

The COP26 Net Zero Atlas

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Foreword



A handwritten signature in black ink, appearing to read 'Arne Staal', written in a cursive style.

Arne Staal

Group Head of Benchmarks
& Indices, CEO
FTSE Russell

Success at COP26 is critical to achieve the goals of the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels and avoid the worst impacts of climate change.

The financial system has a crucial part to play in achieving economy-wide decarbonisation and transitioning to a Net Zero economy. This requires rapid innovation, creating tools for investors to measure and manage climate risk in their portfolios and to help direct capital flows to a Paris-aligned trajectory.

In this first FTSE Russell *Net Zero Atlas*, we leverage our analytical tools – originally developed to assess climate risk for sovereign assets in fixed income markets – to evaluate the ‘temperature alignment’ of national climate commitments for G20 countries in a systematic, rigorous manner. We are also grateful to researchers at IIASA and NewClimate Institute for their valuable input and analysis.

This analysis shows that while much progress has been made since Paris, national commitments in aggregate could still fall short of the scale and pace of change required, with countries’ current policies aligning with a 3°C global warming trajectory, double that of the Paris agreement.

This has major implications for investors and underlines once again the urgency in redoubling global climate efforts and the importance of COP26 negotiations in safeguarding the well-being and prosperity of future generations.

Executive summary

Since the landmark 2015 Paris Agreement was reached at COP21, the low carbon transition has gathered significant momentum and mitigation solutions are becoming increasingly practical and affordable. Nonetheless, emissions continue to grow as accelerating carbon intensity reductions and energy efficiency gains have so far been insufficient to offset the ongoing expansion of the global economy. Meanwhile, many governments have also updated their 2030 'Nationally Determined Contributions' (NDCs) and set new 2050 'Net Zero' targets² in the run-up to COP26 climate summit.

As world leaders gather in Glasgow to review progress and agree new climate measures, our first Net Zero Atlas surveys countries' climate targets and mitigation strategies, including the latest announcement from India. Building on our work on climate risk for sovereign assets in fixed income markets, we calculate the Implied Temperature Rise (ITR) associated with individual national climate goals. This provides a consistent (if highly stylized) metric to assess alignment with different global warming trajectories and to systematically compare climate commitments across countries and over time.

We apply this methodology to the climate commitments of G20 countries for 2050, based on their Net Zero targets, and for 2030, based on both their NDCs and 'Current Policies'. The latter presents emissions projections that have been developed in an associated research project led by researchers from IIASA and the NewClimate Institute,³ and assumes that current national climate policies would stay in place unaltered.

In addition to Climate Ambition Profiles for each G20 country (see Section 3) , our key takeaways include:

