its 1.5°C emissions budget by 2032.

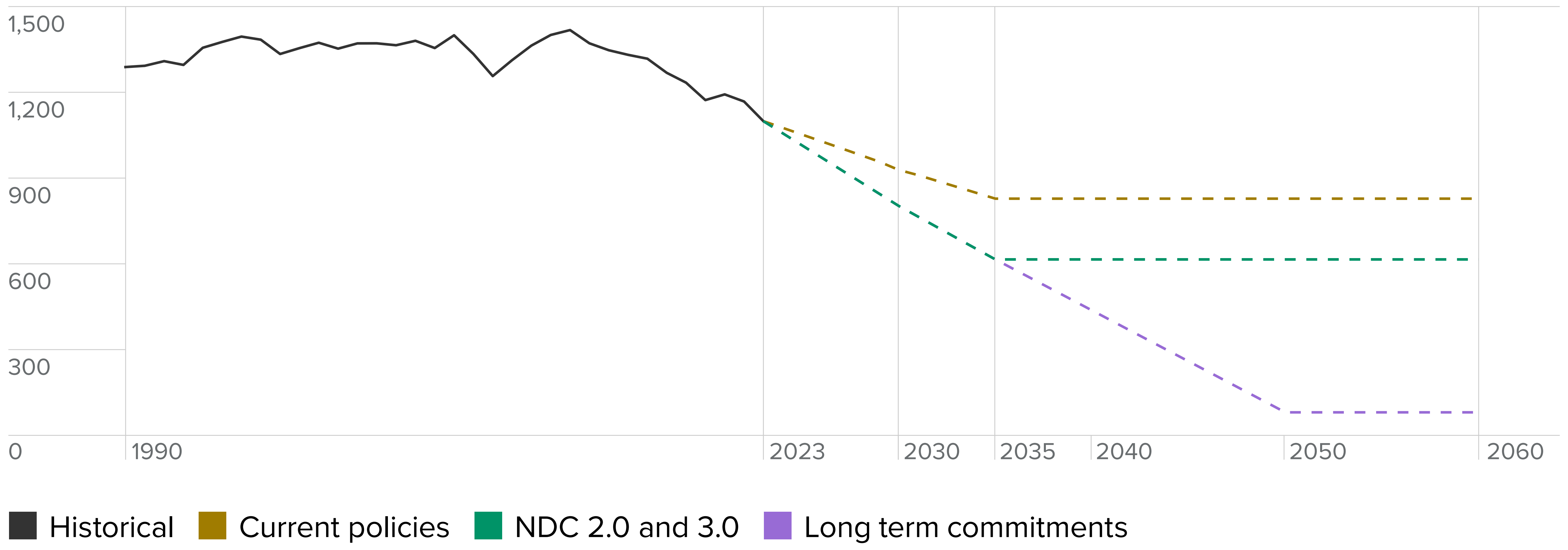
Projected annual decarbonisation rates



Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Historical and projected annual GHG emissions ($MtCO_2e$)



Japan

Policies overview

✓ National adaptation plan[4]

Regular published risk assessments[5]	✓
Monitoring and evaluating report[6]	✓
Part of a sovereign catastrophe risk pool[7]	✓

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies	0.45% of GDP[3]

✓ Carbon pricing system[1]

% of GHG emissions covered by carbon price	80%
Covers at least 50% of national GHG emissions	✓
Carbon price ($/t$CO_2$e)	1.93
Aligned with the global carbon price corridor[2]	✗

Climate finance

3-year average climate finance contribution as a % of GDP	0.23%[8]
Proportional share of $100 billion global climate finance commitment[9]	✓
Targeted level of international climate finance contribution as a % of GDP	N/A
Target to increase global climate finance contributions	✗

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[11]	11.29	8th
Solar[10]	0.39	19th
Hydroelectric[13]	0.14	16th
Geothermal[12]	0	N/A

Mexico

Mexico has not yet set an NDC3.0.

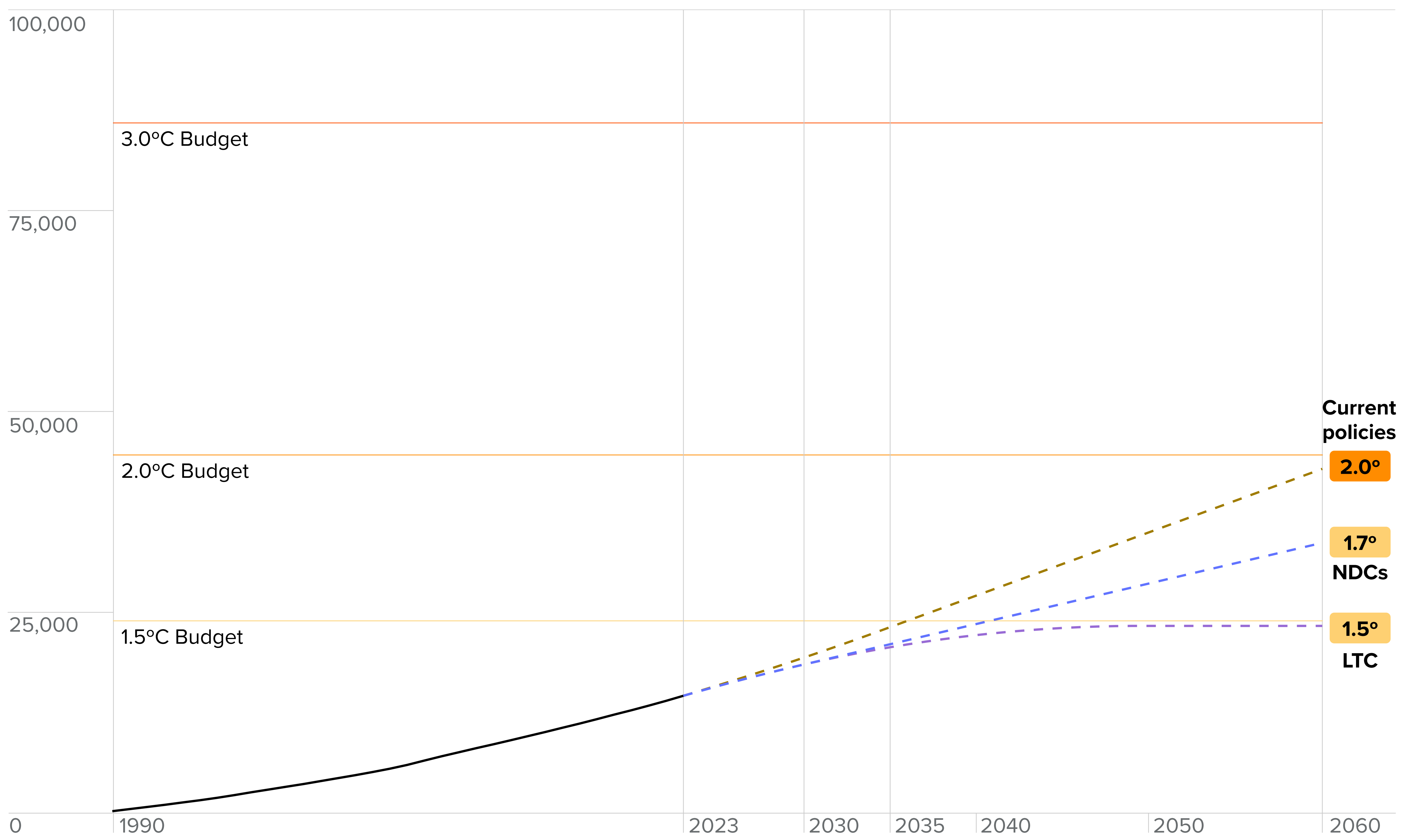
We estimate its unconditional 2030 target of 35% below business-as-usual aligns with a 1.7°C pathway.

Current policy alignment

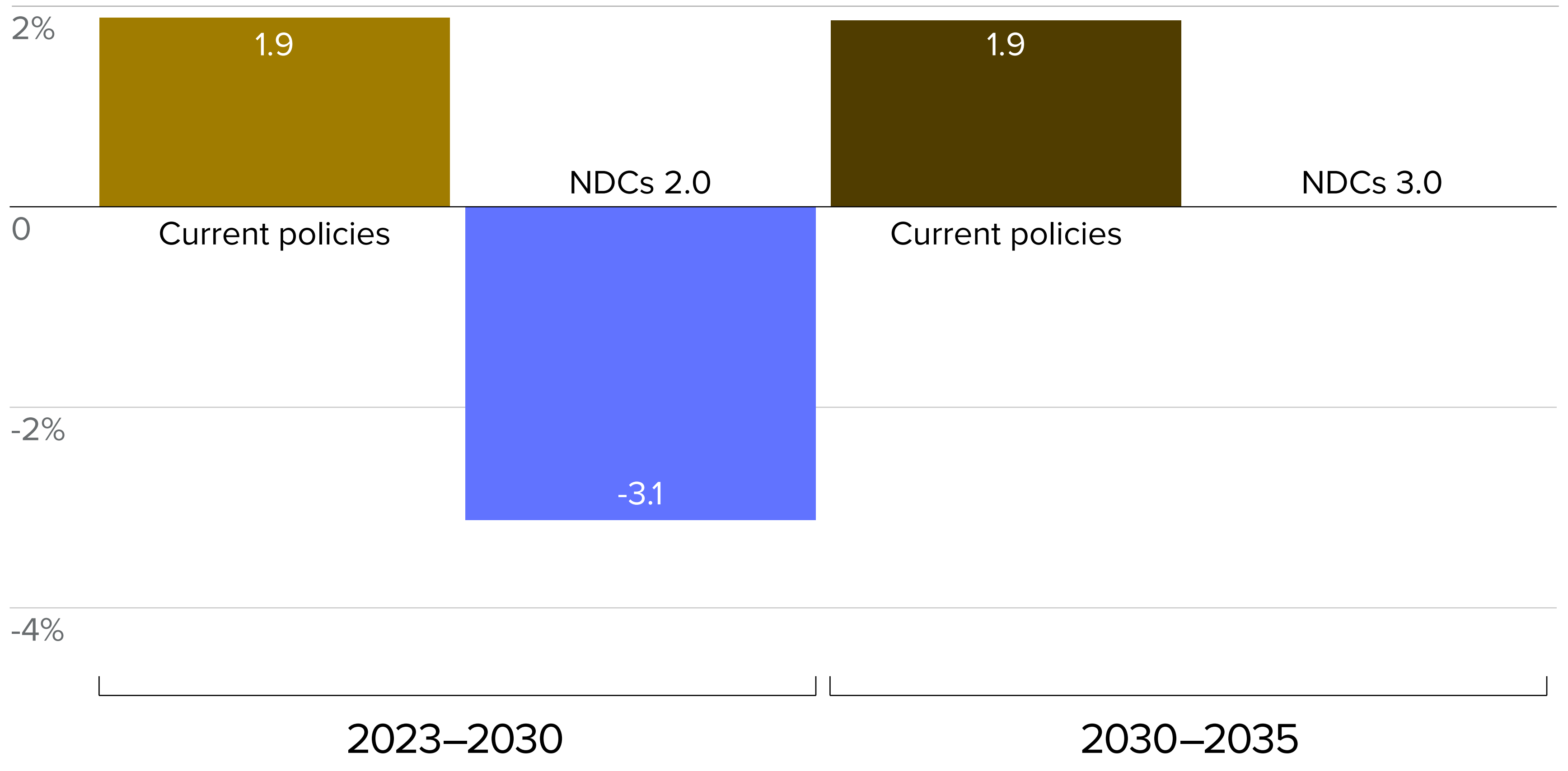
On track to meet 2030 target ✖

We project that by 2030, Mexico's current policies will result in the country overshooting its NDC by 42% (or 214 $MtCO_2e$). This would result in Mexico surpassing its 1.5°C emissions budget by 2036.

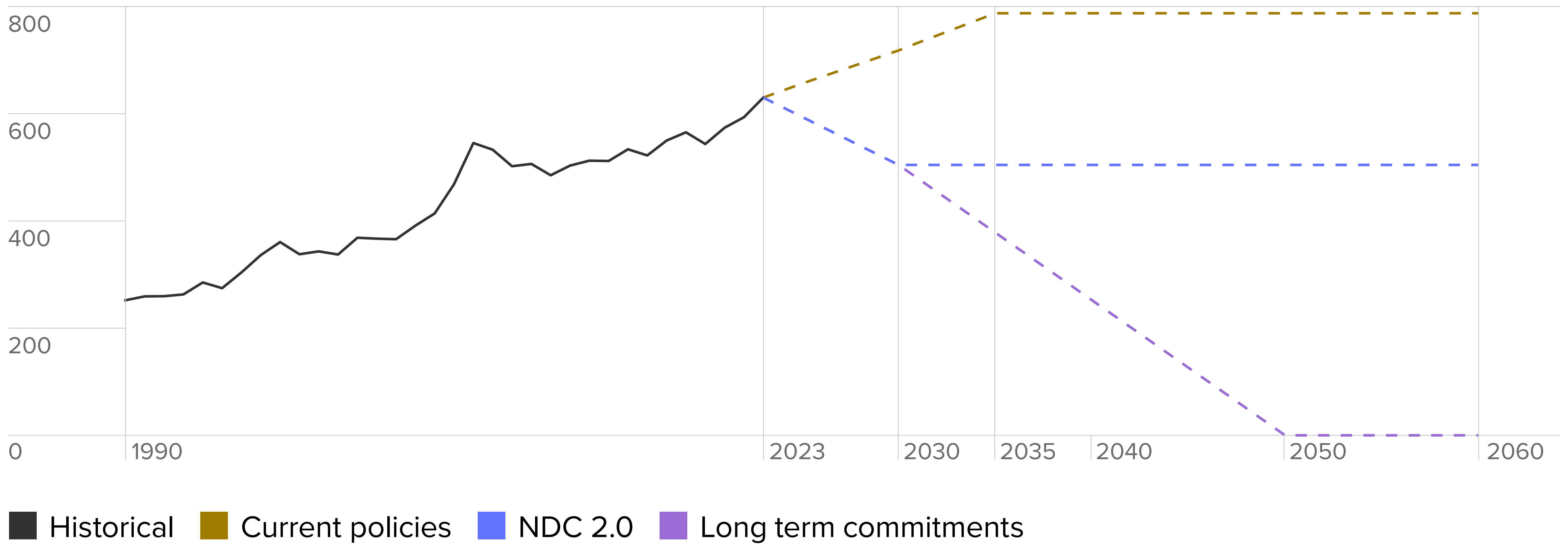
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Mexico

Policies overview

✗ National adaptation plan

Regular published risk assessments	✗
Monitoring and evaluating report	✗
Part of a sovereign catastrophe risk pool	✗

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies	0.75% of GDP[4]

✓ Carbon pricing system[1,2]

% of GHG emissions covered by carbon price	Tax	29%
	ETS	36%
Covers at least 50% of national GHG emissions	Tax	✗
	ETS	✗
Carbon price ($/t$CO_2$e)	Tax	4.31[3]
	ETS	0
Aligned with the global carbon price corridor	Tax	✗
	ETS	✗

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[6]	1.45	17th
Solar[5]	11.30	7th
Hydroelectric[8]	0.31	15th
Geothermal[7]	0	N/A

Russia

Russia has set an NDC3.0 of 65-67% below 1990 emission levels.

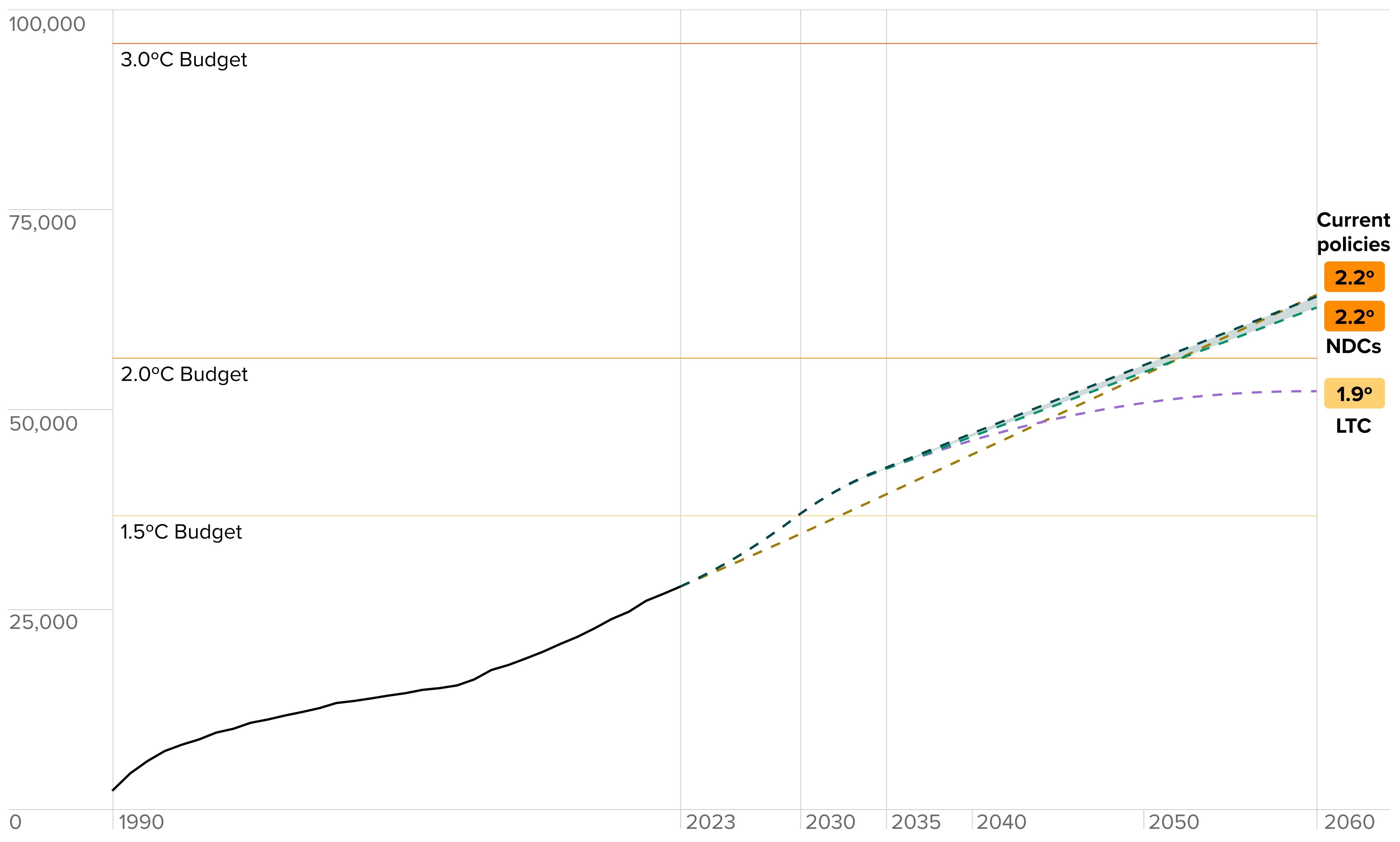
We estimate this to be 805-854 $MtCO_2e$ by 2035, aligning with a 2.2°C pathway.

Current policy alignment

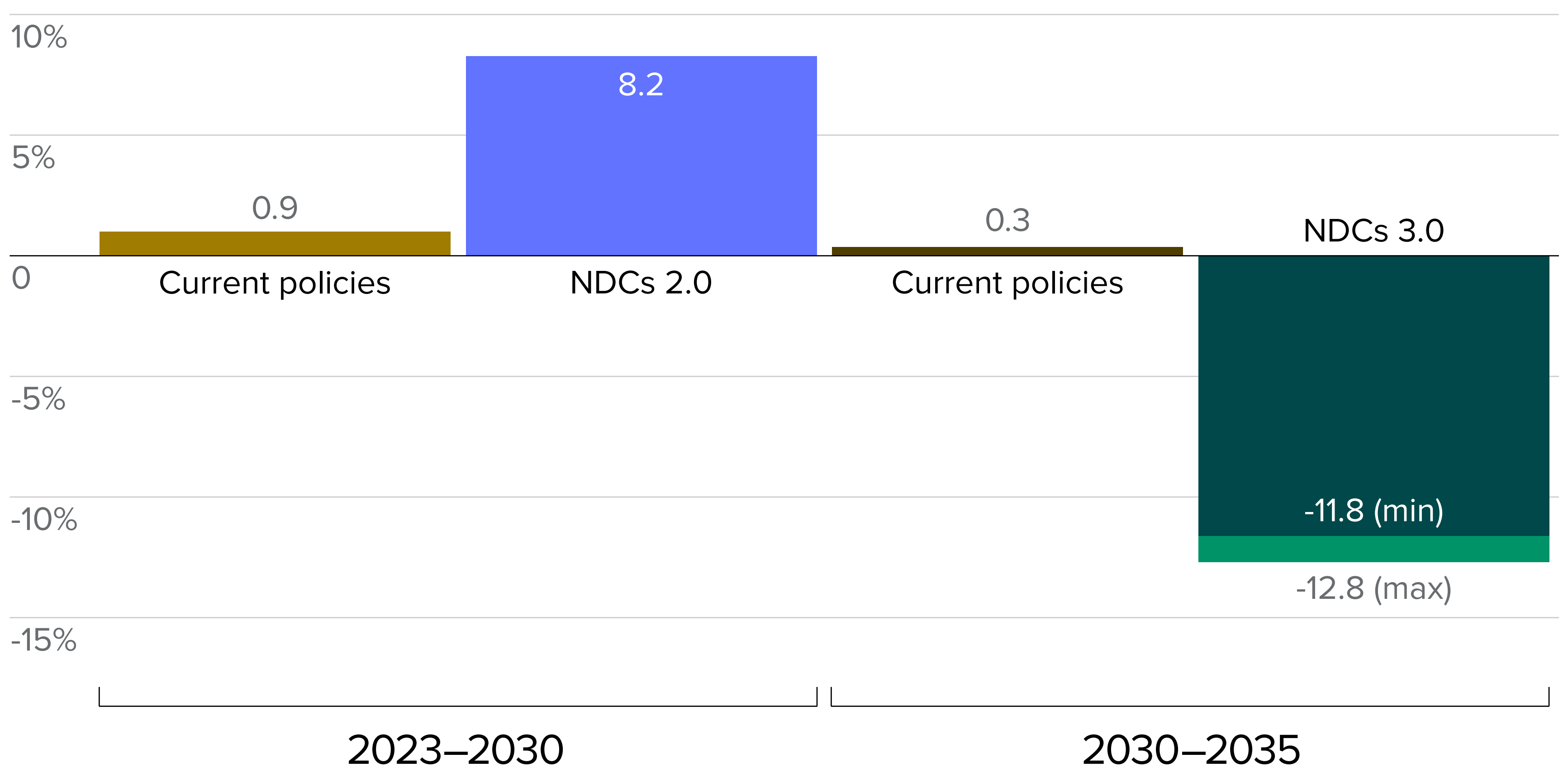
On track to meet 2030 target

We project that by 2030, Russia's current policies will result in the country meeting its NDC and come in 39% below it (or 619 $MtCO_2e$). This would result in Russia surpassing its 1.5°C emissions budget by 2033.