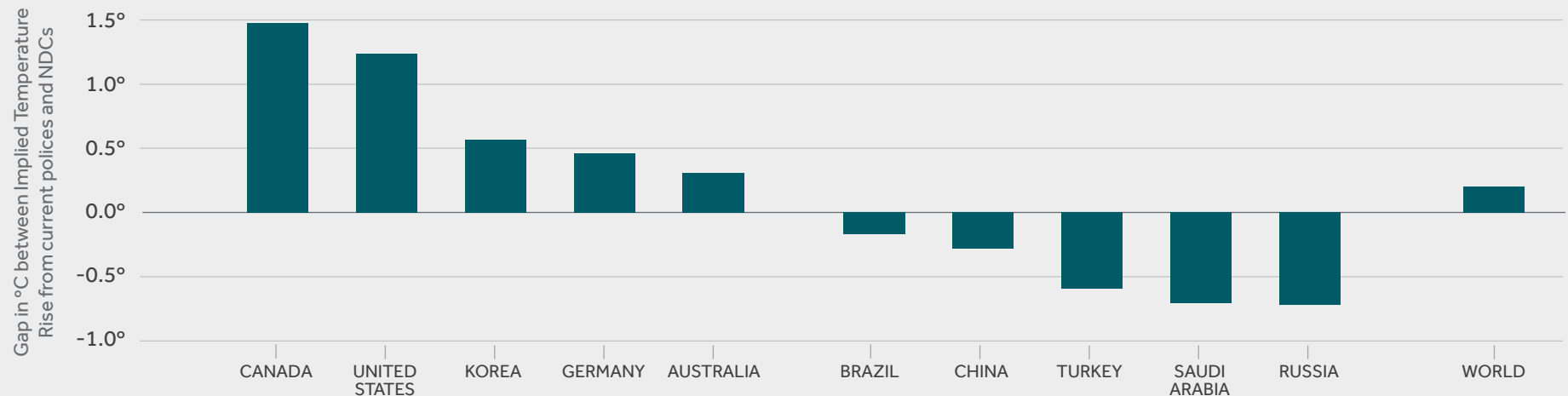
- ⦿ **Net Zero targets are not necessarily Paris aligned.** The Net Zero targets announced ahead of COP26 would on average lead to a global temperature rise of 2.1°C based on our estimates, well above a 1.5°C trajectory. Among G20 countries, we find Saudi Arabia has the least ambitious Net Zero target, aligned with 2.9°C. Several G20 countries are yet to set Net Zero targets, including Mexico and Russia.
- ⦿ **There is an 'ambition gap' between 2050 Net Zero targets and 2030 NDCs.** On average, NDCs imply a temperature rise 0.7°C higher than their corresponding Net Zero pledges. The EU, the UK, and India (due to low per capita emissions) are the only major emitters with 2030 targets in line with the Paris Agreement. The NDCs of Saudi Arabia, Russia, and Australia currently align to a 4°C+ warming trajectory; while those of China, South Korea and Canada align to a 3°C+ trajectory.
- ⦿ **Like the NDCs, we find that the current policies of G20 countries are not yet aligned with the Paris Agreement** – in aggregate, we estimate a 3.0°C warming trajectory based on current policies vs. 2.8°C for the NDCs. However, we find significant variability in the relationship between current policies and NDCs across countries.

Executive summary

⦿ **Current policies for several advanced economies appear significantly off track when measured against their more ambitious NDCs.** This is most pronounced for the US and Canada, where Current Policies are tracking towards a 4°C+ trajectory (over 1°C higher than implied by their NDCs); but this also applies to South Korea and Germany, who both have temperature pathways that are 0.5°C and 0.6°C higher for current policies than what is implied by their NDCs.

⦿ **By contrast, for a number of emerging economies, current policies are on track to deliver significantly greater emissions reductions than pledged in their NDCs.** This includes Russia (with Current Policies aligning to a 0.7°C lower trajectory than its NDCs), Turkey (0.6°C) and China (0.3°C). These countries appear well-positioned to increase the ambition of their NDC commitments.

Gap between Implied Temperature Rise from Current policies and NDCs



Source: FTSE Russell & Beyond Ratings Research.

Note: We estimate that the ITR of Canada's Current Policies is 1.5°C above the ITR of its NDC.

Introduction

In 2015, at the 21st Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Paris, 195 countries agreed to limit global warming well below 2°C. At the heart of the Paris Agreement is an iterative process, in which countries increase their mitigation commitments over time to eventually align with this long-term objective. Countries developed their first “Nationally Determined Contribution” (NDC) in the run-up to COP, with the view to revise these every five years.

As COP26 kicks off in Glasgow, this mechanism appears to be at least a partial success. Most large emitters have revised their NDCs and set new ambitious goals to reach Net Zero⁴ emissions by the middle of the century, including the EU, US, and Japan by 2050, China by 2060, and India by 2070.⁵

In parallel, countries have not only set targets, but also enacted a wide range of key climate policies that aim to slash emissions, particularly in sectors such as power generation or road transportation, where immediate mitigation options appear most tangible. The fast decarbonization of electricity seen in the United Kingdom – thanks mainly to a carbon price mechanism and a renewable energy support scheme – or the targets on stopping the sale of internal combustion vehicles, such as those planned in Japan by 2035 – are great examples in this regard. Many other policies could be mentioned in other areas, such as the successful afforestation and reforestation programs in China or India.