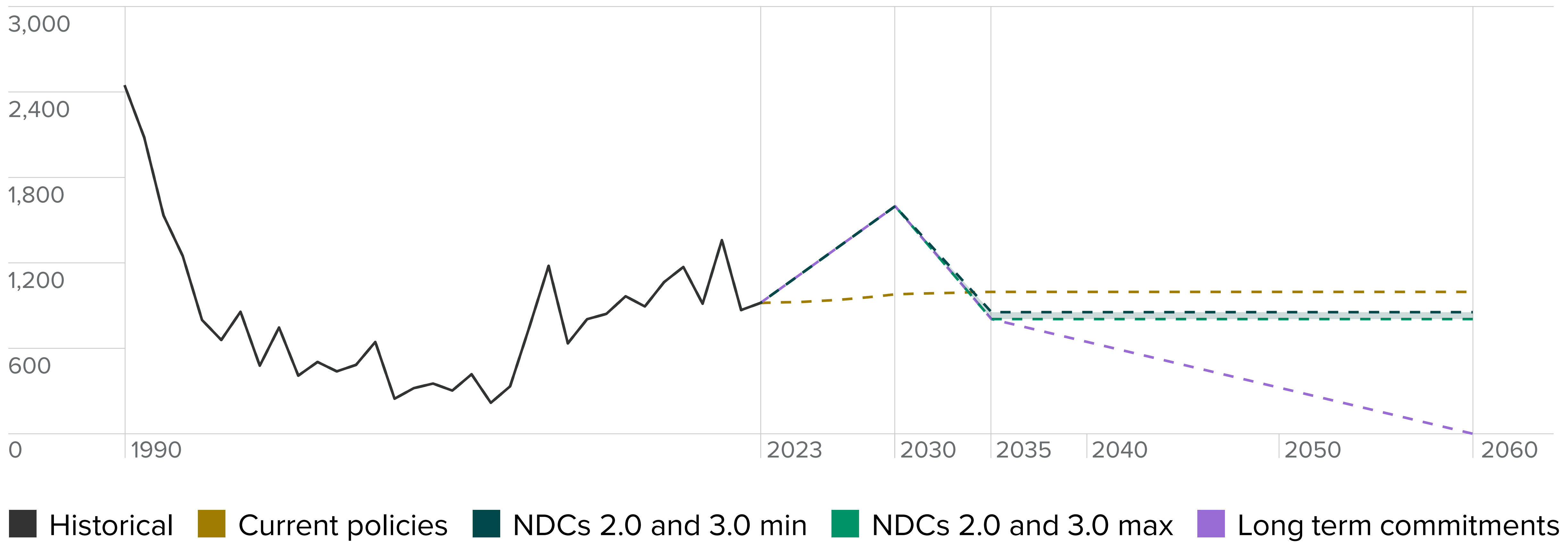
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Russia

Policies overview

National adaptation plan[2]	✔
Regular published risk assessments[3]	✔
Monitoring and evaluating report	✘
Part of a sovereign catastrophe risk pool	✘

Commited to fossil fuel subsidies phase out	✘
Annual amount spent on explicit fossil fuel subsidies as % of GDP	2.92% of GDP[1]

Carbon pricing system	✘

Climate finance	
3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[5]	0.71	20th
Solar[4]	0.35	20th
Hydroelectric[7]	1.82	20th
Geothermal[6]	0	N/A

Saudi Arabia

Saudi Arabia has not yet set an NDC3.0.

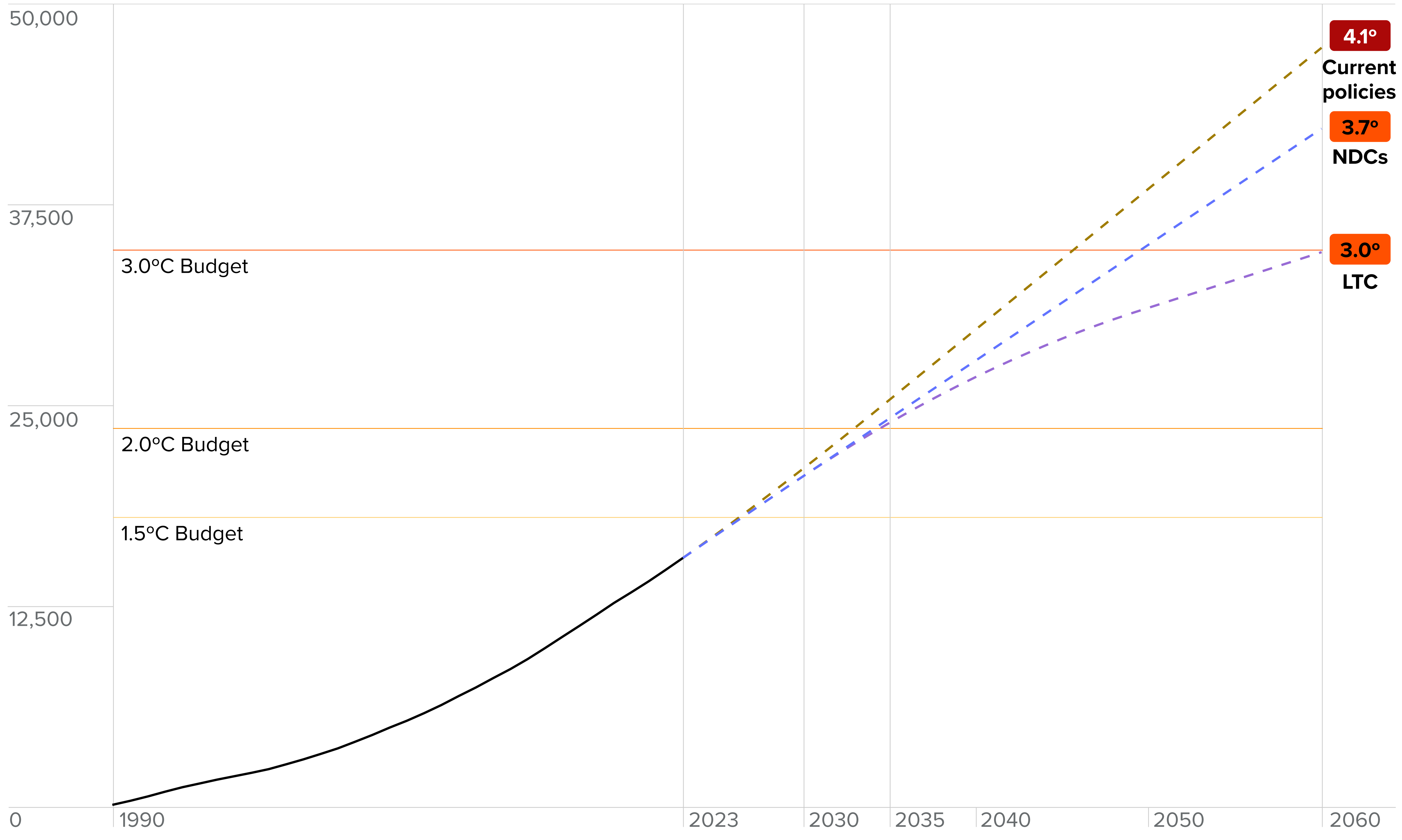
We estimate its target of reducing emissions by 278 $MtCO_2e$ annually by 2030 aligns with a 3.7°C pathway.

Current policy alignment

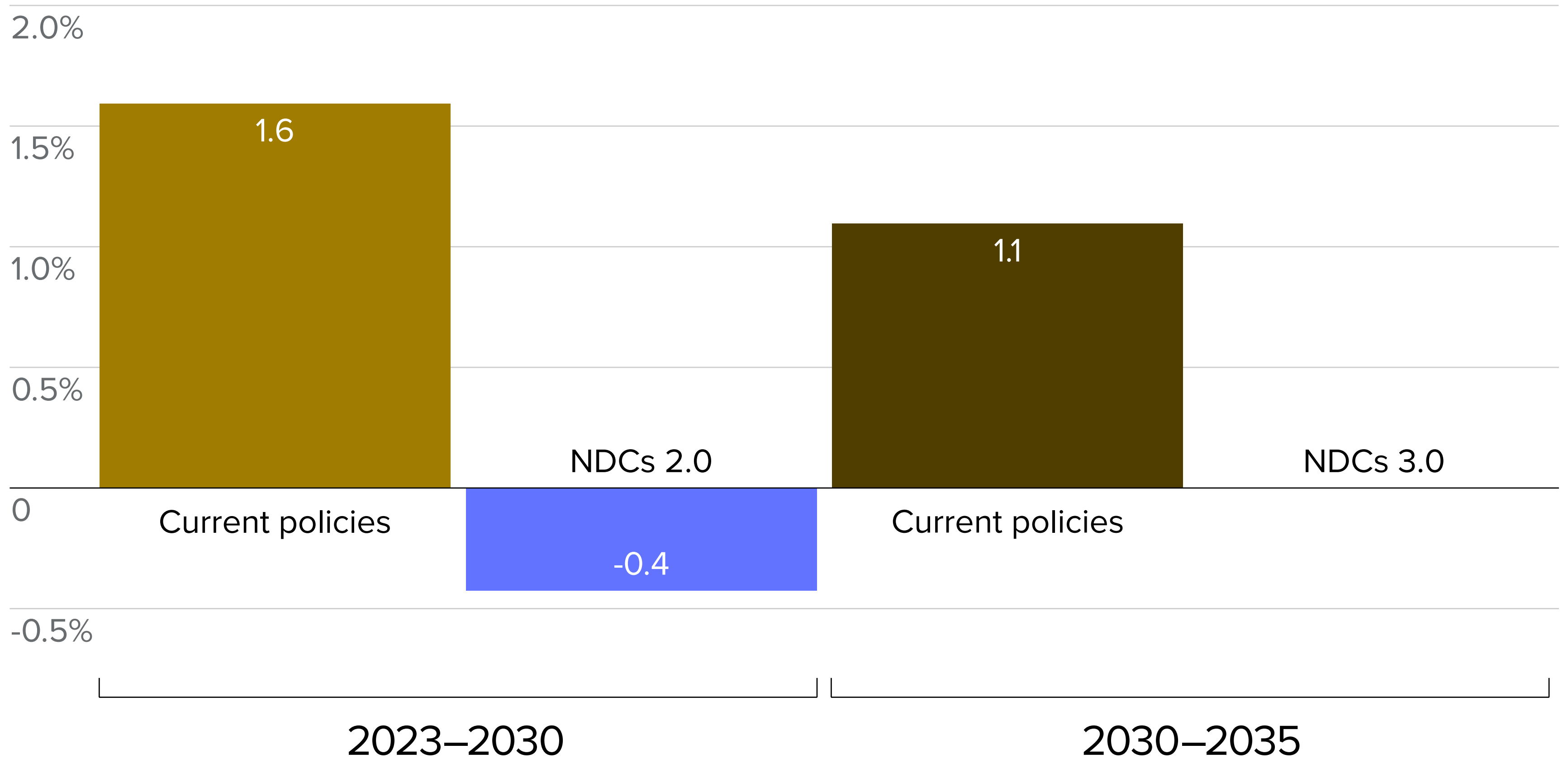
On track to meet 2030 target ✖

We project that by 2030, Saudi Arabia's current policies will result in the country overshooting its NDC by 15% (or 109 $MtCO_2e$). This would result in Saudi Arabia surpassing its 1.5°C emissions budget by 2027.

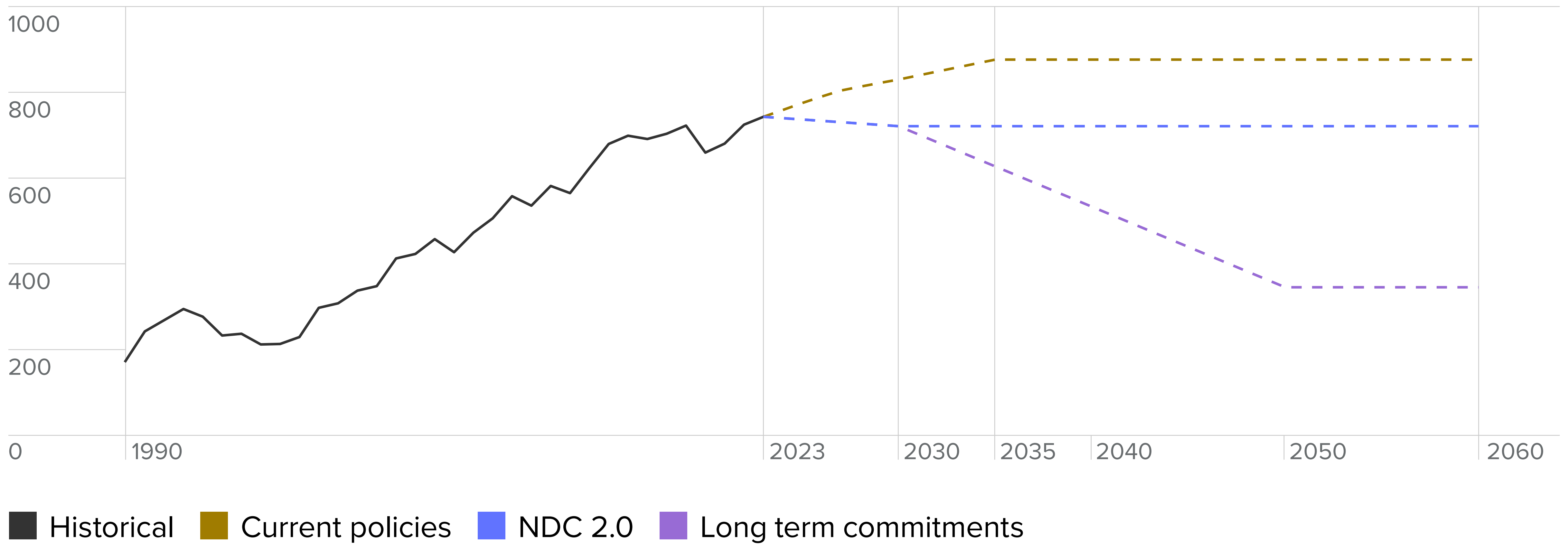
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Saudi Arabia

Policies overview

National adaptation plan[4]

Regular published risk assessments[5]	✗
Monitoring and evaluating report	✗
Part of a sovereign catastrophe risk pool	Exempt

Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies as % of GDP[3]	6.46% of GDP[1]

Carbon pricing system

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[3]	2.80	20th
Solar[2]	17.26	20th
Hydroelectric[5]	0	N/A
Geothermal[4]	0	N/A

South Africa

South Africa has set an NDC 3.0 of 320-380 $MtCO_2e$ in 2030.

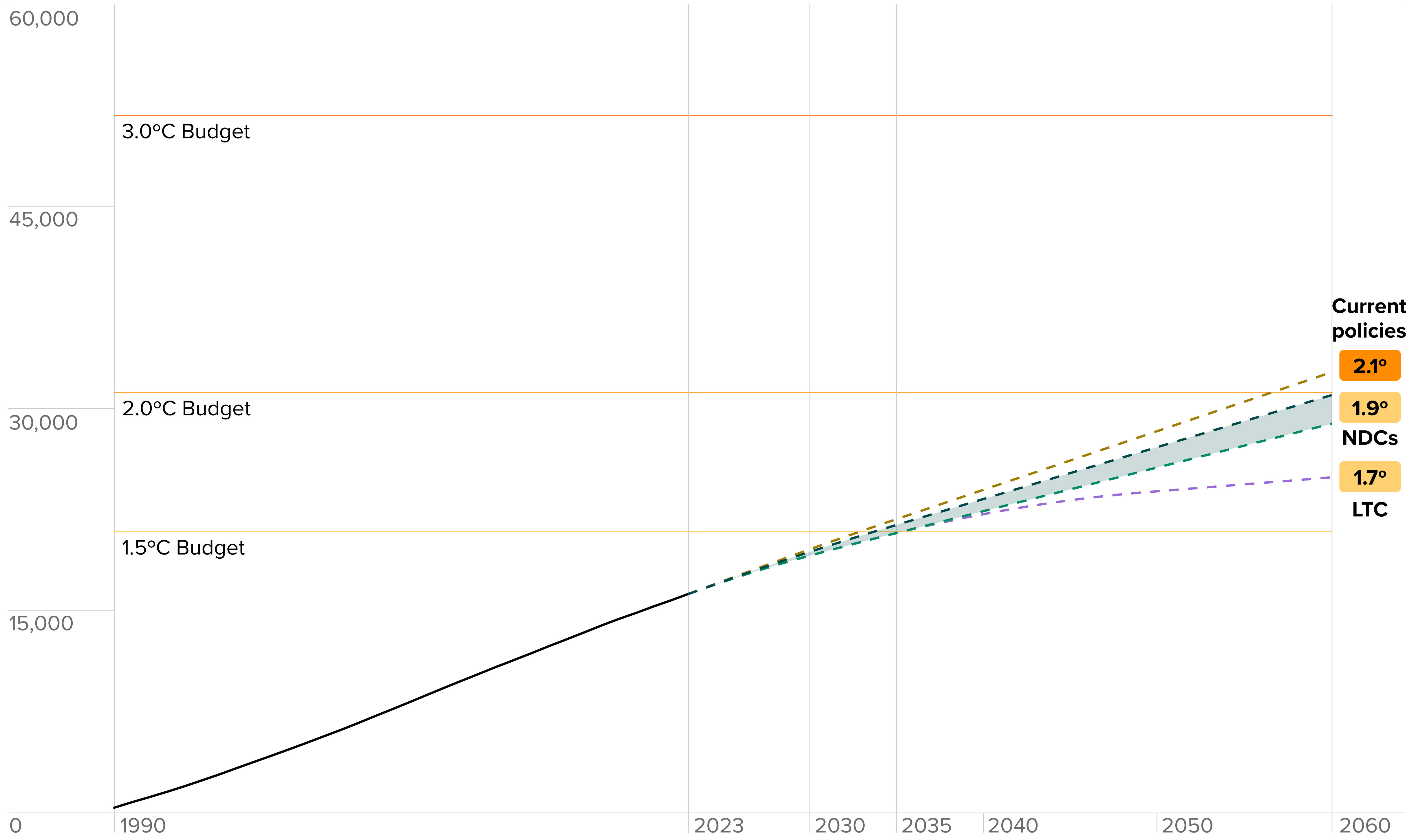
We estimate this aligns with a 1.9-2.0°C pathway.

Current policy alignment

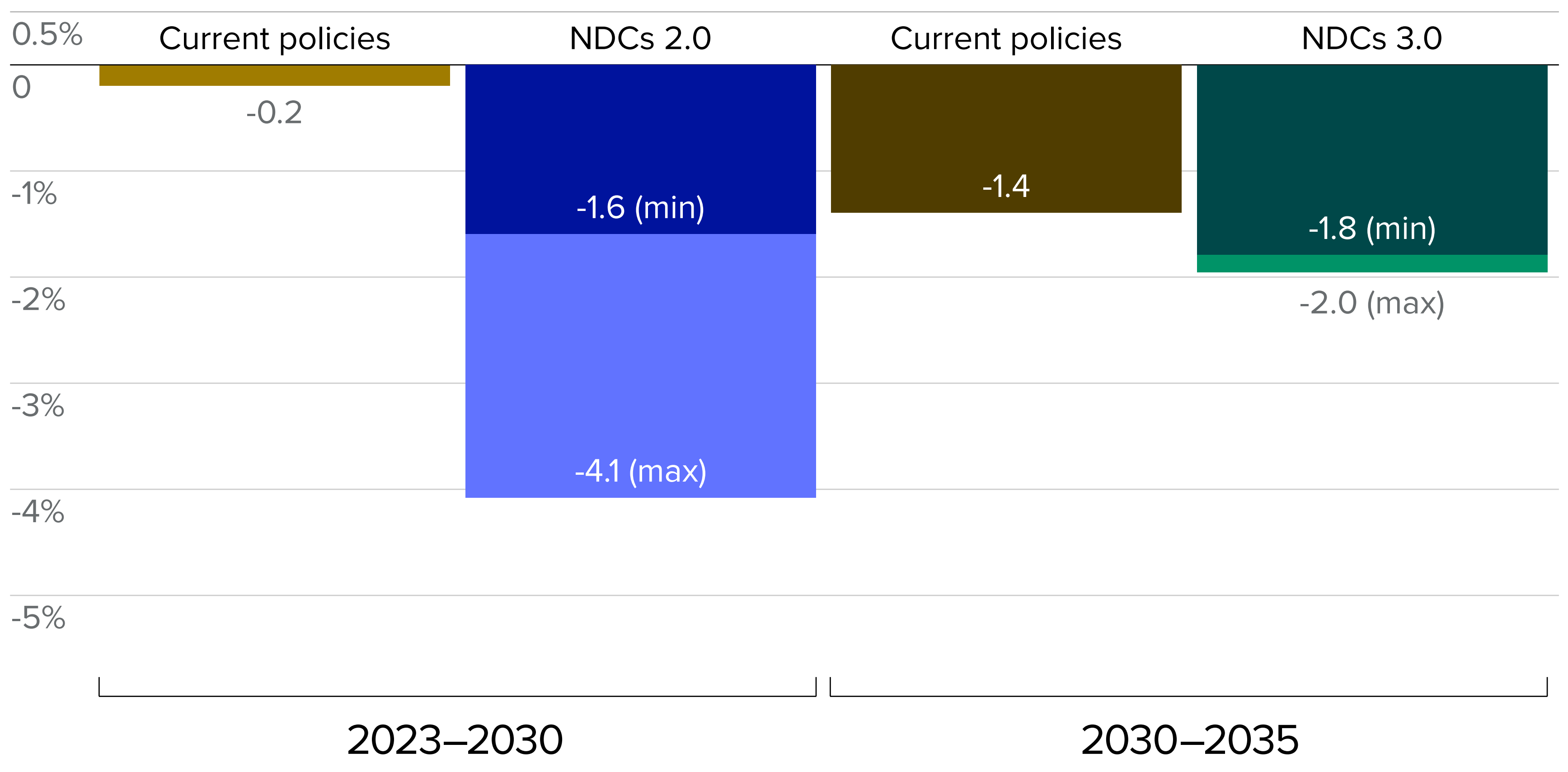
On track to meet 2030 target ⊗

We project that by 2030, South Africa's current policies will result in the country overshooting its NDC by 10-32% (or 43-113 $MtCO_2e$). This would result in South Africa surpassing its 1.5°C emissions budget by 2033.