With multiple policies, targets and ambitions being formulated and revised by countries at different stages of economic development, taking stock of global mitigation efforts has become a daunting exercise. That greater efforts are required is clear, but who is leading and who is lagging? Are the new Net Zero targets consistent with the Paris Agreement? Are the revised NDCs, in turn, consistent with their Net Zero Targets? And are countries’ current policies really on track to achieve 2030 commitments and 2050 goals?

Our first Net Zero Atlas is attempting to answer these questions. We do this by calculating the Implied Temperature Rise (ITR) associated with G20 countries

Net Zero targets, NDCs and, crucially, mitigation measures in force today. For the latter, we draw on detailed emissions trajectories based on Current Policies constructed by researchers from the NewClimate Institute and IIASA in Nascimento et al. (2021).⁶

While ITR methods are more commonly used in assessing climate risk in investment portfolios, our approach builds on our extensive work in assessing climate risks for sovereign assets in fixed income markets. This enables us to evaluate the alignment of national climate commitments with the Paris Agreement’s objectives at different points in time, and to compare countries with very different current and future emissions profiles on a consistent basis.⁷

In the following section, we first provide an analysis of global sectoral greenhouse gas emission (GHG) trends and their key drivers, as well as available mitigation options. We then outline a cross-country overview of our findings, evaluating the latest round of national climate targets, which include both Net Zero and Nationally Determined Contributions. Particular attention is paid to the consistency between commitments and the alignment of implemented policies. The final section of this report is devoted to Climate Ambition Profiles for each of the G20 countries. A description of the data and methodologies used for our assessments can be found in the Appendix.

1

A sectoral lens on the race to (Net) Zero



In the following section, we provide an analysis of global sectoral greenhouse gas emission (GHG) trends and their key drivers, as well as available mitigation options.

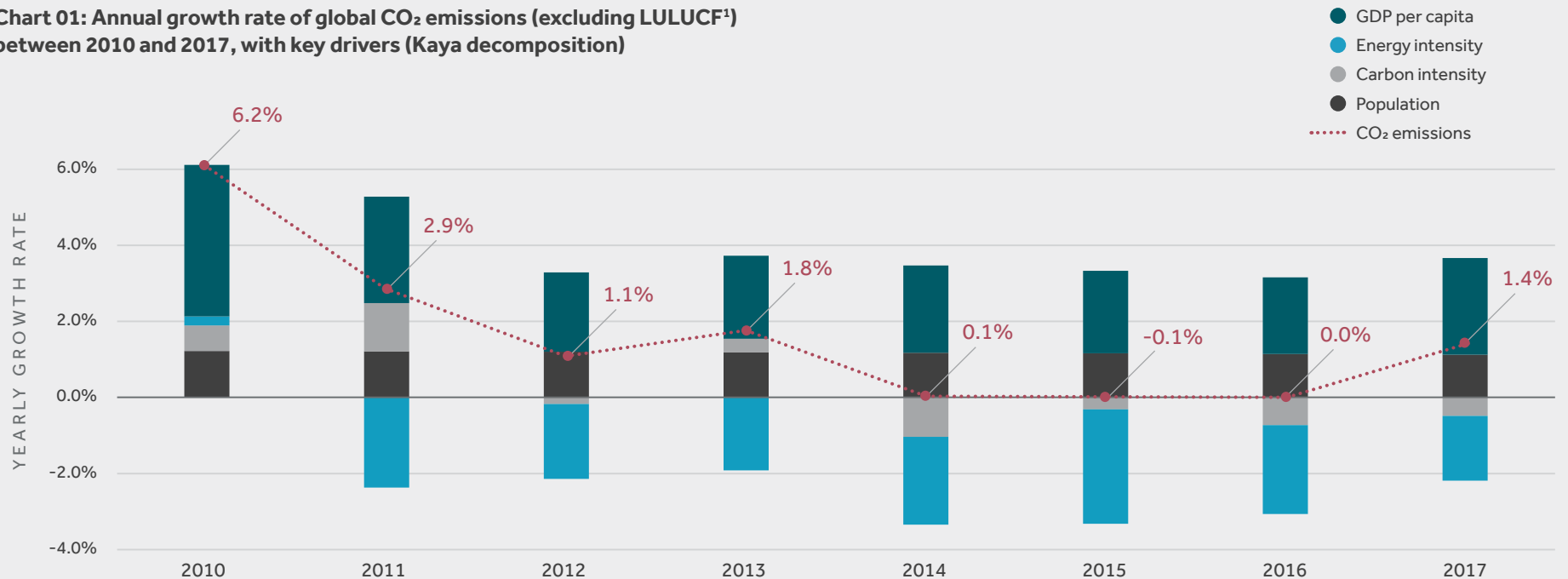
The Paris Agreement fired the starting gun in the race to “limit the temperature increase to 1.5°C above pre-industrial levels” by reaching Net Zero emissions by the middle of the century (defined by the IPCC as a state where “anthropogenic CO₂ emissions are balanced globally by anthropogenic CO₂ removals”).