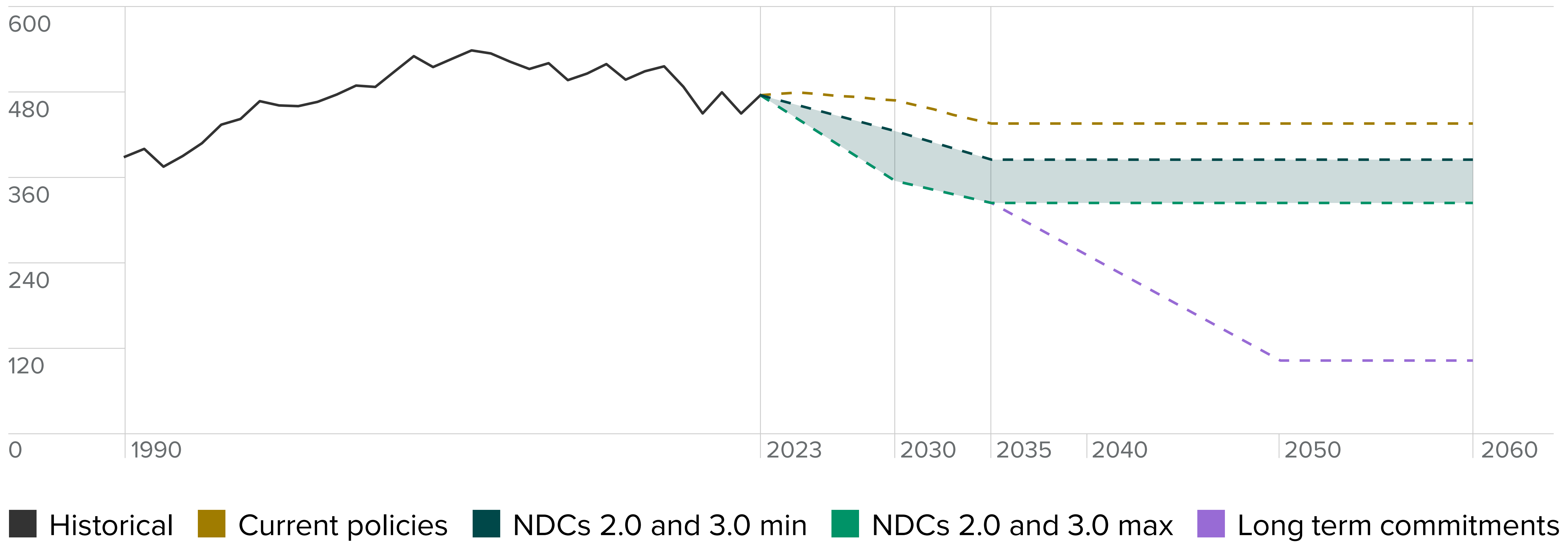
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



South Africa

Policies overview

✔ National adaptation plan[4]

Regular published risk assessments	✘
Monitoring and evaluating report[5]	✔
Part of a sovereign catastrophe risk pool	✘

✘ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies	1.07% of GDP[3]

✔ Carbon pricing system[1]

% of GHG emissions covered by carbon price Covers at least 50% of national GHG emissions	82% ✔
Carbon price ($/tCO$_2$e) Aligned with the global carbon price corridor[2]	12.85 ✘

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[7]	7.43	10th
Solar[6]	19.55	5th
Hydroelectric[9]	3.75	7th
Geothermal[8]	0	N/A

South Korea

South Korea has signalled an NDC3.0 of 60% below 2018 emission levels.

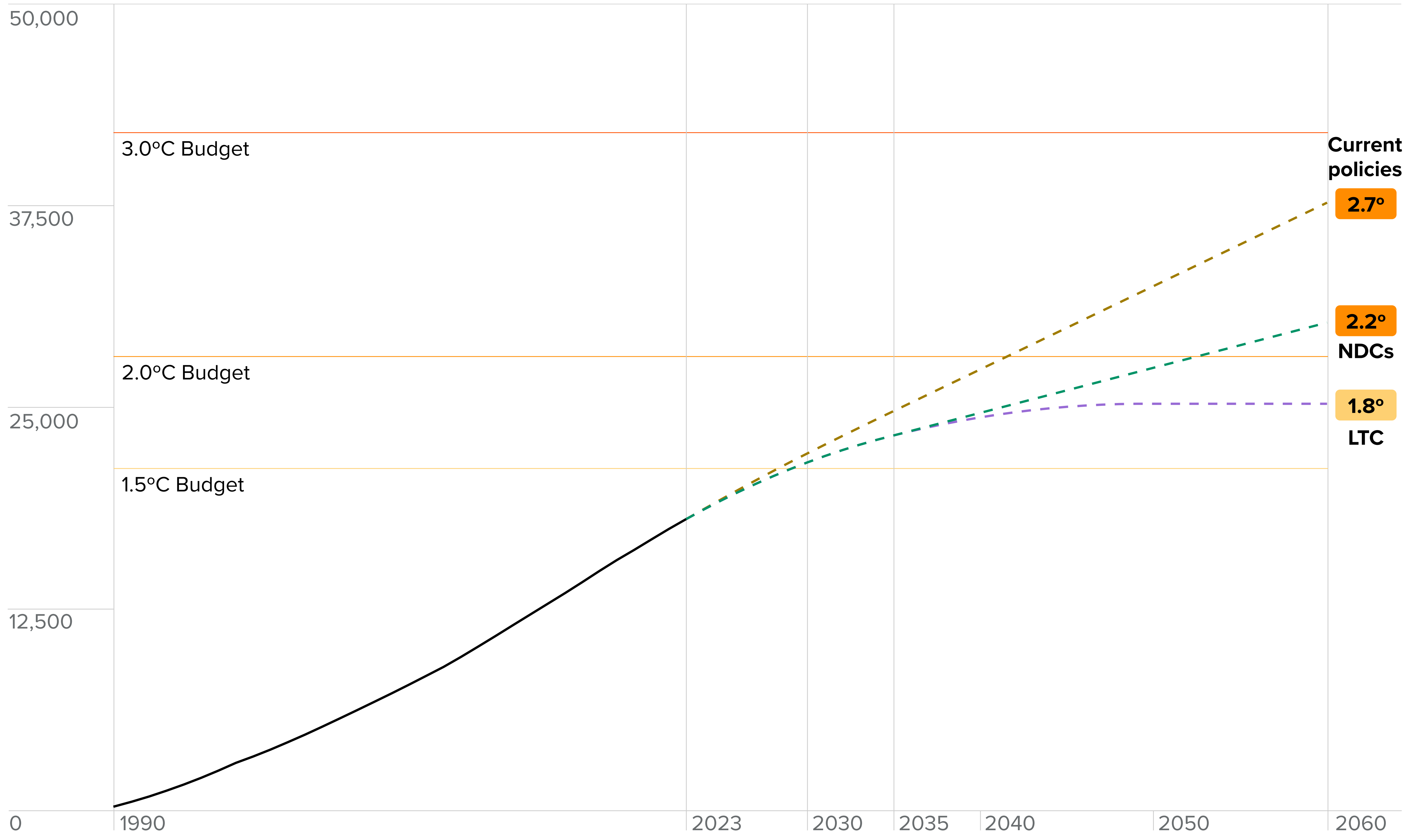
We estimate this to be 279 $MtCO_2e$ by 2035, aligning with a 2.2°C pathway.

Current policy alignment

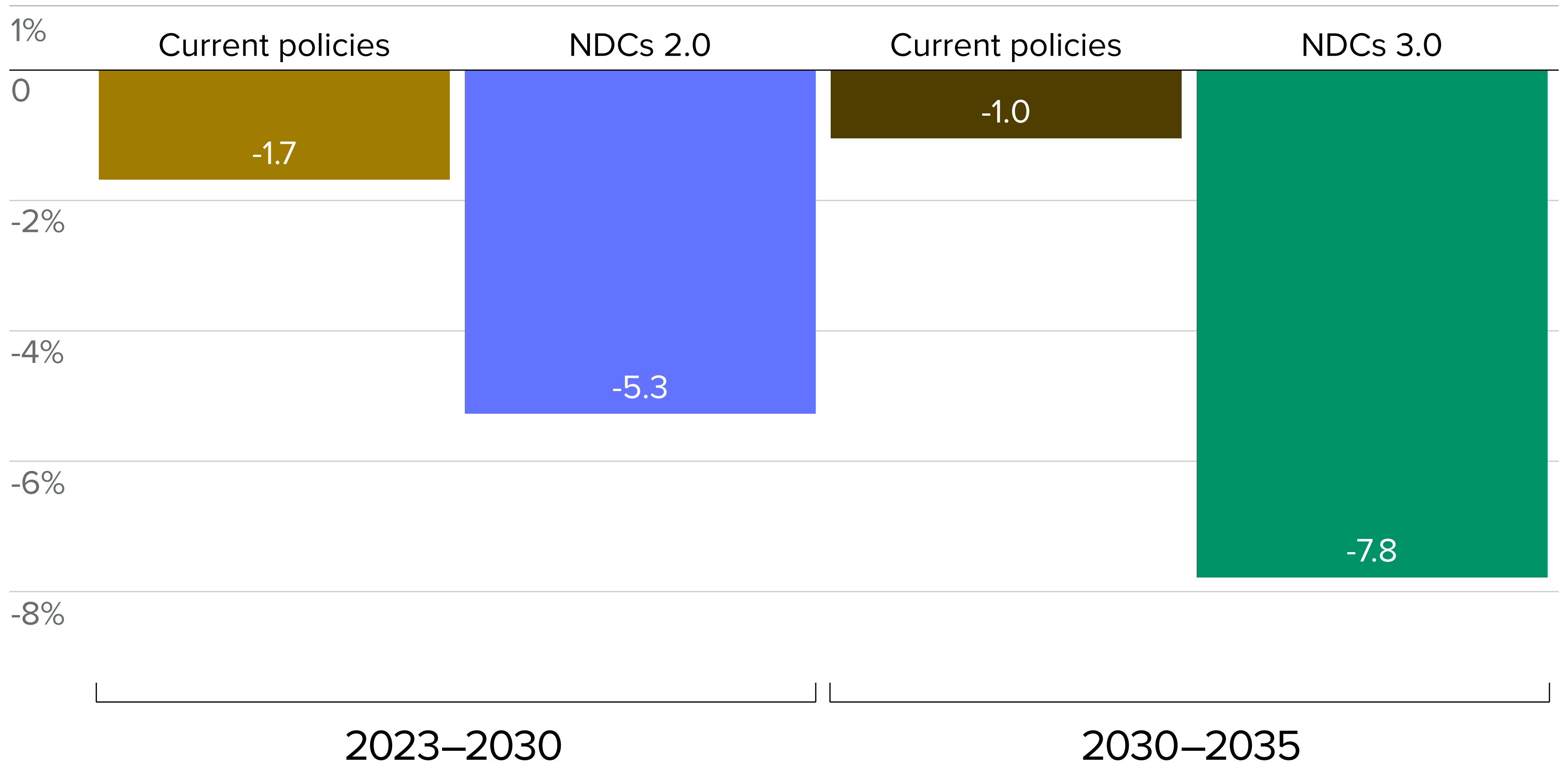
On track to meet 2030 target ✖

We project that by 2030, South Korea's current policies will result in the country overshooting its NDC by 30% (or 125 $MtCO_2e$). This would result in South Korea surpassing its 1.5°C emissions budget by 2029.

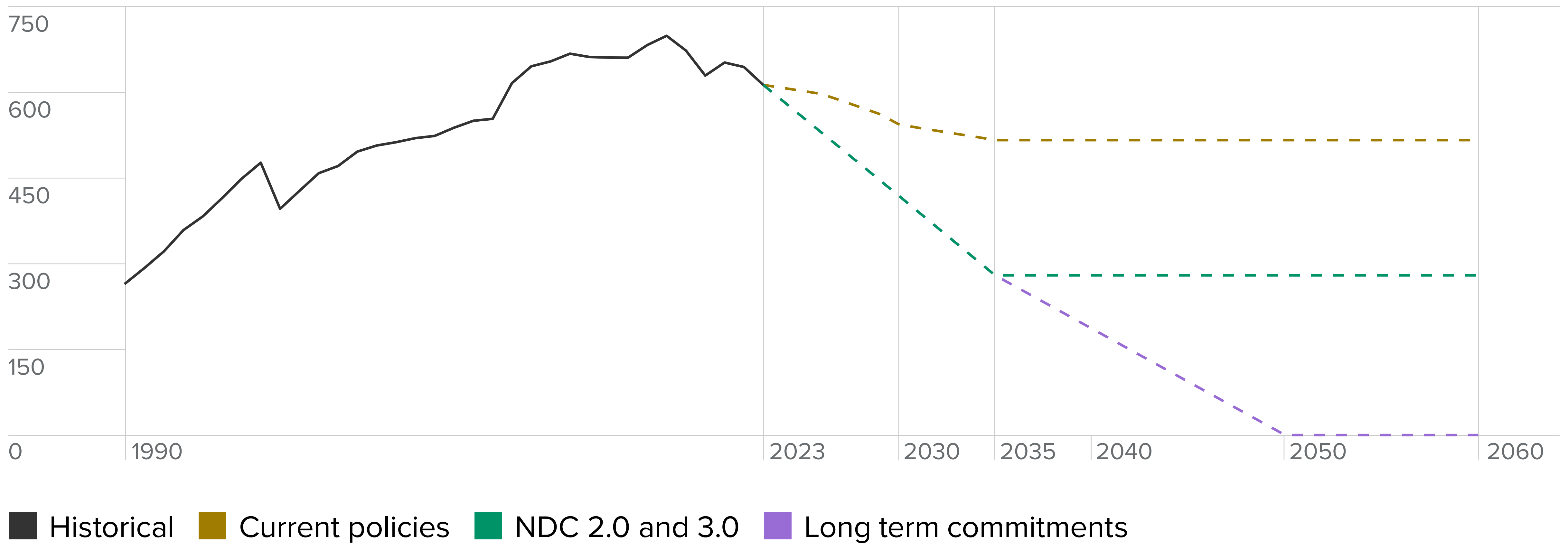
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



South Korea

Policies overview

National adaptation plan[4]	✓
Regular published risk assessments[5]	✓
Monitoring and evaluating report[6]	✓
Part of a sovereign catastrophe risk pool	Exempt

Commited to fossil fuel subsidies phase out	✗
Annual amount spent on explicit fossil fuel subsidies	1.22% of GDP[3]

Carbon pricing system[1]	✓
% of GHG emissions covered by carbon price	79%
Covers at least 50% of national GHG emissions	✓
Carbon price ($/t$CO_2$e)	6.45
Aligned with the global carbon price corridor[2]	✗

Climate finance	
3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[8]	36.93	3rd
Solar[7]	2.46	14th
Hydroelectric[10]	0	N/A
Geothermal[9]	0	N/A

Türkiye

Physical Risk

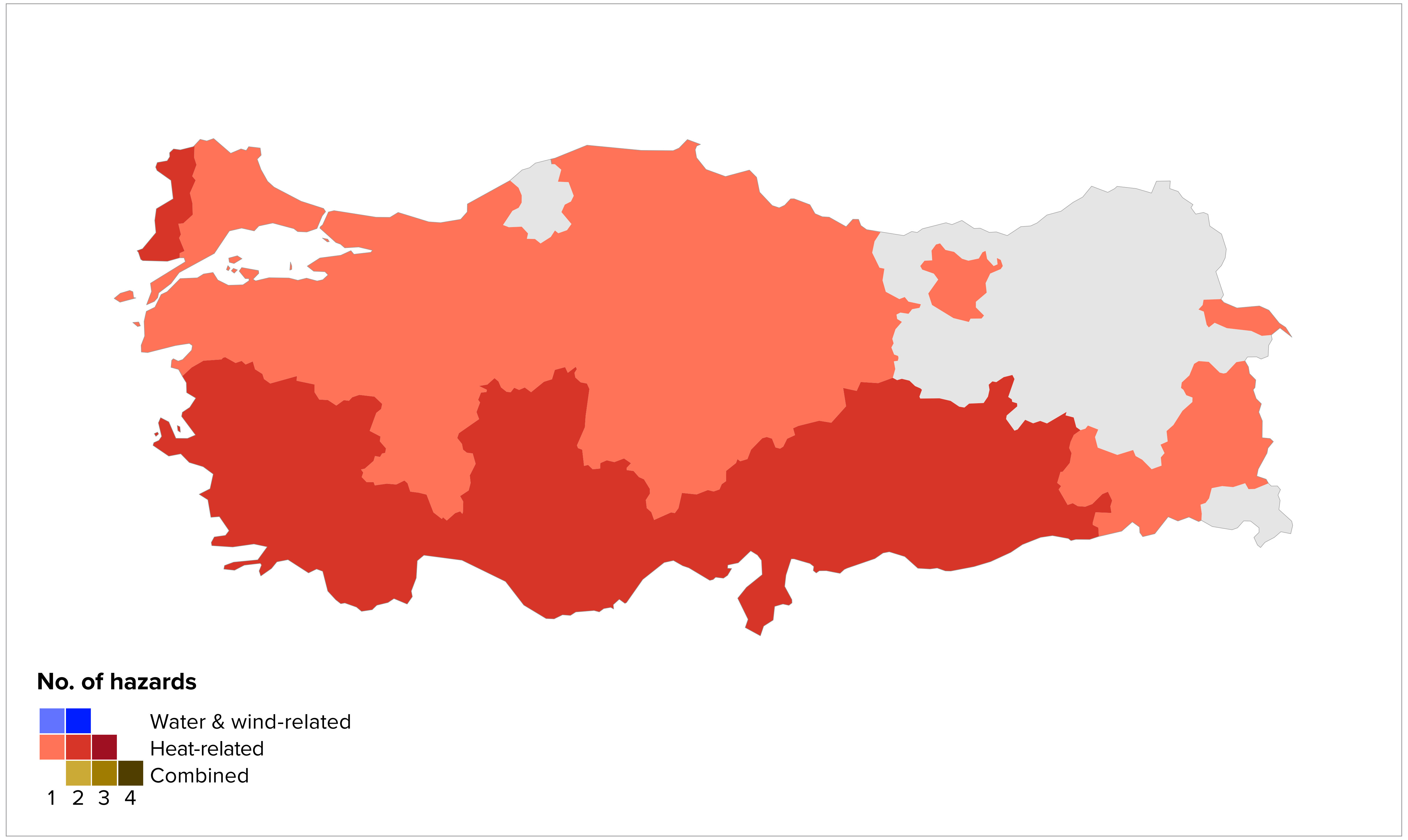
Between our baseline period (1980-2010) and 2050, Türkiye is projected to face a sharp increase in exposure to the twin heat-related hazards of water stress and heatwaves.

Water stress is expected to become the most dominant hazard, with the proportion of the population at high risk rising from 0% to over 91%, and GDP exposure increasing from 0% to more than 95%. Similarly, **heatwave** exposure is projected to grow significantly, with population risk increasing to almost 40% and 31% of GDP from low levels (<4% each) over the baseline period.