However, despite accelerating transition efforts, anthropogenic greenhouse gas emissions (GHGs) are higher than ever before and continue to accumulate in the atmosphere. On a macro level, the primary drivers of these emissions are the size

of the economy (determined by population size and GDP per capita), its energy intensity (energy consumption per unit of GDP), and the carbon intensity of the energy it consumes.

Chart 01 shows that economic growth has been the leading factor driving emissions growth, overpowering gains in energy efficiency and the gradual decarbonization of the energy system, resulting in a net growth rate of emissions of 1.3% per annum (see Chart 01) based on Lamb et al., (2021).

Chart 01: Annual growth rate of global CO₂ emissions (excluding LULUCF¹) between 2010 and 2017, with key drivers (Kaya decomposition)



Source: FTSE Russell & Beyond Ratings Research based on Lamb et al., 2021.

Readers' notes: Energy intensity measured in joules of energy per unit of GDP, carbon intensity measured in CO₂ emissions per joule of energy

Mitigation strategies

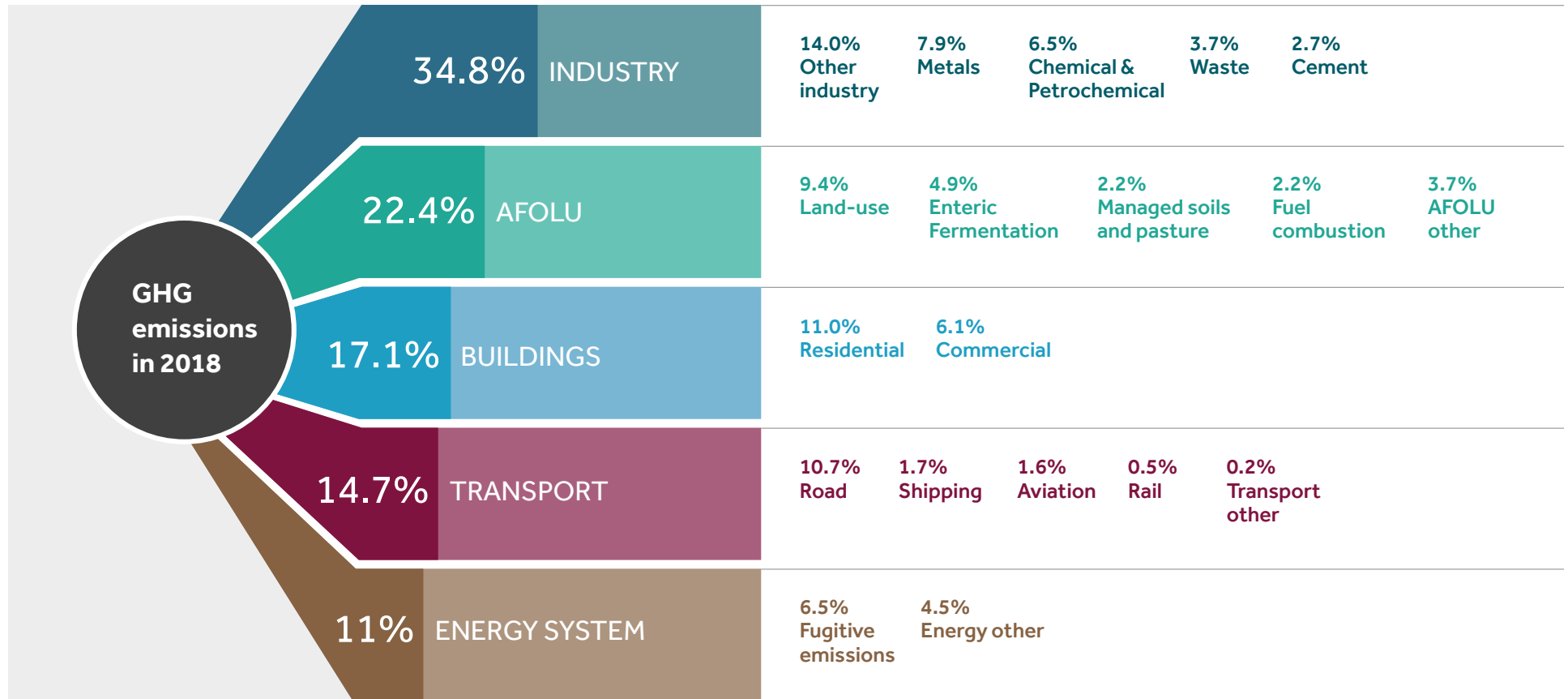
Understanding the levers to accelerate energy efficiency gains and the decarbonization of the global economy requires a sectoral perspective. GHG emissions can principally be linked to Industry, Transport and Buildings, as well as the Agriculture, Forestry and Other Land Use (AFOLU) sector, and the energy system (see Chart 02). Despite emissions falling in some countries' energy sectors, many studies show that no economic sectors are aligned with the 1.5°C global objective based on current rates of decarbonization (IPCC, 2018;² IEA, 2021;³ Rogelj et al., 2018;⁴ Lebling et al., 2020⁵), see Chart 05 for a sectoral overview.

While each sector has its own emissions profile, the lion's share of global emissions results from the combustion of fossil fuels in various forms, which contributed⁶ 76% of net total GHG emissions in 2018. Most climate change mitigation strategies therefore, unsurprisingly, focus on reducing the use of fossil fuels. A recent study estimated that 60% of oil and gas reserves and 90% of coal reserves should be left in the ground to limit warming to 1.5°C,⁷ with global production respectively declining by an average of 3% and 7% per year through to 2050. To achieve a Net Zero economy, however, also requires tackling other areas that are significant sources of GHG emissions, such as industrial processes, for instance through cement or steel production, and agricultural and land-use changes.



Despite emissions falling in some countries' energy sectors, many studies show that no economic sectors are aligned with the 1.5°C objective...

Chart 02: Sectoral GHG emissions in 2018



Source: FTSE Russell & Beyond Ratings Research based on Lamb et al., 2021.⁸

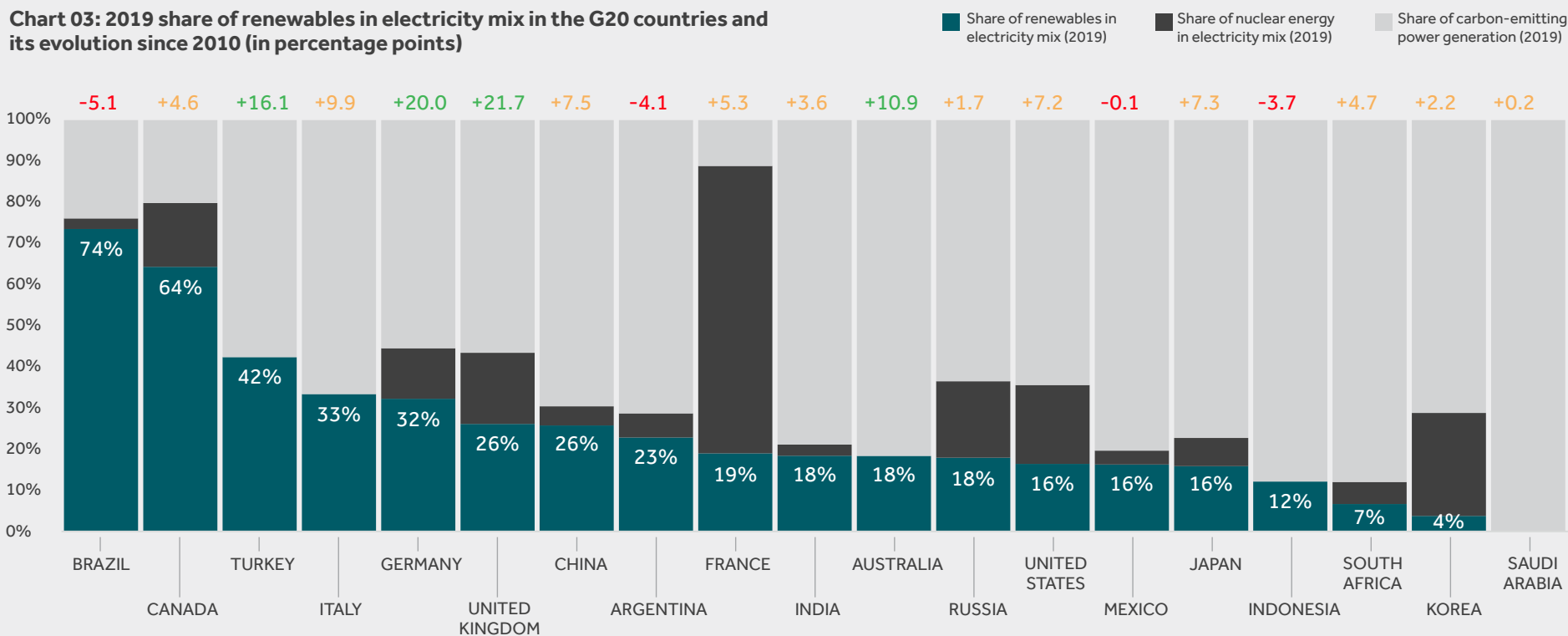
Readers' notes: The GHG emissions produced by generating electricity and heat are allocated to their end-use sectors, with electricity and heat, energy systems account for 34.2% of GHG emissions.

Energy efficiency gains, particularly in industry, have played a key role in slowing emissions growth. Such efficiency gains will continue to be a critical driver of the energy transition in coming decades,⁹ such as through more stringent energy standards for new buildings and the retrofitting of existing buildings,¹⁰ or through shifting passenger demand from private to public transport.

However, broader decarbonization is essential to reverse emissions growth and ultimately achieve Net Zero. Initial steps in the right direction have been taken,