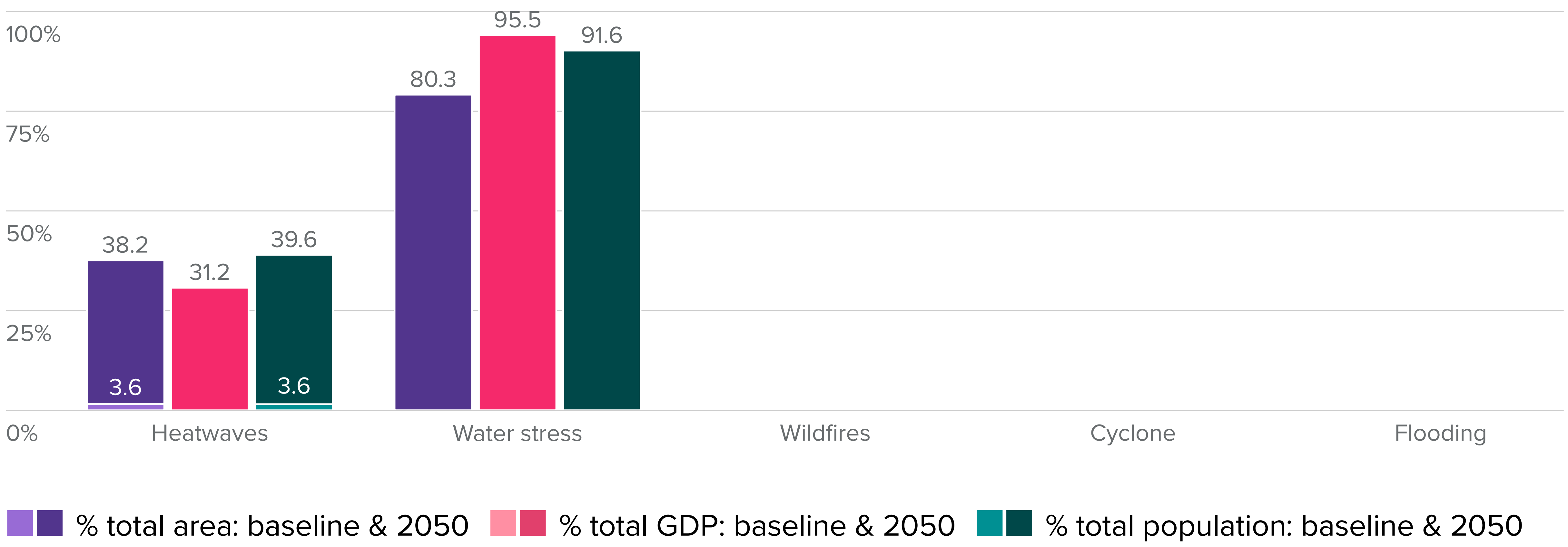
These changes reflect the intensifying impacts of climate change on Türkiye's climate-sensitive regions, particularly in the west and south. Key regions with both high GDP and population – such as Istanbul, Izmir and Ankara – are flagged as high risk for either heatwaves or water stress in 2050.

While other hazards remain medium to low risk across the country, the scale of compounding risks from heat and water scarcity could pose challenges under a high warming scenario.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



Türkiye

Türkiye has signalled an NDC3.0 of 643 $MtCO_2e$ in 2030.

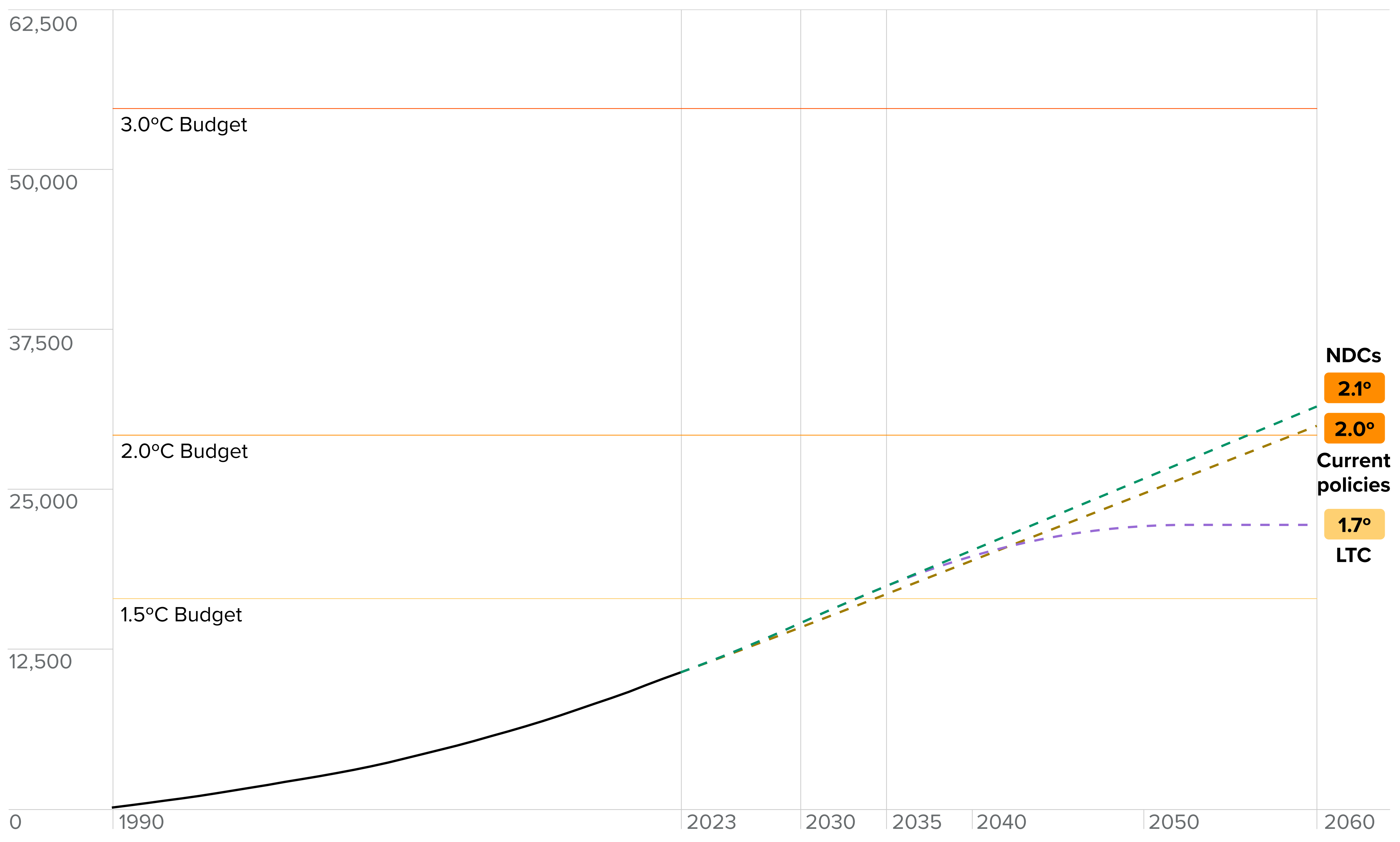
We estimate this aligns with a 2.1°C pathway.

Current policy alignment

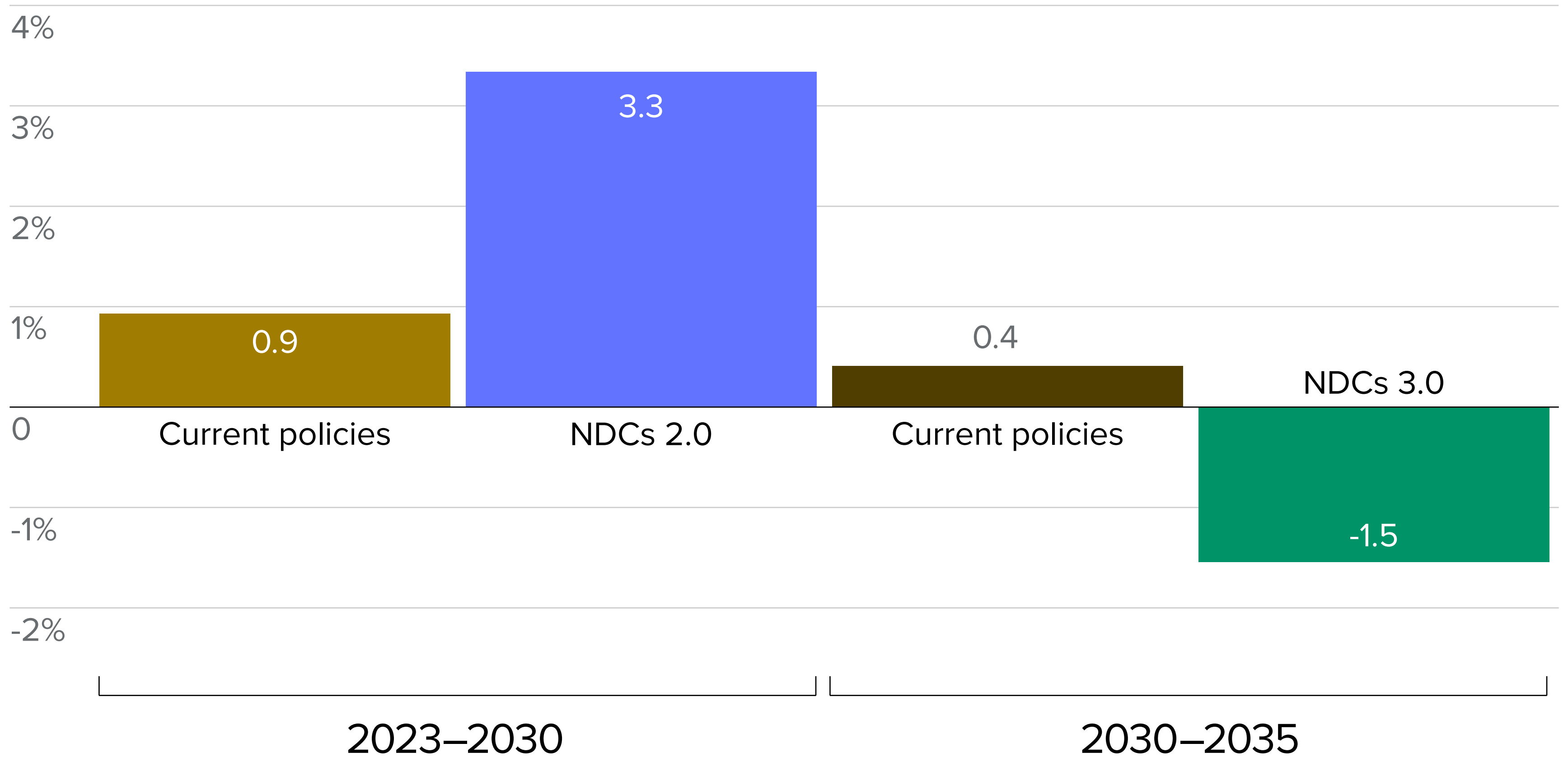
On track to meet 2030 target

We project that by 2030, Türkiye's current policies will result in the country meeting its NDC and come in 15% below it (or 91 $MtCO_2e$). This would result in Türkiye surpassing its 1.5°C emissions budget by 2035.

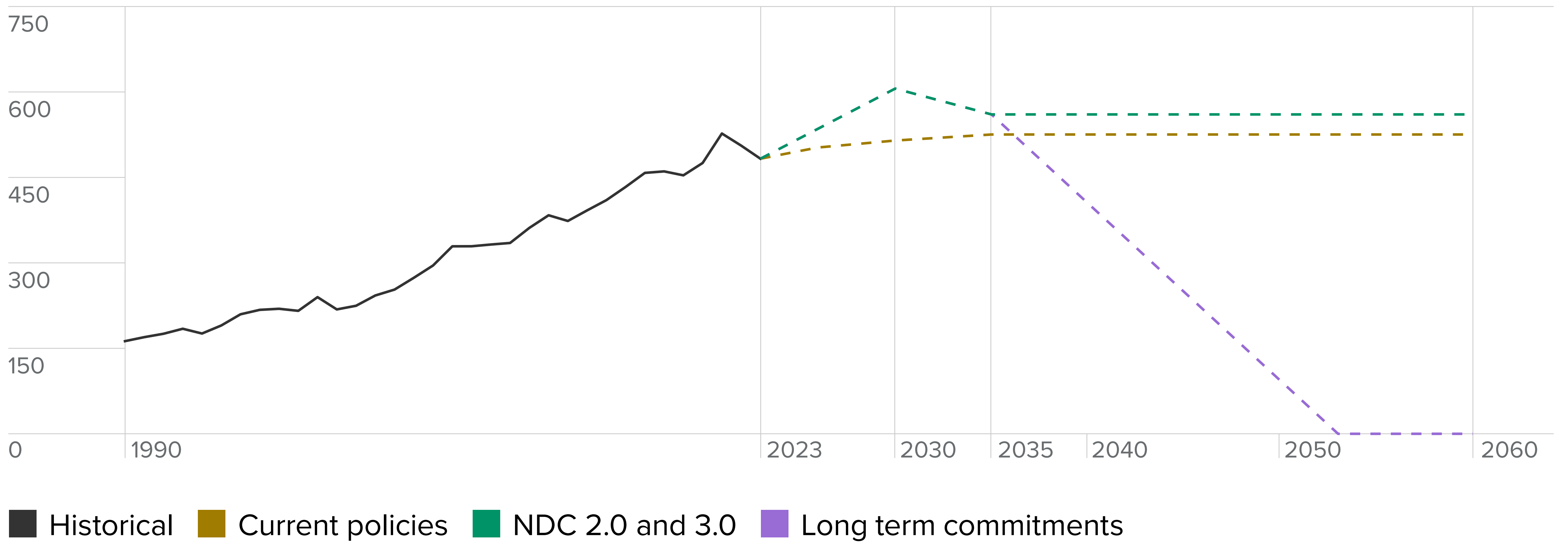
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



Türkiye

Policies overview

✓ National adaptation plan[3]

Regular published risk assessments[4]	✓
Monitoring and evaluating report	✗
Part of a sovereign catastrophe risk pool	Exempt

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies as % of GDP[3]	2.22% GDP[2]

✗ Carbon pricing system[1]

Climate finance

3-year average climate finance contribution as a % of GDP	Exempt
Targeted level of international climate finance contribution as a % of GDP	Exempt

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[6]	1.95	16th
Solar[5]	1.52	20th
Hydroelectric[8]	1.71	11th
Geothermal[7]	0.36	20th

United Kingdom

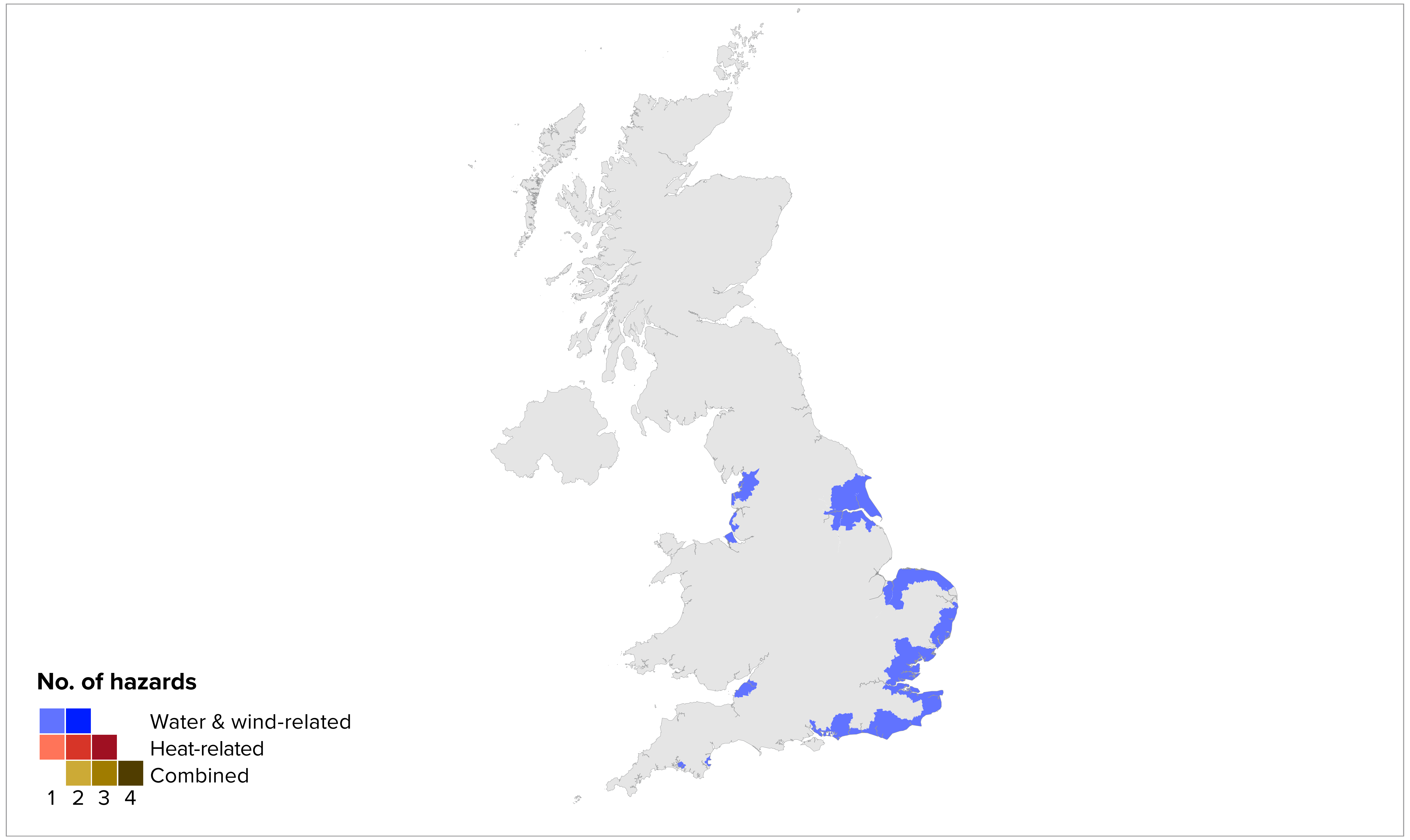
Physical Risk

The United Kingdom is projected to see a notable increase in exposure to **flooding** by 2050, which emerges as the most significant physical hazard. Nationally, the proportion of the population at high flood risk is expected to rise from 8.2% to 12.2%, with the share of GDP rising from 6.2% to 9.7%.

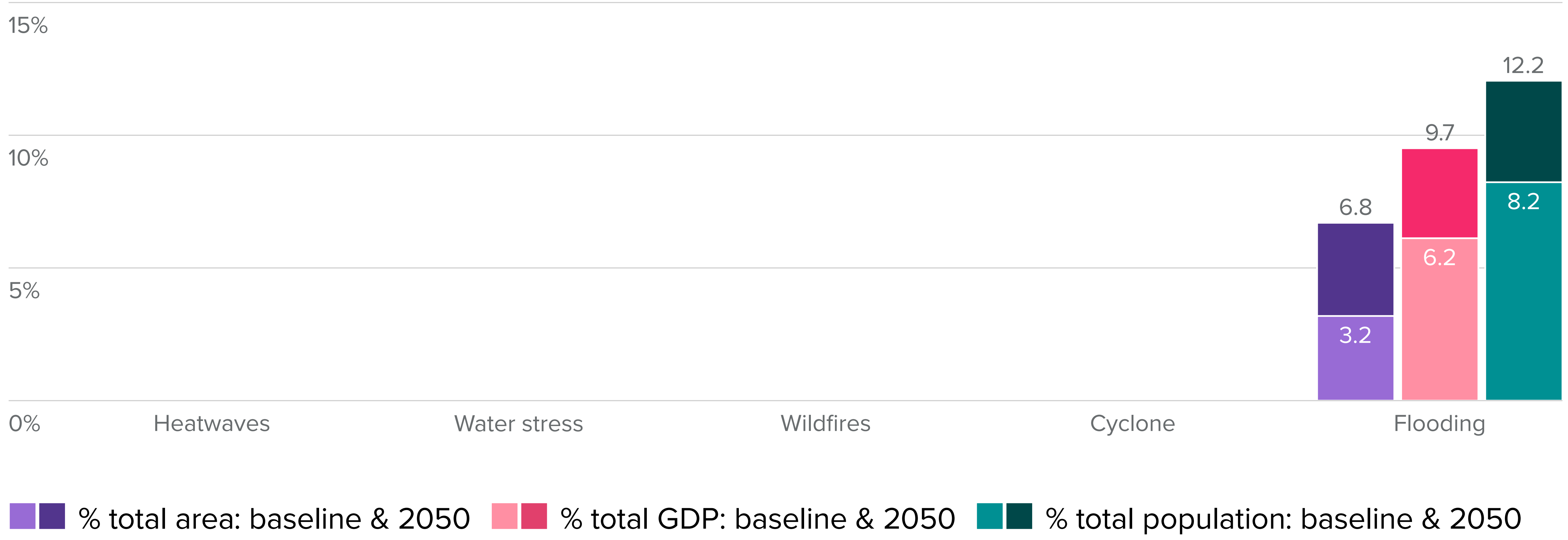
Regions most affected include the Thames Estuary, near London, with 3 million people and US$100 billion in GDP at risk. Coastal cities, such as Bristol and Brighton (home to almost 500,000 and 300,000 people respectively), cross over the high-risk threshold and all become newly high risk from flooding in 2050, while Portsmouth, Plymouth, Hull and East Anglia increase their already high-risk exposure. In total, 8.3 million people in the UK will live in a high-risk flood region in 2050, compared to 5.6 million over the baseline period.

While other hazards remain low to medium-risk, the increasing flood exposure makes the UK the most exposed country in our study by share of population and GDP at high flood risk.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



United Kingdom

The UK has set an NDC3.0 of 81% below 1990 emission levels.

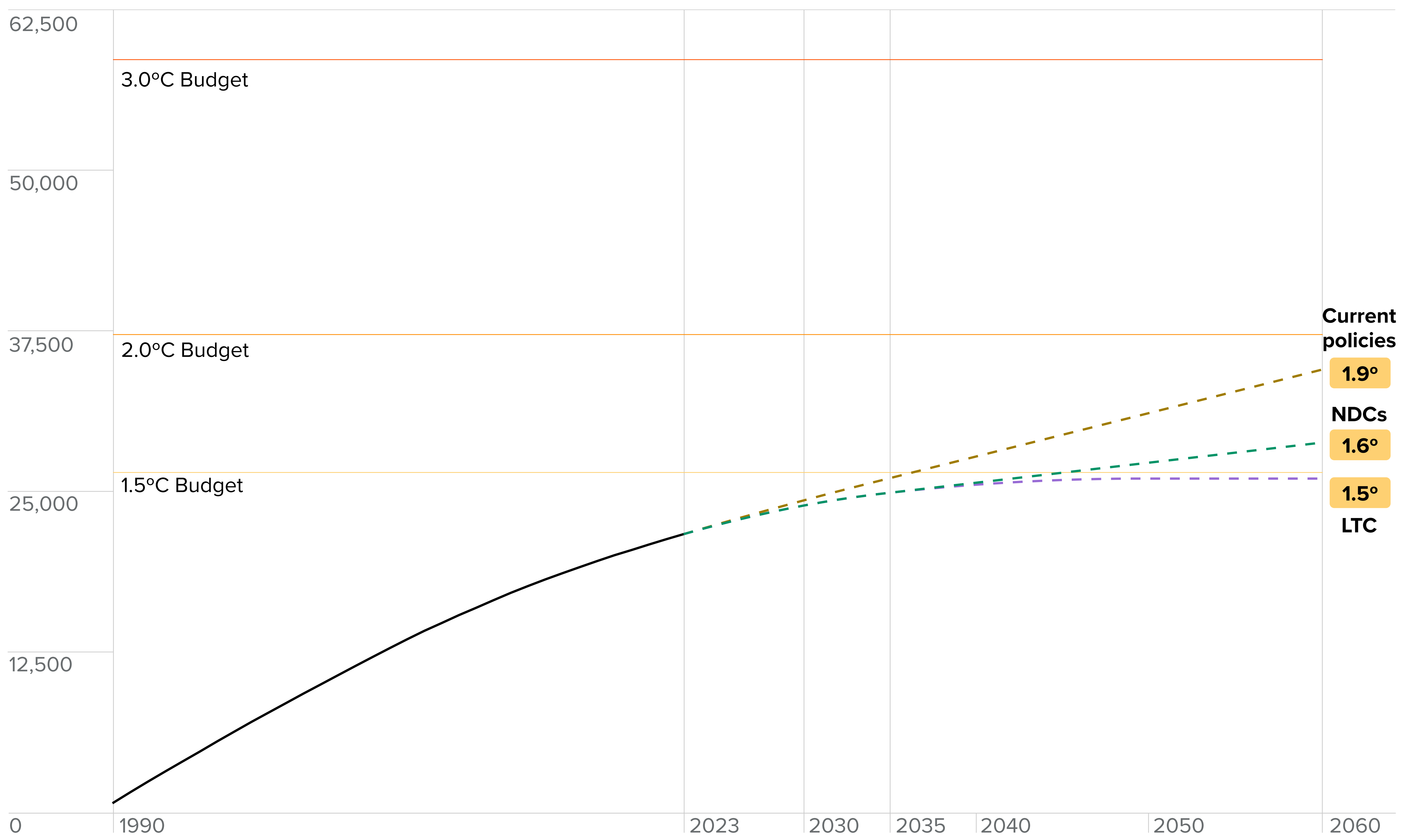
We estimate this to be 156 $MtCO_2e$ by 2035, aligning with a 1.6°C pathway.

Current policy alignment

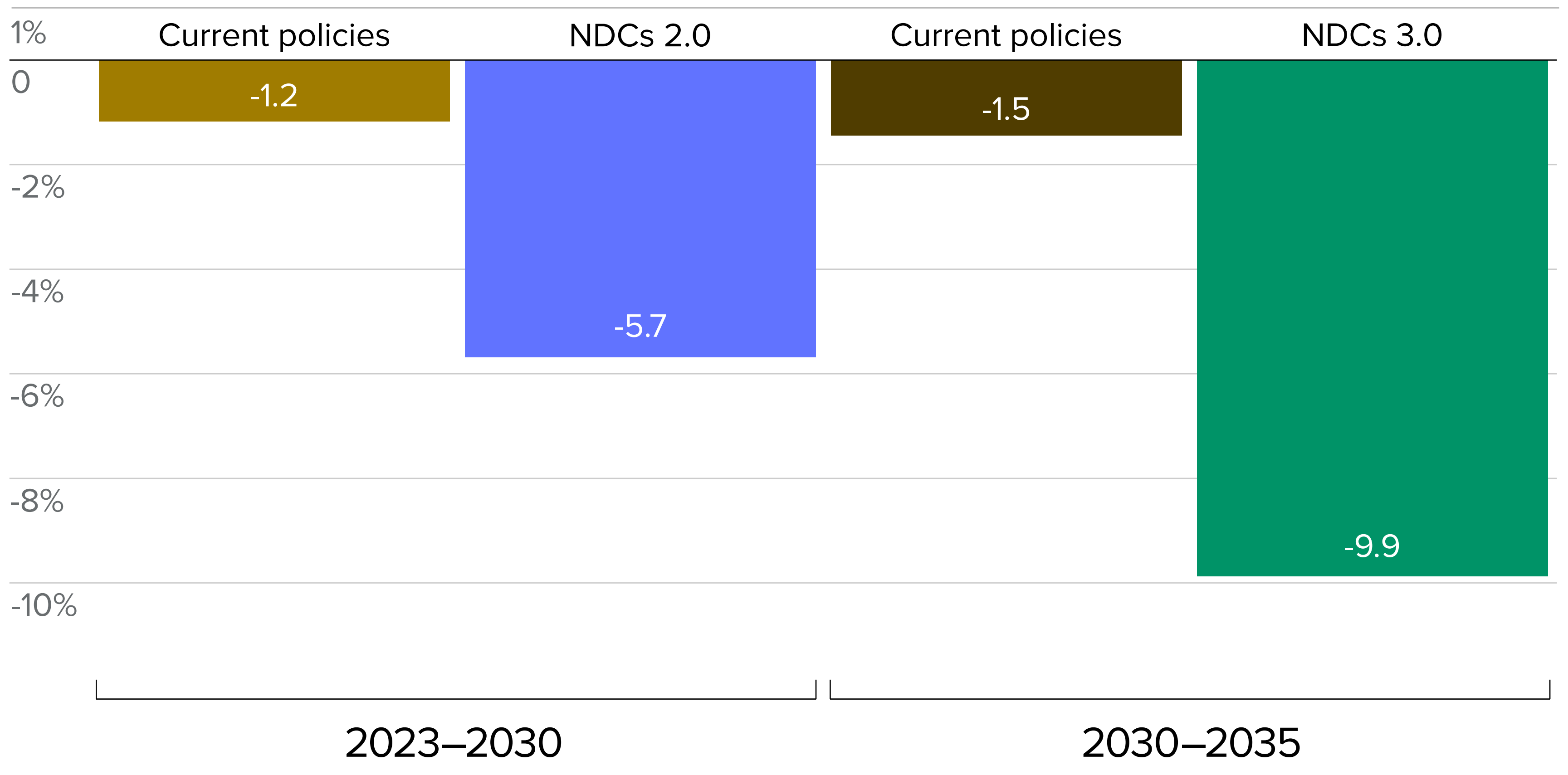
On track to meet 2030 target ⊗

We project that by 2030, the UK's current policies will result in the country overshooting its NDC by 39% (or 101 $MtCO_2e$). This would result in the UK surpassing its 1.5°C emissions budget by 2037.

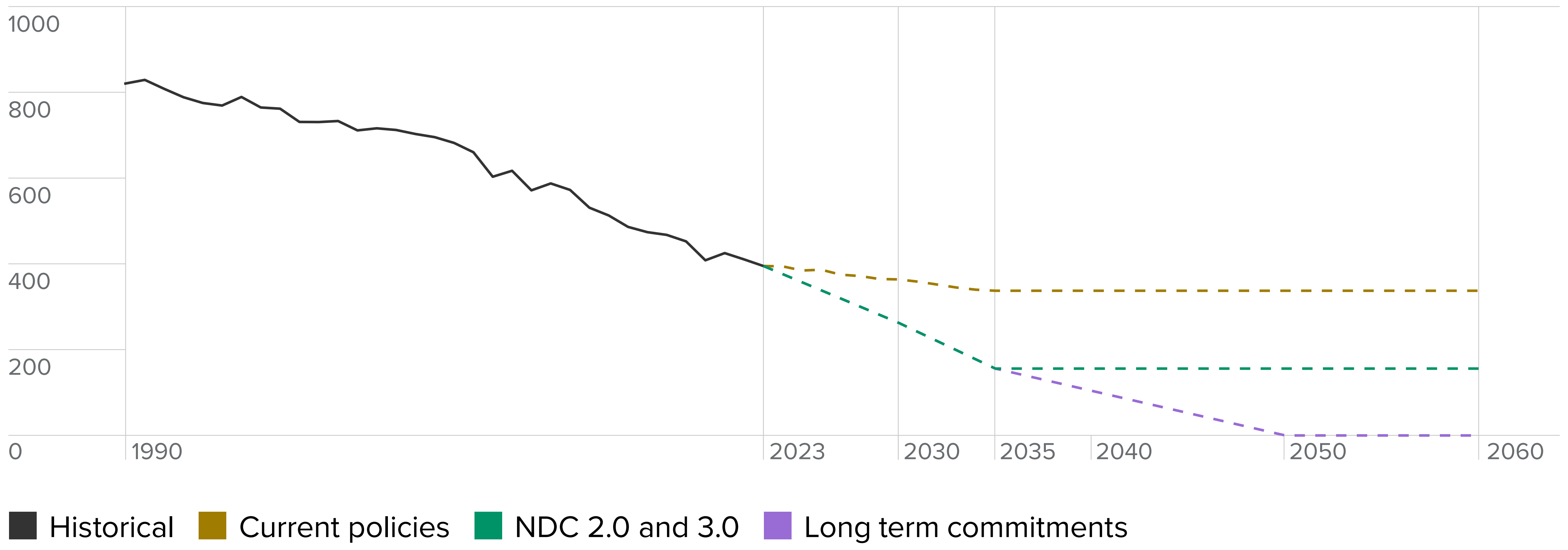
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



United Kingdom

Policies overview

✓ National adaptation plan[5]

Regular published risk assessments[6]	✓
Monitoring and evaluating report[7]	✓
Part of a sovereign catastrophe risk pool	Exempt

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies	0.25% of GDP[4]

✓ Carbon pricing system[1,2]

% of GHG emissions covered by carbon price	Tax	12%
	ETS	27%
Covers at least 50% of national GHG emissions	Tax	✗
	ETS	✗
Carbon price ($/t$CO_2$e)	Tax	23.24[3]
	ETS	57.23
Aligned with the global carbon price corridor	Tax	✗
	ETS	✓

Climate finance

3-year average climate finance contribution as a % of GDP	0.12%[8]
Proportional share of $100 billion global climate finance commitment[9]	✗
Targeted level of international climate finance contribution as a % of GDP	0.08%[10]
Target to increase global climate finance contributions	✓

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[12]	28.07	5th
Solar[11]	6.88	10th
Hydroelectric[14]	2.79	8th
Geothermal[13]	0.01	7th

United States

Physical Risk

By 2050, the United States is projected to experience substantial increases in exposure to multiple physical hazards, led by cyclones, heatwaves and water stress.

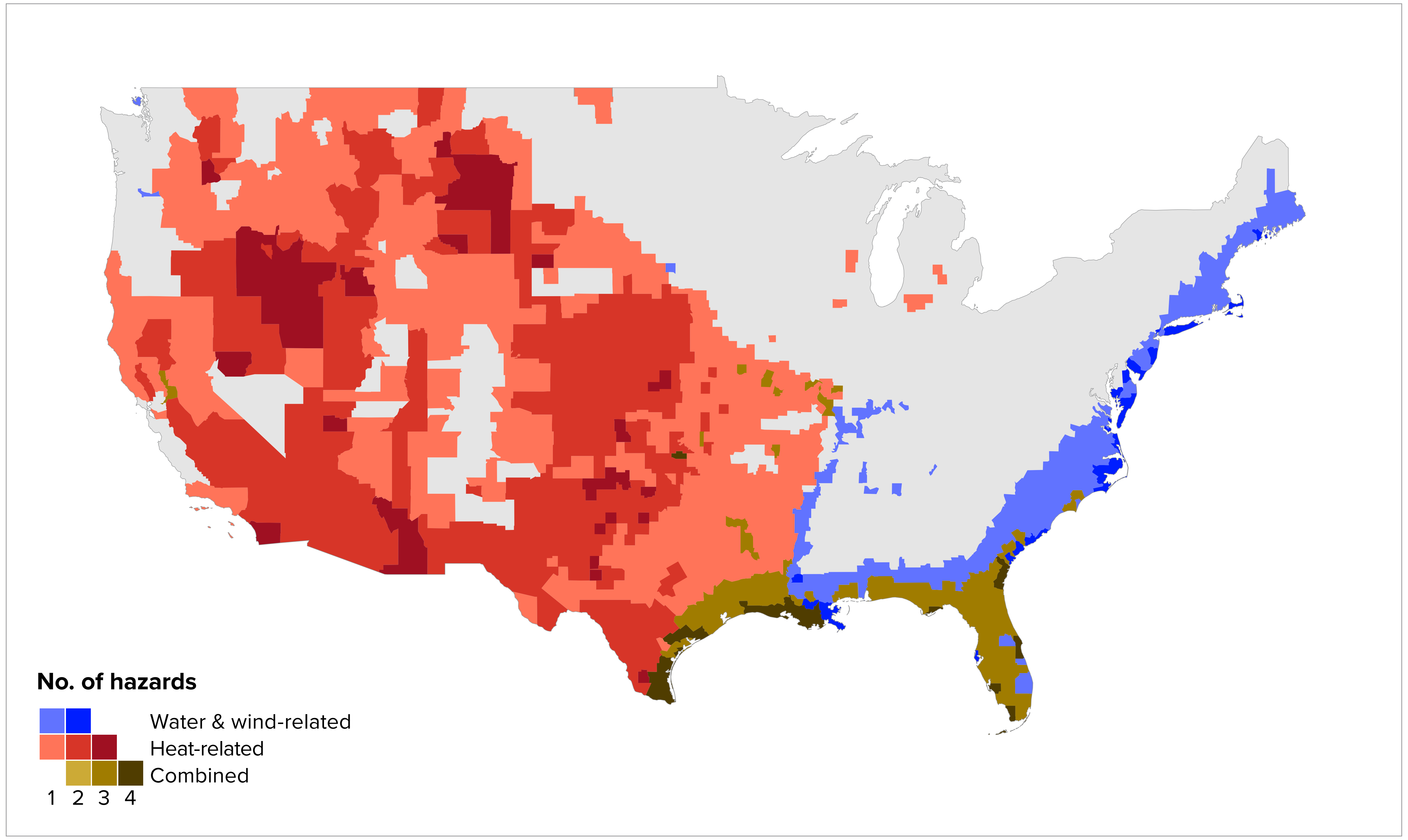
For **cyclones**, Miami-Dade County was one of the most exposed regions in our sample over the baseline period. Even though hurricane frequency may decline slightly in some counties in Florida, across the US, an additional 25 million people and US$2.7 trillion in GDP will be exposed to a cyclone at least once a decade by 2050. The largest increase is in the North Atlantic, where the New York and Philadelphia metropolitan areas fall into high cyclone risk.

For **heatwaves**, nearly 29% of the population and 27% of GDP will be exposed to high heatwave risk – defined as temperatures of over 35°C for a month or more, up from just 2% today. Urban counties such as Maricopa, Los Angeles, Harris, and Miami-Dade are among the most vulnerable, with Maricopa and Miami-Dade facing some of the most extreme heat in our sample.

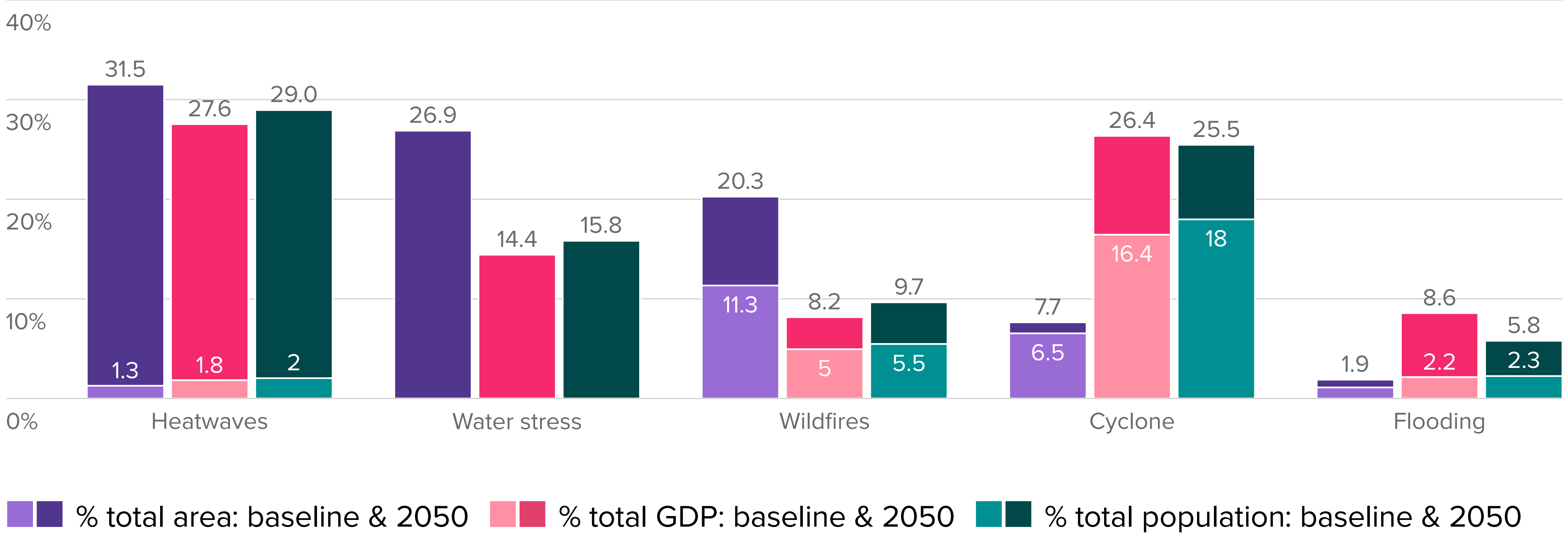
Wildfires, already significant in key urban areas (e.g., Los Angeles), wildfire exposure is projected to rise to 9.7% of the population and 8.2% of GDP in 2050, up from 5.5% and 4.9% over the baseline.

Flooding risk will more than double, with exposure rising to nearly 6% of the population and 8.6% of GDP. Coastal and riverine counties along the Atlantic seaboard and Mississippi will be most affected.

Regions projected to face high exposure to physical climate hazards in 2050 (SSP5-8.5)



Share of total area, GDP and population affected by high exposure to physical hazards in 2050



United States

The US has withdrawn its NDC3.0 of 61-66% below 2005 emission levels.

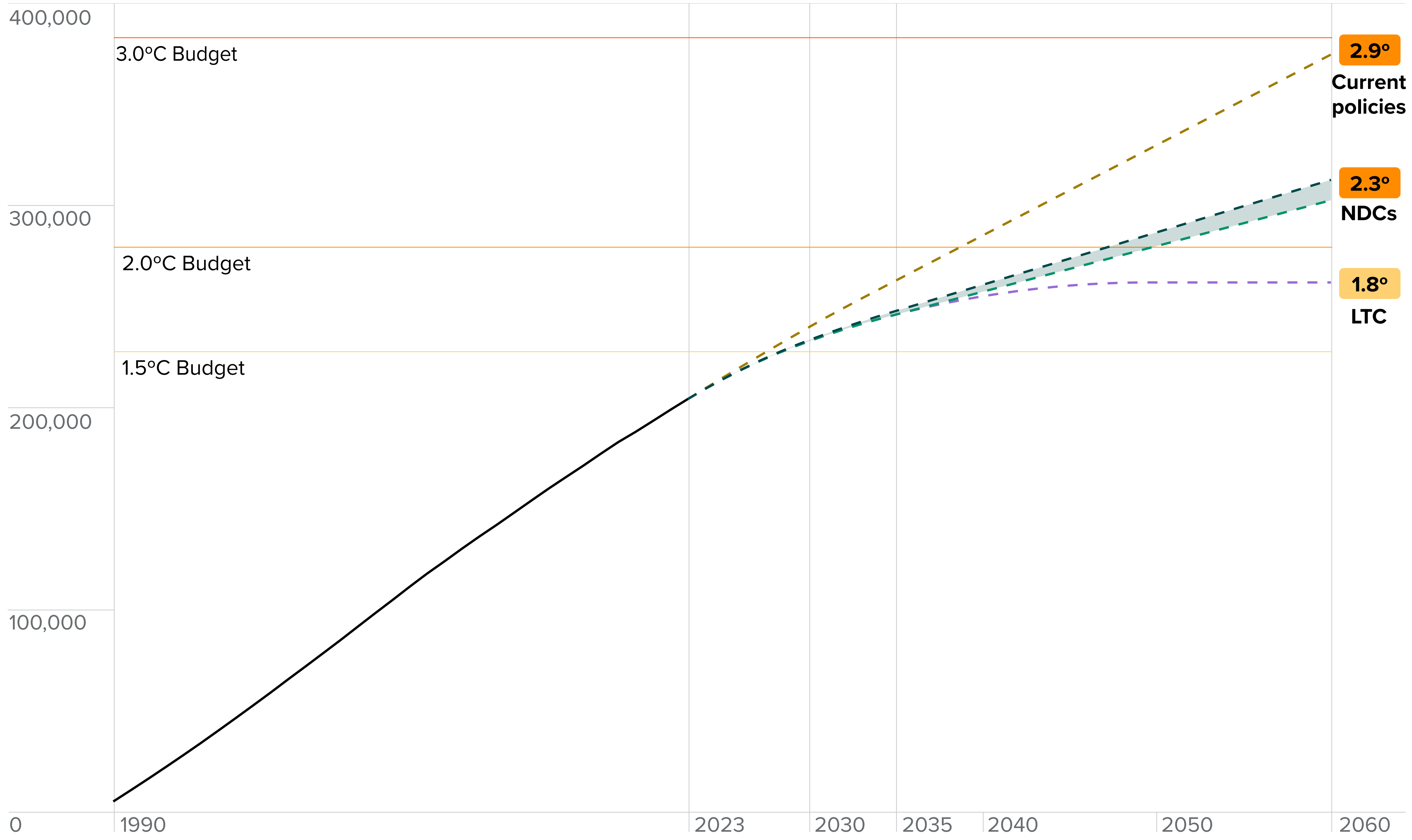
We estimate its withdrawn NDC3.0 to be 2.26-2.59 $GtCO_2e$ by 2035, aligning with a 2.2-2.3°C pathway.

Current policy alignment

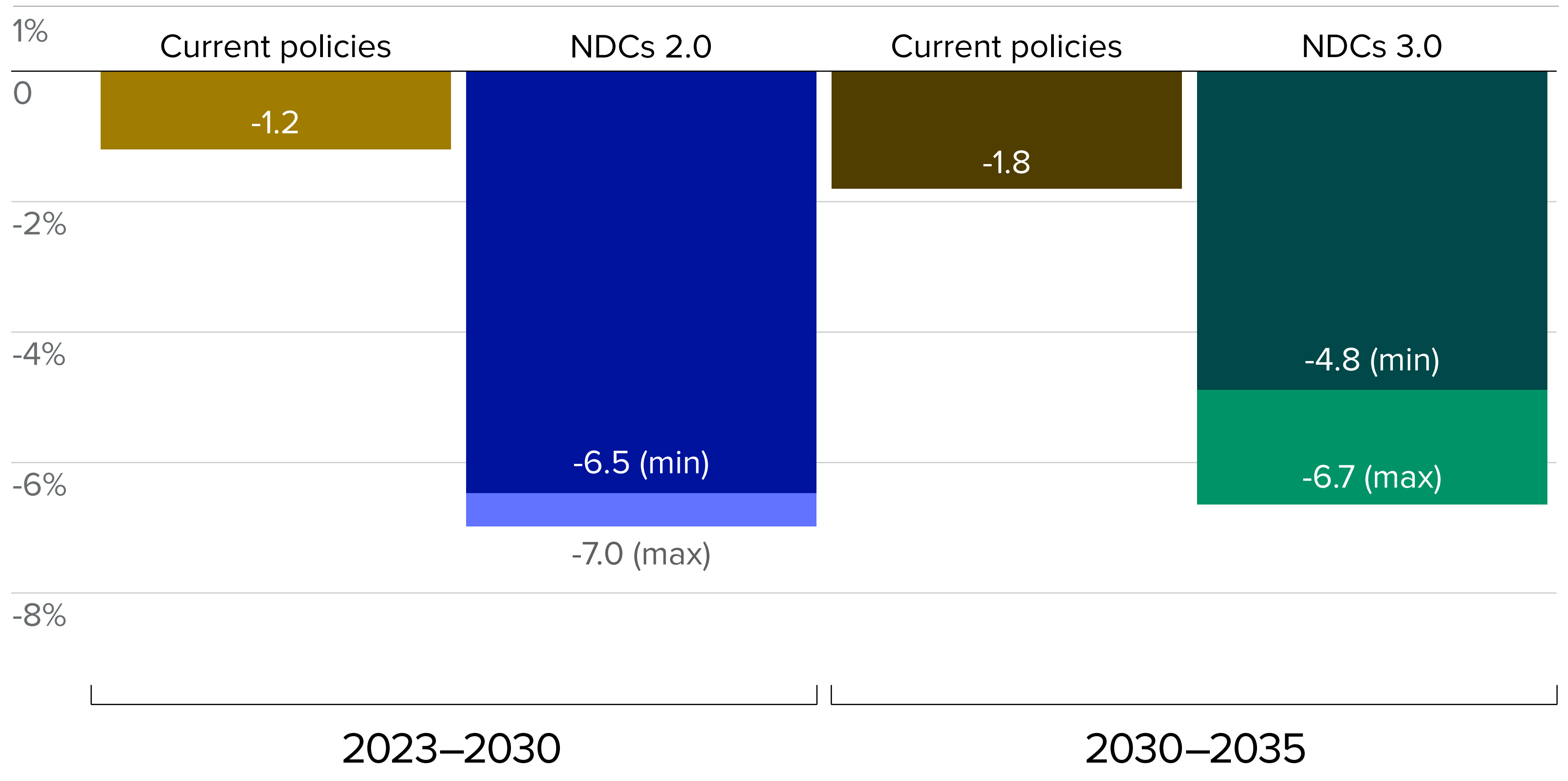
On track to meet 2030 target ✖

We project that by 2030, the US's current policies will result in the country overshooting its NDC by 47-53% (or 1.57-1.70 $GtCO_2e$). This would result in the US surpassing its 1.5°C emissions budget by 2028.

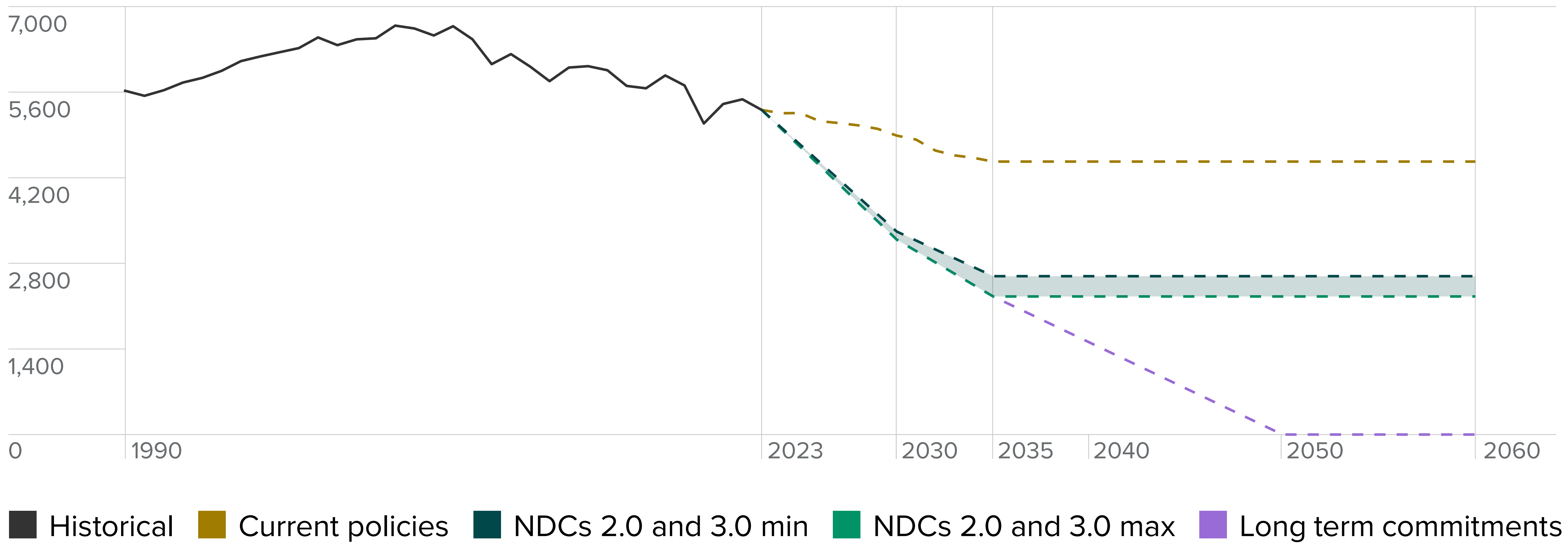
Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Projected annual decarbonisation rates



Historical and projected annual GHG emissions ($MtCO_2e$)



United States

Policies overview

✓ National adaptation plan[2]

Regular published risk assessments[3]	✓
Monitoring and evaluating report[4]	✓
Part of a sovereign catastrophe risk pool	Exempt

✗ Commited to fossil fuel subsidies phase out

Annual amount spent on explicit fossil fuel subsidies	0.01% of GDP[1]

✗ Carbon pricing system

Climate finance

3-year average climate finance contribution as a % of GDP	0.03%[5]
Proportional share of $100 billion global climate finance commitment[6]	✗
Targeted level of international climate finance contribution as a % of GDP	0.04%[7]
Target to increase global climate finance contributions	✓

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Solar[8]	4	11th
Wind[9]	3.49	13th
Hydroelectric[11]	1.69	12th
Geothermal[10]	0.15	4th

European Union

The EU has signalled an NDC3.0 of 66.25-72.5% below 1990 emission levels.

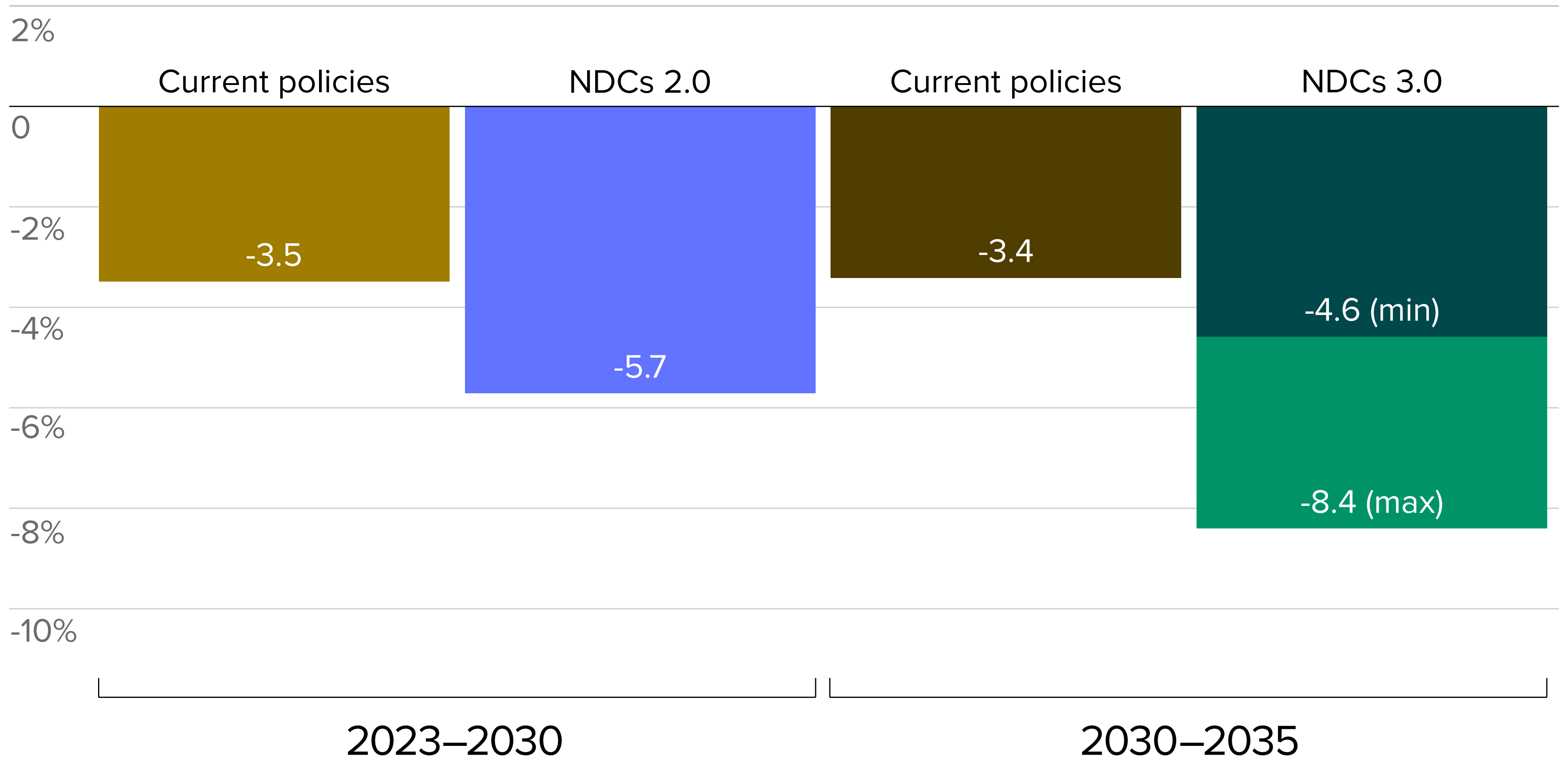
We estimate this to be 1.28-1.57 $GtCO_2e$ by 2035, aligning with a 1.7-1.8°C pathway.

Current policy alignment

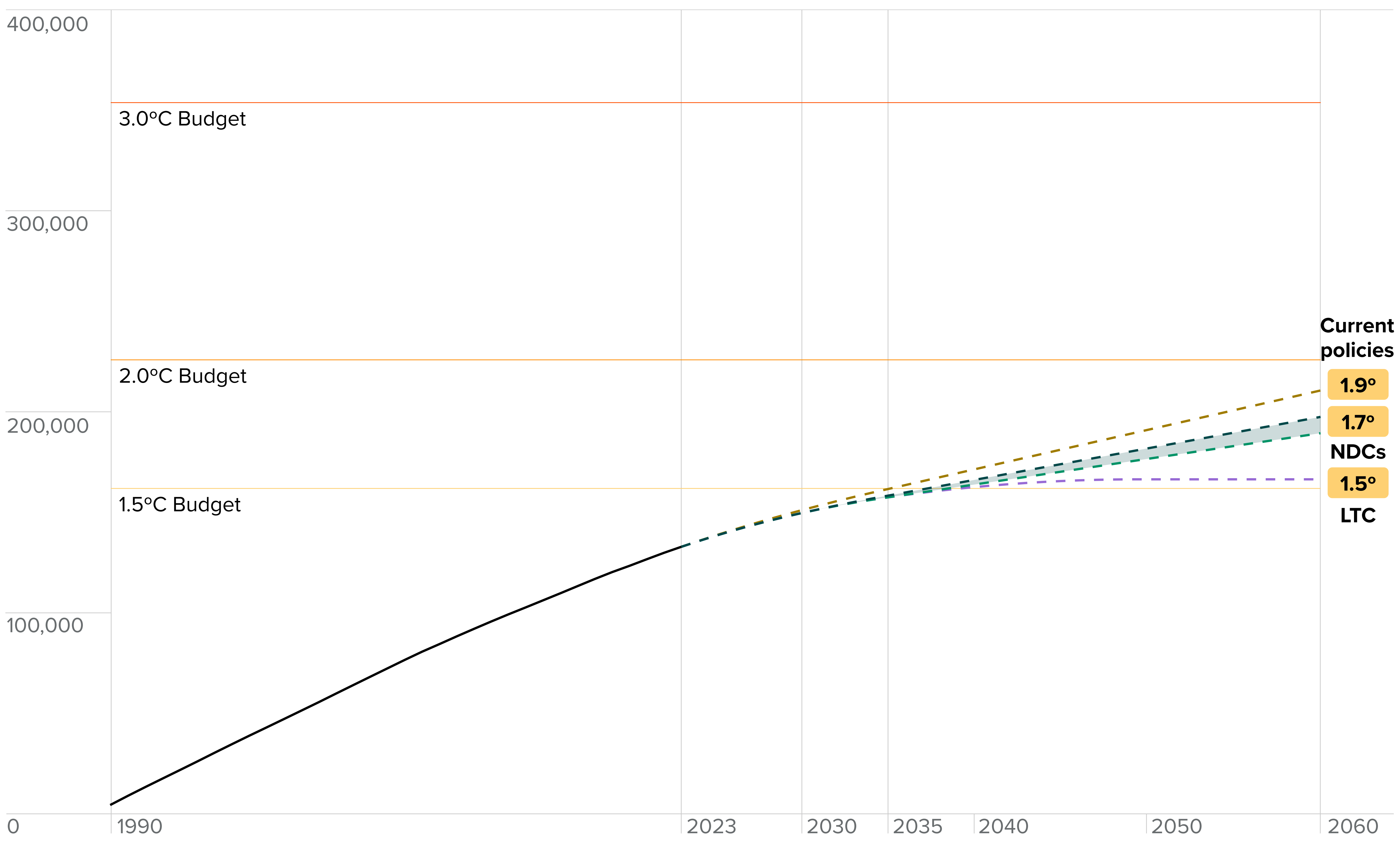
On track to meet 2030 target ✗

We project that by 2030, the EU's current policies will result in the country overshooting its NDC by 18% (or 351$MtCO_2e$). This would result in the EU surpassing its 1.5°C emissions budget by 2036.

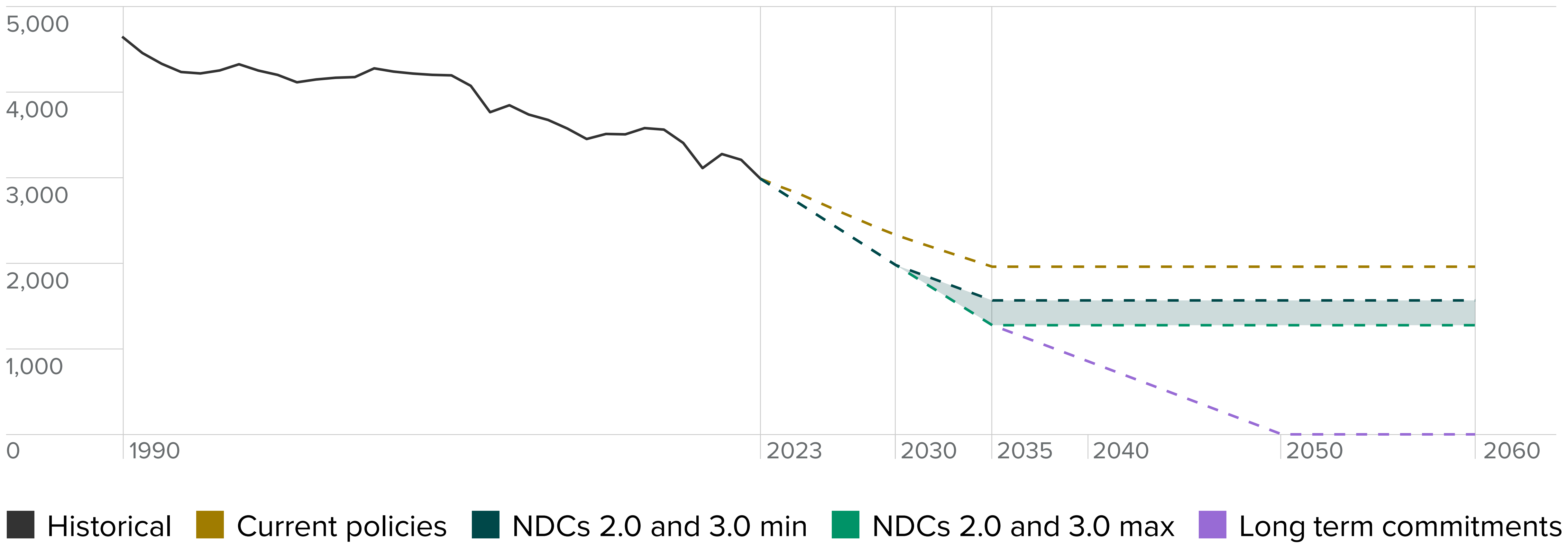
Projected annual decarbonisation rates



Implied Temperature Rise based on cumulative GHG emissions ($MtCO_2e$)



Historical and projected annual GHG emissions ($MtCO_2e$)



European Union

Policies overview

✓ National adaptation plan[3]	
Regular published risk assessments[4]	✓
Monitoring and evaluating report[5]	✓
Part of a sovereign catastrophe risk pool	Exempt

✗ Commited to fossil fuel subsidies phase out	
Annual amount spent on explicit fossil fuel subsidies as % of GDP[3]	0.17%

✓ Carbon pricing system[1]	
% of GHG emissions covered by carbon price	40%
Covers at least 50% of national GHG emissions	✗
Carbon price ($/t$CO_2$e)	70.37
Aligned with the global carbon price corridor[2]	✓

Climate finance	
3-year average climate finance contribution as a % of GDP	0.05%[6]
Proportional share of $100 billion global climate finance commitment[7]	✗
Targeted level of international climate finance contribution as a % of GDP	0.18%[7]
Target to increase global climate finance contributions	✓

Energy opportunity (Prospective energy capacity)	MW/$bn GDP	G20 rank
Wind[9]	25.93	20th
Solar[8]	11.28	8th
Hydroelectric[11]	1.05	13th
Geothermal[10]	0.01	20th

Annex

Data & Methodologies

Chapter 1: Transition Risk

This annex includes a description of the data, methodologies and references used in our Implied Temperature Rise (ITR) evaluations and physical risk assessments.

A) Climate Liabilities Assessment Integrated Methodology (CLAIM) model

The methodology to define national greenhouse gas (GHG) budgets is critical in calculating the Implied Temperature Rise (ITR) for a country. We rely on the Climate Liabilities Assessment Integrated Methodology (CLAIM) model developed by LSEG.[1] It enables the computation of national GHG budgets compliant with any global temperature target and time horizon (for this report a 1.5°C scenario is selected).

Allocating shares of global emissions budget between countries is a source of scientific and diplomatic controversy. There are two main methodologies: 1. the egalitarian approach and 2. the grandfathering approach. Hybrid approaches are also possible (see Giraud et al. 2017 for further details[2]). The egalitarian approach allocates the same right to GHG emissions to every human being, while the grandfathering approach relies on the idea that the global GHG budget should be divided along the criterion of current emissions, meaning that the weight of each country in global emissions remains stable over time. The CLAIM model does not assign a national budget following a unique criterion, such as 'capacity' or 'responsibility'. Instead, it offers a statistical, and non-normative approach, which avoids choosing between egalitarian or grandfathering sharing.

B) Implied Temperature Rise (ITR) model

The country-level temperature metrics (denoted in °C) presented in this report indicate the global Implied Temperature Rise (ITR) that would result if every country that has a commitment or set of policies with the same level of ambition as the studied country. However, they do not imply that those countries alone can have such an influence on global temperature.

Interpreting these temperature metrics, it is important to note that two countries with a Nationally Determined Contribution (NDC) or long-term commitments, which indicates the same level of emissions reduction, may not share the same ITR. As the methodology also considers historical cumulative emissions, a country that has already used a significant portion of its carbon budget will need to decarbonise at a faster rate than a target year (e.g. 2050) to remain in line with the Paris Agreement's objectives.

Chapter 1: Transition Risk

Method

1. First, we estimate the annual emissions of each country for NDCs, current policies, and for long-term commitments. We calculate this based on the reductions implied by the announced NDCs and long-term commitments, assuming countries meet their goals. For the current policies, we use projections developed by the International Institute for Applied Systems Analysis (IIASA) and NewClimate Institute.[3] These projections operate under the assumption that no additional mitigation measures will be undertaken beyond the policies already in place.

2. We then calculate each country's share of the global 'carbon budget' – the total available emissions budget consistent with a 1.5°C scenario.

    a. We first choose a future emissions pathway that gives a global carbon budget that aligns with a 1.5°C rise in global temperature. The pathway used here is the Net Zero 2050 scenario from the MESSAGEix-GLOBIOM model as presented in the latest phase (Phase IV) of the Network for Greening the Financial Systems (NGFS)'s Climate Scenarios.[4]

    b. We then distribute the annual global carbon budget between countries to obtain a carbon budget per country per year that would align with a 1.5°C trajectory. To do this, we use LSEG's proprietary Climate Liabilities Assessment Integrated Methodology (CLAIM) model which estimates the budget using a statistical approach that factors in historical and current emission levels to determine the remaining GHG allowance for each country.

3. Next, we determine the gap in cumulative emissions between a country's projected emissions for its commitments or current policies and its carbon budget under the 1.5°C scenario from the present until 2060. This 'emissions gap' is the main variable in assessing the alignment of a country with a global warming target.

$$GAP_i = \frac{\sum_{y}^{2060} E_{i,p,y}}{\sum_{y}^{2060} E_{i,1.5,y}}$$

Where i is the given country, y is the current year, p is the projected emissions and 1.5 is the 1.5°C GHG emissions budget as calculated using CLAIM and the global 1.5°C emissions pathway.

4. Lastly, we calculate the ITR above pre-industrial levels for each country and scenario, respectively. This calculation is based on an equation that effectively converts estimated future GHG emission volumes into an ITR for each country. The implied temperature rise is given by the equation:

$$\mathbf{T_i = T_{CO2} + T_{non\text{-}CO2}(T_{CO2})}$$

with $\mathbf{T_{CO2} = TCRE * (GAP_i * B_{tot,1.5}) + T_{hist}}$

and $\mathbf{T_{non\ =\text{-}CO2} = 0.4085 * T_{CO2} – 0.3942}$

Where T_i is the implied temperature rise of a country, and T_{CO2} and $T_{non–CO2}$ are the implied temperature rise due to CO_2 and non-CO_2 greenhouse gases respectively.

We base the 'allowable' emissions under a 1.5°C scenario – denoted by B_{tot} – on the latest Net Zero 2050 NGFS scenario, defines the global emissions pathway that would keep globally averaged temperature rise to 1.5°C above pre-industrial levels in the year 2100.

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C) Database of decarbonisation targets, trajectories, and policies

The ambition assessments presented within this report focus on the G20 countries.

Historical emissions

Our historical GHG emissions inventories includes the land use, land-use change and forestry (LULUCF) sector. The emissions inventories from this sector are collected by the International Institution for Applied Systems Analysis (IIASA) based on the United Nations Framework Convention on Climate Change (UNFCCC) and the Food and Agriculture Organization (FAO) reported emissions.[5] The emissions from the other sectors are based on the PRIMAP-hist[6] database of the Potsdam Institute (mostly emissions from energy-use, industry and agriculture).

NDCs 2.0 (2030 targets)

The 195 parties to the Paris Agreement have submitted a Nationally Determined Contribution (NDC), as required. However, only 132 of the 2030 NDCs (NDCs 2.0) are concrete enough to be quantifiable, representing 96% of global emissions. The commitments of some developing countries have both conditional (to financing) and unconditional parts. In our assessments, we consider only the unconditional component of the NDC targets.

For NDCs that are based on a percentage reduction from a base year, we calculate the 2030 target using the percentage reduction provided by the country and applied to our own historical inventories for the base year.

Current policies

In this report, we use ‘current policies’ emissions trajectories constructed by the NewClimate Institute and IIASA that provide annual emissions estimates from 2023 to 2030. Both institutes have a long history in estimating the impact of current policies on future GHG emissions. The methods used for developing the current policy scenarios are presented in detail in Nascimento et al. (2021)[7] and described in detail elsewhere (Nascimento L. et al., 2023;[8] Kuramochi et al., 2021;[9] den Elzen et al., 2019;[10] Fekete et al., 2021[11]). The NewClimate Institute/IIASA database of current policy trajectories update for this report covers the G20 countries, accounting for 77% of global emissions. Our ‘current policies’ emissions trajectories are based on the growth rates (between 2023 and 2030) deduced from the trajectories provided by NewClimate and IIASA and harmonised on our historical inventories. See Figure 1.

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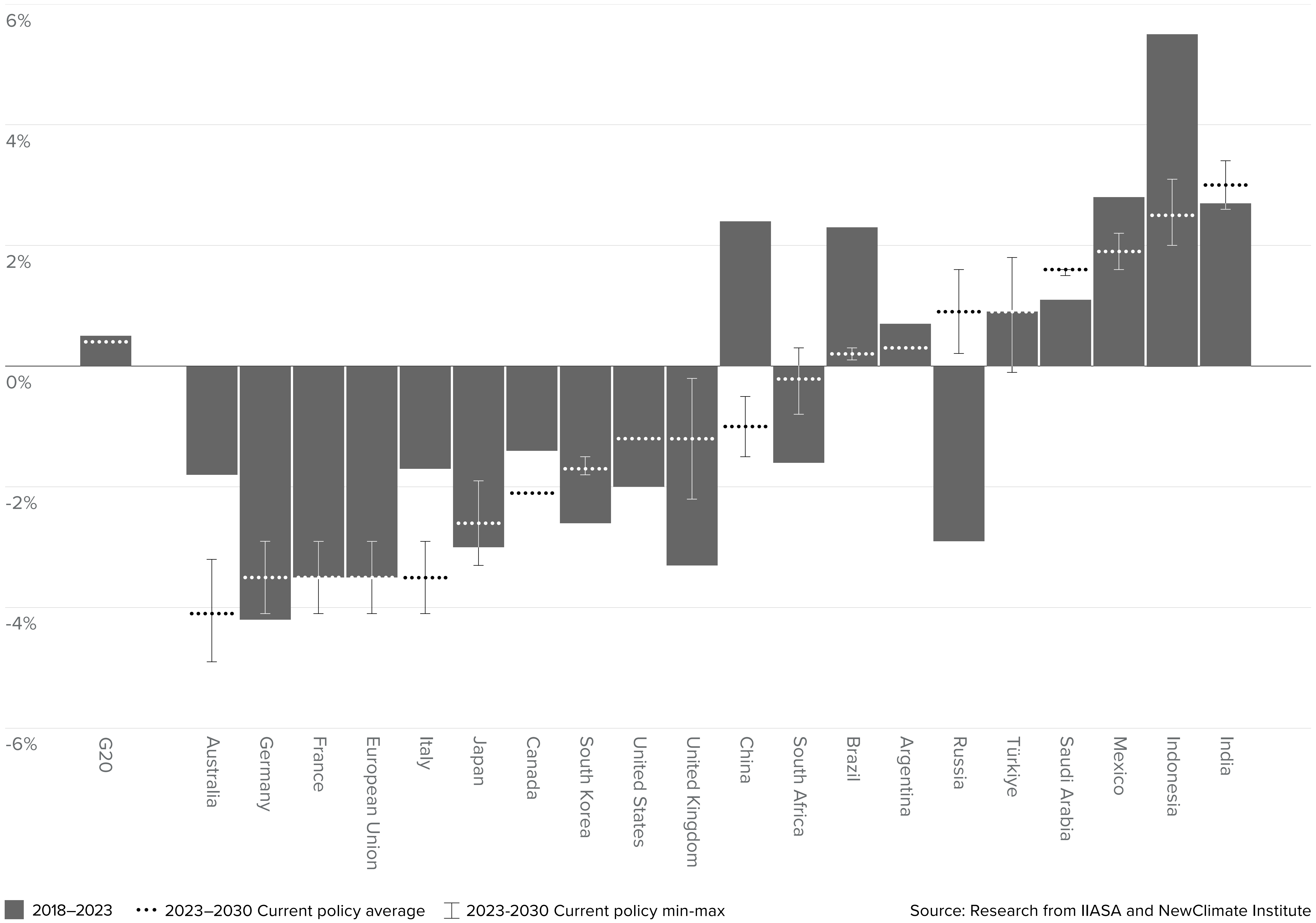
Figure 1: Comparing projected emissions growth in the G20 countries based on current policies with historical trends



Source: Research from IIASA and NewClimate Institute

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NDCs 3.0 (2035 targets)

At the time of writing, only 72 parties to the Paris Agreement have submitted a 3rd Nationally Determined Contribution (NDC 3.0), as required.[12] The commitments of some developing countries have both conditional (to financing) and unconditional parts. In our assessments, we consider only the unconditional component of the NDC targets. For NDCs that are based on a percentage reduction from a base year, we calculate the 2035 target using the percentage reduction provided by the country and applied to our own historical inventories for the base year.

Figure 2. NDC 2.0 (2030) targets versus announced NDC 3.0 (2035) targets.

Country	2030 target	2035 target
Australia	43% below 2005 levels	62-70% below 2005 levels
Brazil	53% below 2005 levels	59-67% below 2005 levels
Canada	40-45% below 2005 levels	45-50% below 2005 levels
China	65% below 2005 level (carbon intensity)	7-10% below 'peak levels' (not yet formally submitted to UNFCCC)
EU	55% below 1990 levels	66.25-72.5% below 1990 levels (not yet formally submitted to UNFCCC)
Indonesia	17.5-30.3% above 2019 levels	9.8-30.0% above 2019 levels
Japan	46% below 2013 levels	60% below 2013 levels
Russia	30% below 1990 levels	65-67% below 1990 levels
South Africa	350-420 $MtCO_2e$	320-380 $MtCO_2e$
South Korea	40% below 2018 levels	60% below 2018 levels (not yet formally submitted to UNFCCC)
Türkiye	41% below BAU level	643 $MtCO_2e$ in 2035 (not yet formally submitted to UNFCCC)
UK	68% below 1990 levels	81% below 1990 levels
US	50-52% below 2005 levels (to be withdrawn)	61-66% below 2005 levels (to be withdrawn)

Source: LSEG

Chapter 1: Transition Risk

NDC 3.0 Ambition Scenarios

For the COP29 Net Zero Atlas, we constructed a series of scenarios that allow us to estimate the emissions levels and associated ITR that a country might track towards in 2035. Explained in Figure 3, we build three scenarios based on a number of growth (reduction) assumptions, resulting in country-specific implied decarbonisation trajectories between 2030 and 2035 (see Figure 4).

Figure 3. Ambition scenarios breakdown

Scenario	Description
'NDC 2.0 ambition'	• We first calculate the annual emissions reduction (growth) rate for 2015-30, based on the countries' latest NDC and assume that its 2035 target will be set to reduce (grow) emissions at the same rate. • Secondly, we use the ITR associated with our current policies projections for 2030; and assume that countries 2035 targets will align to the same temperature outcome. • We use the average of both as the estimate for a 2035 target that is consistent with the 2030 NDCs. • A country's full emissions pathway is therefore a linear progression from current levels to its 2030 NDC, then to the calculated 2035 NDC. We assume post-2035 emissions remain constant until 2060, the end of our time domain.
'Long-term commitment (LTC) ambition'	• We assume a linear decrease in emissions from a country's 2030 NDC to its long-term commitment and assume that the 2035 NDC lies on this pathway. • For the LTC ambition, the full pathway is a linear progression from current levels to its 2030 NDC, followed by the linear decrease to its LTC. If the LTC is before 2060, then we assume emissions remain constant after its LTC until 2060, the end of our time domain.
'Paris ambition'	• We assume a level of ambition required to keep implied temperature rise in the G20 to approximately 1.8°C; however, the rate of decarbonisation is specific to the long-term commitments made by G20 members. • The decarbonisation trajectory results in 2040 emissions that are equivalent to a 90% reduction for countries with 2050 LTCs, 70% reduction with 2060 LTCs, and a 30% reduction in emissions in 2040 for India, which has a 2070 LTC. We calculate a country's 2035 NDC from where it intersects this pathway. • If the LTC is before 2060, then we assume emissions remain constant after its LTC until 2060, the end of our time domain.

Source: LSEG

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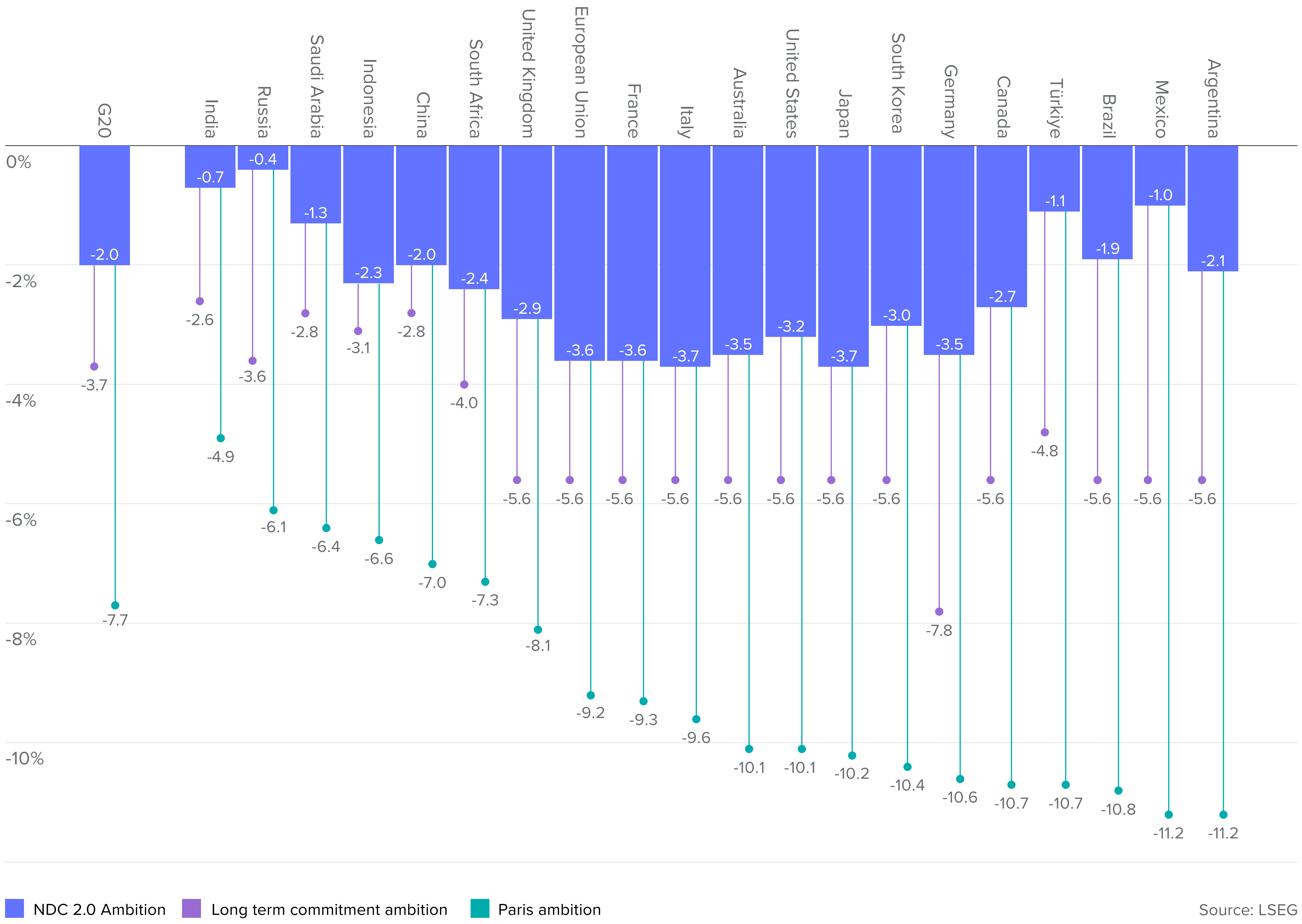
Figure 4. Comparing projected annual emissions growth in G20 countries between 2030 and 2035



Source: LSEG

Figure 5. Implied Temperature Rise for G20 countries for COP30 (°C)

Country names	2030 Current Policies	NDCs 2.0	NDCs 3.0	Long-term commitments
India	1.6	1.6		1.5
France	1.8	1.7	1.6 (unofficial)	1.5
United Kingdom	1.9	1.7	1.6	1.5
Mexico	1.9	1.7		1.5
Italy	1.9	1.8	1.7 – 1.8 (unofficial)	1.5
European Union	2.0	1.9	1.7 – 1.8 (unofficial)	1.5
Türkiye	2.0	2.1	2.1 (unofficial)	1.7
South Africa	2.1	1.9 – 2.0	1.9 – 2.0	1.7
Germany	2.2	2.0	1.8 – 1.9 (unofficial)	1.6
Indonesia	2.2	2.2 – 2.3	2.1 – 2.3	1.8
Japan	2.2	2.1	1.9	1.7
Russia	2.2	2.7	2.2	1.9
Brazil	2.3	2.0	1.9	1.6
Argentina	2.4	2.3		1.7
China	2.6	2.7	2.6	2.2
South Korea	2.7	2.4	2.2 (unofficial)	1.8
Australia	2.9	2.9	2.3 – 2.5	1.9
United States	3.0	2.5	2.2 – 2.3	1.8
Canada	3.2	2.7 – 2.9	2.7 – 2.8	2.0
Saudi Arabia	4	3.7		3.0
G20	2.5	2.4	2.2 – 2.3 (official and unofficial)	1.9

Note: Long-term commitment (LTC) pathways are a result of NDC 2.0, NDC 3.0 (where official or unofficial), and the long-term commitment

Source: LSEG

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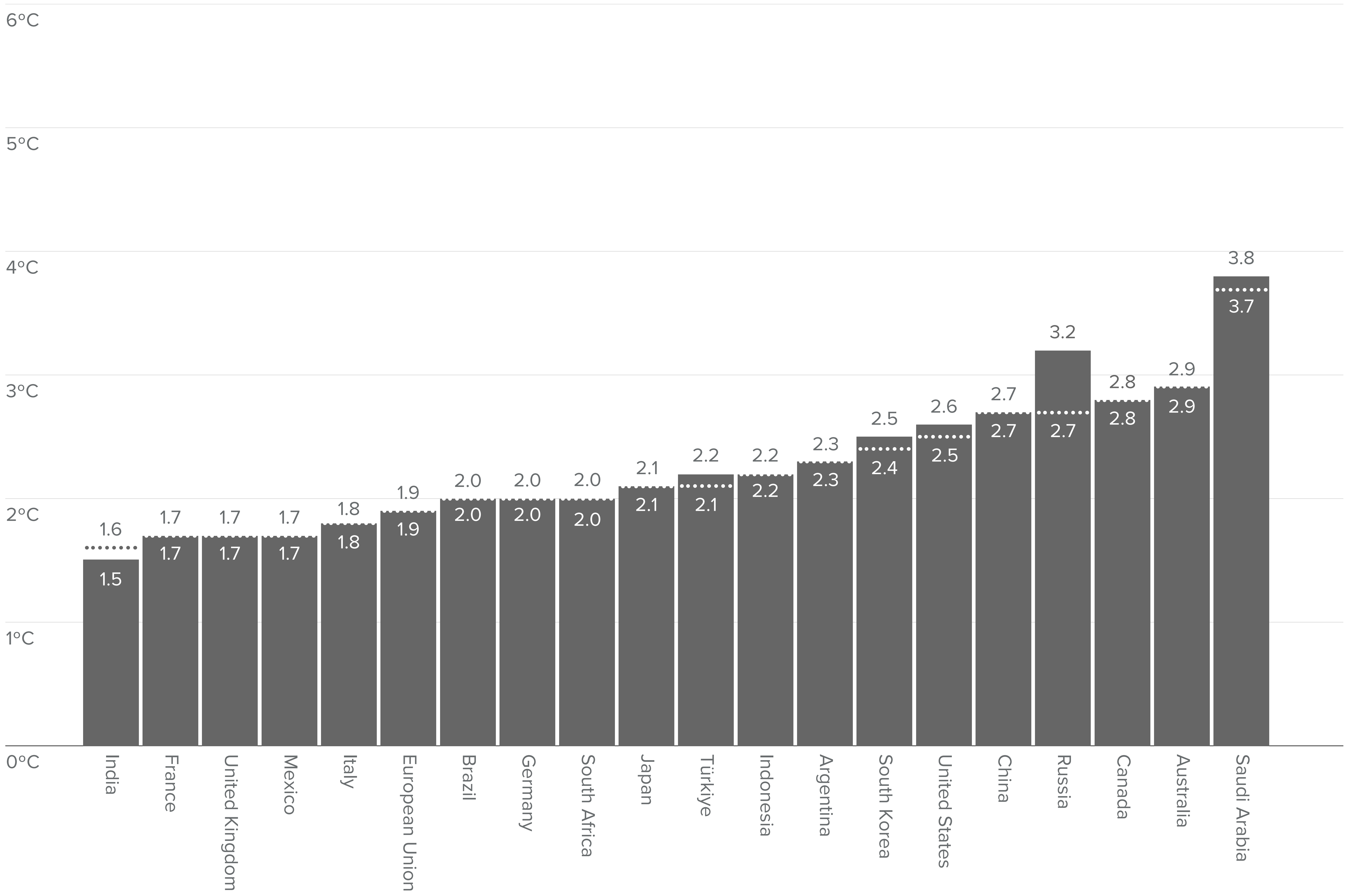
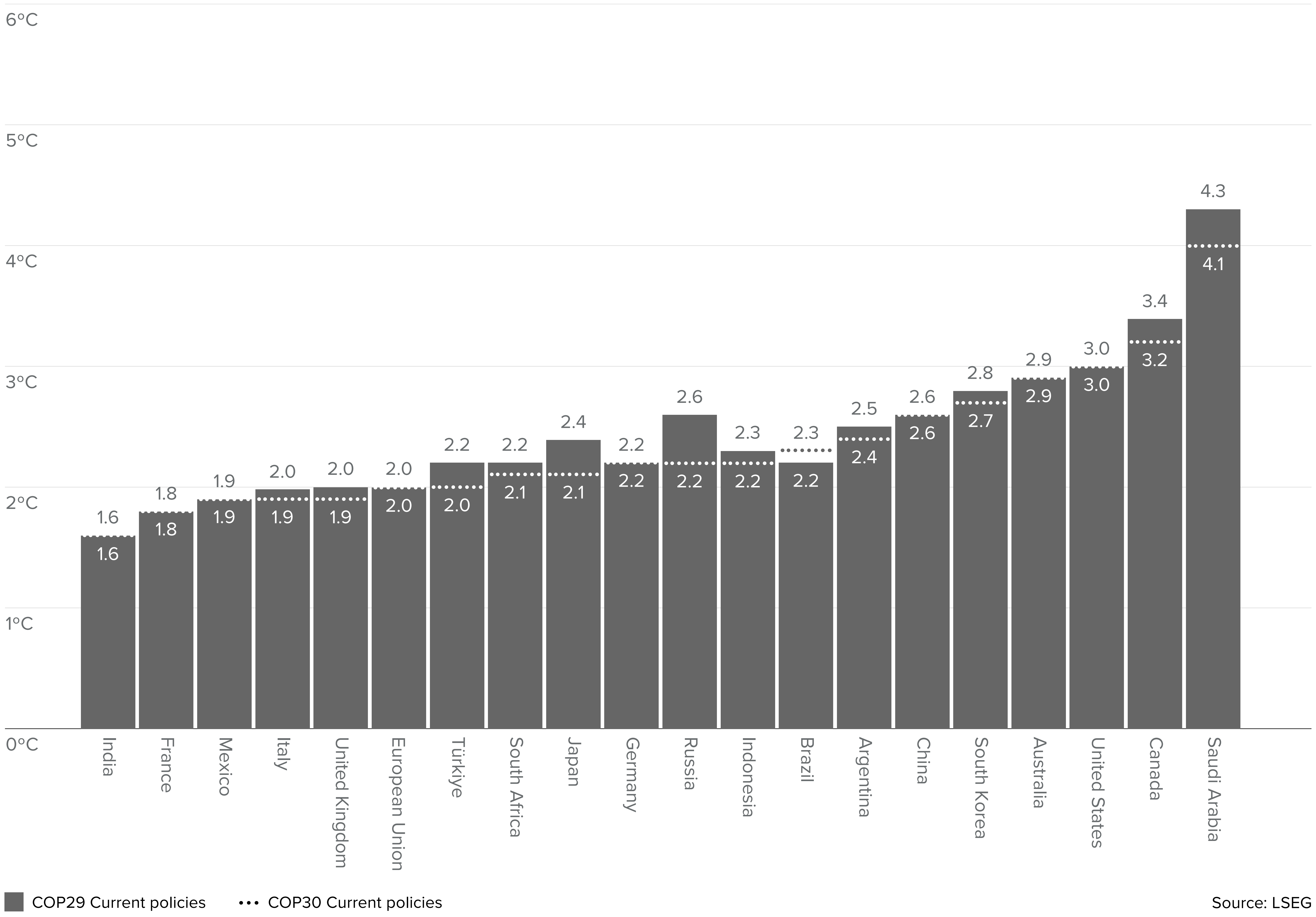
Figure 6. Implied Temperature Rise based on 2030 NDCs for COP29 and COP30 for the G20 countries (°C)



Note: We take the mean ITR where a range exists Source: LSEG

Chapter 1: Transition Risk

Figure 7. Implied Temperature Rise based on current policies from COP29 and COP30 for the G20 countries (°C)



Source: LSEG

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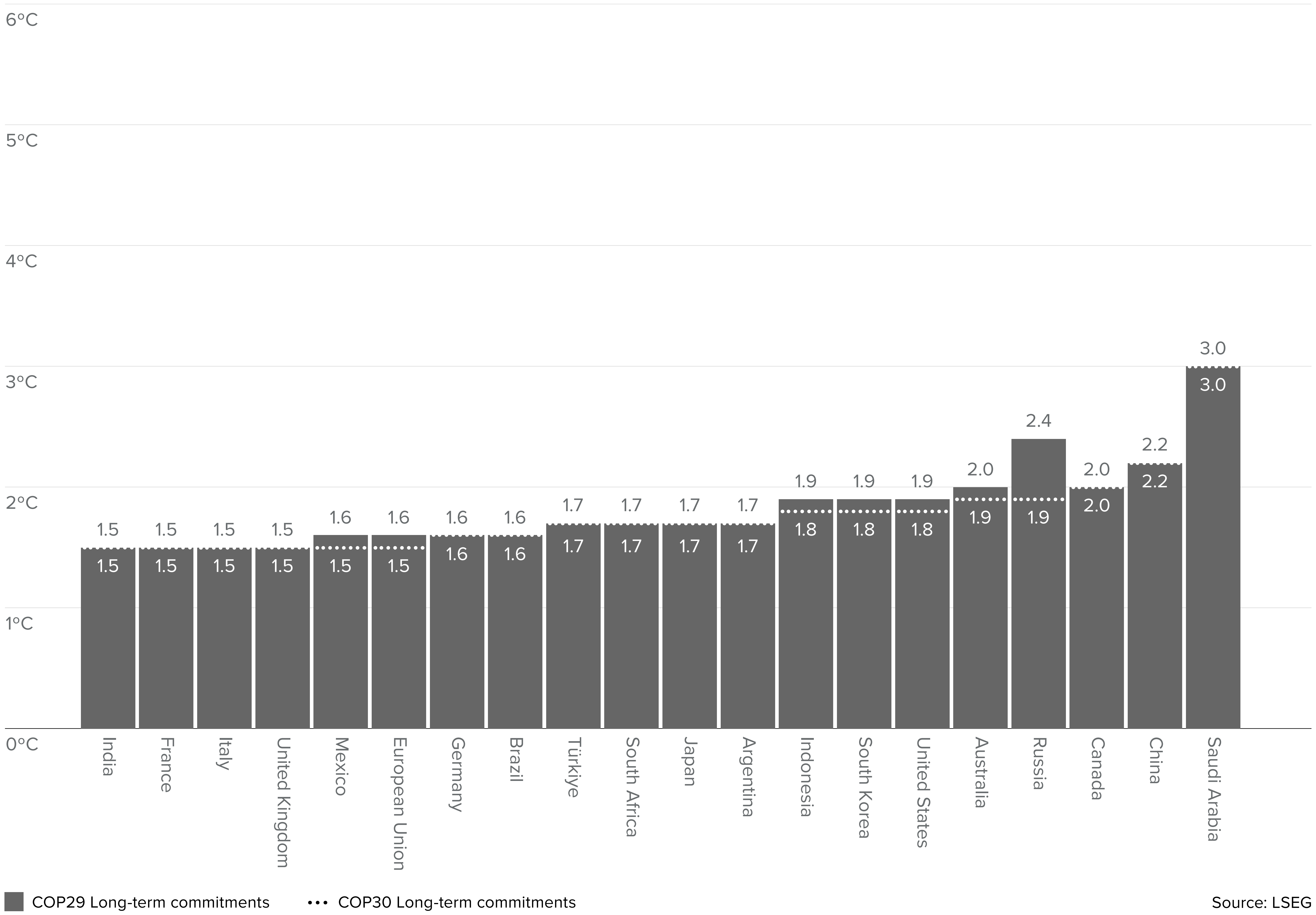
Figure 8. Implied Temperature Rise based on long-term commitments from COP29 and COP30 for the G20 countries (°C)



Source: LSEG

Chapter 1: Transition Risk

Figure 9. Climate policy KPIs from ASCOR[13]

ASCOR Indicator ID	Indicator title
CP2.a	Does the country have a carbon pricing system?
CP2.b	Does the country's carbon pricing system cover at least 50% of national greenhouse gas emissions?
CP2.b.i	What percentage of national greenhouse gas emissions is covered by an explicit carbon price?
CP2.c	Is the carbon price at least at the floor of a global carbon price corridor aligned with the Paris Agreement?
CP2.c.i	What is the country's most recent explicit carbon price?
CP3.a	Has the country committed to a deadline by which to phase out fossil fuel subsidies?
CP3.a.i	By what year has the country committed to phase out fossil fuel subsidies?
CP3.b.i	How much is spent annually on explicit fossil fuel subsidies as a percentage of GDP?
CP5.a	Has the country published a National Adaptation Plan?
CP5.b	Does the country regularly publish national climate risk assessments?
CP5.c	Has the country published a Monitoring & Evaluation report on implementing adaptation?
CP5.e	Is the country part of a sovereign catastrophe risk pool?
CF1.a	Does the country contribute at least a proportional share of the $100 billion commitment to climate finance?
CF1.a.i.	What is the country's 3-year average climate finance contribution as a % of GDP?
CF1.b	Has the country set a target for further increasing its international climate finance contributions?
CF1.b.i.	What is the country's targeted level of international climate finance contributions as a % of GDP?
CF4.a.i.	What is the country's prospective solar energy capacity?
CF4.a.ii.	What is the country's prospective wind energy capacity?
CF4.a.iii.	What is the country's prospective geothermal energy capacity?
CF4.a.iv.	What is the country's prospective hydroelectric energy capacity?

Source: ASCOR

Climate policy KPIs

In this COP30 Net Zero Atlas, we display a sub-set of indicators within the Country Profiles section that are adapted from Assessing Sovereign Climate-related Opportunities and Risks (ASCOR), an initiative backed by asset owners, asset managers and investor networks.[14]

Chapter 2: Physical Risk

Socio-economic data sources used in the analysis

China

Population and GDP: China's National and Provincial Statistical Yearbooks, accessed via Honghei Database, 2025;
Population: [Honghei]; **GDP:** [Honghei]

France, Germany, Italy and Türkiye

Population: Eurostat, Population change - Demographic balance and crude rates at regional level (NUTS 3), [eurostat]
GDP: Eurostat, Gross domestic product (GDP) at current market prices by NUTS 3 region, 2025 [eurostat]

Japan

Population and GDP: Japanese Government Statistics, System of Social and Demographic Statistics Prefectural Data Basic Data, 2025
Population: [e-Stat]; **GDP:** [e-Stat]

United Kingdom

Population and GDP: Office for National Statistics, Regional gross domestic product: all ITL regions, 2025 [ONS]

United States

Population: United States Census Bureau, County Population by Characteristics: 2020-2024, 2025 [US Census];
GDP: US Bureau of Economic Analysis, Gross Domestic Product by County and Metropolitan Area, 2023 [BEA]

Chapter 2: Physical Risk

Table 1. Regional units included in this analysis.

Country	Regional Unit	No. of regions	Median population	Median GDP (US$)	Median size (km²)
China	Administrative level 2 regions (prefectures)	360	3,159,400	29,390,810,277	12,380
France	Nomenclature of Territorial Units for Statistics (NUTS) level 3	101	528,600	18,910,358,997	5,944
Germany	NUTS level 3	400	156,540	6,719,577,206	802
Italy	NUTS level 3	107	380,900	12,028,481,834	2,444
Japan	Prefectures	47	1,550,000	46,033,056,737	6,095
Türkiye	NUTS level 3	81	542,170	4,399,416,090	7,854
United Kingdom	International Territorial Level 3	182	328,844	14,210,068,365	5,09
United States	Counties	3,138	26,052	1,294,129,525	1,629

Source: LSEG

Chapter 2: Physical Risk

Table 2. Definitions of the five hazards in our analysis, along with the number of regions projected to be at high risk from each hazard in 2050.

Hazard	Hazard metric	High Risk threshold	Number of regions at high risk in 2050 (% of total)
Cyclone	Annual probability of a Category 1 or stronger tropical cyclone	0.1	472 (10.7%)
Flooding	Annual probability of ≥0.5 m flood depth across an area	0.033	189 (4.3%)
Heatwave	Combination of annual number of days above the 98th percentile of historical temperatures, and the 98th percentile absolute temperature	30 days above 35°C	992 (22.5%)
Water Stress	Unitless water stress score, combining the Standardised Precipitation Evapotranspiration Index (SPEI) and WRI Aqueduct's water stress scores.	0.5	670 (15.2%)
Wildfire	Average percentage of region burned in one year	0.01	305 (6.9%)

Source: LSEG, adapted from Sust Global

Endnotes

Chapter 2: Transition Risk

1 UNFCCC, 2024 NDC Synthesis Report, 2024 [UNFCCC].

2 As per executive order "Putting America First in International Environmental Agreements", 2025 [The White House]. Formal withdrawal takes effect one year after notification.2023 [The White House].

3 UNFCCC, The United States of America Nationally Determined Contribution, 2025 [UNFCCC].

4 EU Environment Council, 2040 climate target, 2025 [Consilium].

5 As of 28th October 2025. This includes NDC 3.0s from 5 states that are not yet formally submitted to the UNFCCC registry or are in preliminary draft form (Türkiye, South Korea, European Union, Tunisia and China).

6 Permanent Mission of the People's Republic of China to the UN, 'President Xi Jinping Delivers Video Remarks at the U.N. Climate Summit, 2025 [Permanent Mission of the People's Republic of China to the UN].

7 United Nations, New national climate plans unveiled at high-level summit ahead of COP 30 conference, 2025 [UN].

8 The Chosun, 'Environment ministry proposes 60% emissions cut by 2035', 2025. [The Chosun].

9 Bloomberg, 'India draft plan reveals $21 Trillion Net Zero Investment Need', 2025. [Bloomberg].

10 Mexico Business news, 'Mexico unveils updated NDC 3.0 Commitments Ahead of COP30', 2025 [MexicoBusiness].

11 The G77, Statement on behalf of the Group of 77 and China by the delegation of Iraq at the informal meeting of the UN General Assembly on the priorities and preparation for the 2025 United Nations Climate Change Conference (COP30), 2025 [G77].

12 In July 2025, the One Big Beautiful Bill Act was codified, making broad changes to tax provisions for clean energy, including: phasing out solar and wind energy tax credits, expiration of tax credits for electric vehicles and home & commercial building energy efficiency credits, and extension of clean energy tax credits for clean hydrogen and biofuels. Estimates suggest the bill will materially slow deployment of renewables and electric vehicles in the US. Rhodium Group, What Passage of the "One Big Beautiful Bill" Means for US Energy and the Economy, 2025 [Rhodium Group].

13 While renewables are increasingly contributing to new energy demand, the large existing fossil infrastructure means reliance on fossil power remains significant. Global Energy monitor, Despite a record year, India needs to double renewables deployment by 2030 to meet energy targets, 2025 [GEM].

14 In Türkiye, the government unveiled its Renewable Energy Roadmap for 2035 on October 21, 2024, outlining ambitious plans to quadruple its wind and solar capacity to 120 GW by 2035. The roadmap includes measures such as annual renewable energy auctions of 2 GW, investments of $108 billion for capacity expansion and grid upgrades, and targets to add at least 7.5-8 GW of new renewable capacity each year.

15 For the purpose of aggregate G20 calculations, we include targets formally and informally announced by 10 G20 members. This excludes the Biden Administration's 2035 target which is set to be withdrawn.

16 UNFCCC, Nationally determined contributions under the Paris Agreement. Synthesis report by the secretariat, 2025 [UNFCCC].

17 We assume the EU's target is based on its recent statement of intent. EU Environment Council, 2040 climate target, 2025 [Consilium].

For France, Germany and Italy, we assume the same effort-sharing approach for the 2030 target as for the 2035 target. UNFCCC, EU NDC 2023 update, 2023 [UNFCCC].

For Türkiye, we assume its target to be 643 $MtCO_2e$ in 2035 based on recent announcements. President Erdoğan, Türkiye accelerates the green transformation, 2025 [The Republic of Türkiye Directorate of Communications].

Although Russia's NDC 3.0 appears more ambitious than NDC 2.0, its 2035 target is likely achievable with limited additional policy effort. For China, given uncertainty about the timing and level of its peak emissions, we assume the peak occurs at 2023 levels; NewClimate's current-policy projections show emissions rising only about 0.5% by 2025, so any resulting bias should be modest.

18 In this analysis, we focus on NDCs rather than countries' aspirational mid-century zero goals (or long-term low-emission development strategies (LT-LEDS) in the language of the Paris Agreement). Full implementation of both NDCs and LT-LEDS would imply material reductions in ITRs, often in the range of 0.3-0.6°C.

19 We determine the country's share of the global carbon budget by using LSEG's proprietary Climate Liabilities Assessment Integrated Methodology (CLAIM) model, which estimates the budget using a statistical approach that factors in historical and current emission levels to determine the remaining GHG allowance for each country. More details can found on page 12.

20 In 2024, Russia recalculated the emissions sink from its land use, land use change and forestry (LULUCF) sector for the whole historical time series from 1990 to 2022. This recalculation has resulted in, on average a c. 350% increase in its carbon sink. It's revision of 1990, the base year of its NDC, results in our calculation of its 2030 NDC being 1.60 $MtCO_2e$, compared to 2.05 $GtCO_2e$ in last year's COP29 Net Zero Atlas.

Endnotes

Chapter 2: Physical Risk

1 Munich Re, Natural disaster figures for the first half of 2025, 2025 [Munich Re].

2 Swiss Re, Wildfires and severe thunderstorms in the US drive global insured losses to USD 80 billion in first half of 2025, Swiss Re Institute estimates, 2025 [Swiss Re].

3 AXA XL, Los Angeles wildfires; the reinsurance claims picture, 2025 [AXA XL].

4 LA Times, Estimated cost of fire damage balloons to more than US$250 billion, 2025 [LA Times].

5 Reuters, More than 300 people dead in Pakistan after heavy rains, floods, 2025 [Reuters].

6 Sources for GDP and population per country found on page 18. Global total based on World Bank data [World Bank].

7 Physical risk data was provided by Sust Global, a specialist in climate hazard analytics [Sust Global].

8 Projections are based on Lee et al., Future Global Climate: Scenario-Based Projections and Near-Term Information. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 2021 [IPCC]. By contrast, scenarios with stronger climate action project warming of about 1.6-2.1°C over the same period.

9 Based on data from Figure SPM.8 (v20210809) in the Summary for Policymakers of the Working Group I Contribution to the IPCC Sixth Assessment Report [CEDA].

10 S&P Global Ratings, LADWP Power and Water Systems - Ratings Report, 2025 [LADWP].

11 ING, Extreme weather is making major trade routes less reliable, and it's only going to get worse, 2024 [ING].

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13 AON, 2025 Climate and Catastrophe Insight, 2025 [AON].

14 CNN, Florida's home insurer of last resort is in serious trouble. Will Milton put it over the edge?, 2024 [CNN].

15 LSEG, Investing in the Green Economy 2025, 2025 [LSEG].

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21 Seneviratne, S.I., X. Zhang, M. Adnan, W. Badi, C. Dereczynski, A. Di Luca, S. Ghosh, I. Iskandar, J. Kossin, S. Lewis, F. Otto, I. Pinto, M. Satoh, S.M. Vicente-Serrano, M. Wehner, and B. Zhou, Weather and Climate Extreme Events in a Changing Climate. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 2021 [IPCC].

22 These finding are complimented by recent research that found the probability that cyclones will reach or exceed Category 3 has risen by nearly 50% per decade since 1980: Kossin, J., Knapp, K., Olander, T. and Velden, C., Global increase in major tropical cyclone exceedance probability over the past four decades, The Proceedings of the National Academy of Sciences, 117 (22) 11975-11980, 2020. https://doi.org/10.1073/pnas.1920849117.

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24 UK Environment Agency, Risk of flooding from surface water – understanding and using the map, 2025 [UK Government].

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33 BBC News, Spain and Portugal wildfires drive worst EU season on record, 2025 [BBC].

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Chapter 3: Country Profiles

Argentina

1. Argentina's National Carbon Tax [World Bank]. Data correct as of 1 April 2025.

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5. Global Energy Monitor, Global Wind Power Tracker [GEM]. Data correct as of February 2025. GDP values are GDP (current US$) [World Bank].

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Australia

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3 IMF, Fossil Fuel Subsidies, 2024. [IMF]. Data correct as of 28 November 2024. We consider explicit subsidies only.

4 Australia's National Climate Resilience and Adaptation Strategy 2021 – 2025, [UNFCCC].

5 Australia's Adaptation Communication, 2021 [UNFCCC].

6 Australia's Fifth Biennial Report and First Biennial Transparency Report [BR5 and BTR]. Values are based on total climate-specific contributions. GDP values are GDP (current US$) [World Bank].

7 We base our assessment on the work of The Assessing Sovereign Climate-related Opportunities and Risks (ASCOR) project, which calculates a proportional share of the \$100 billion climate finance commitment to be 0.2% of GDP.

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Source: NDC and long-term commitment emission trajectory plots and Implied Temperature Rise values in the Country Profile chapter are based on LSEG data and analysis. Current policy emission projections are based on data from NewClimate.

Disclaimer: The emissions projections presented in the Atlas are based on current data, modelling assumptions, and policy scenarios. They should not be interpreted as definitive forecasts. Actual future emissions may vary due to changes in technology, policy and other unforeseen factors.

Endnotes

Annex: Data & Methodologies

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About LSEG

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