particularly in power generation, but mitigation efforts need to be strongly reinforced to continue this trend (see Chart 03). To align with a 1.5°C warming pathway, power generation from renewables as a proportion of global supply needs to at least double by 2030 from 25% today, while the share from coal needs to fall by over 90%, from 38% today.¹¹

Chart 03: 2019 share of renewables in electricity mix in the G20 countries and its evolution since 2010 (in percentage points)



Source: based on Enerdata Global Energy & CO₂ database, www.enerdata.net.

Note: the evolution of the renewable share in the electricity mix are given in the labels above the countries' mix (in percentage points)

Through electrification, the decarbonization of power generation also unlocks transition strategies in other sectors such as transport, buildings or industry. The rapid spread of electric vehicles is a primary example of this, although progress has been uneven. For example, in industry, electricity as a share of final energy consumption has been relatively stagnant, due to challenges in substituting fossil fuel inputs in some industrial processes (such as cement or chemicals). Overcoming these challenges instead requires rapid innovation to develop alternative technological solutions to decarbonize (Rissman et al., 2020).¹² Among the potential solutions are Carbon Capture and Storage (CCS) and zero-carbon hydrogen.

For agriculture, mitigation strategies include productivity improvements and changes in diet and consumption patterns, including the reduction of waste. New agricultural practices, which for example limit or avoid the use of fertilizers, are emerging mitigation options that reduce emissions associated with fertilizers consumption. For land use in general, enhancing forest cover remains a critical strategy for sequestering and lowering GHG emissions through reforestation, afforestation, avoiding deforestation and improved forest management. Directly removing emissions from the atmosphere is an important part of the Net Zero challenge (See Box 1).

BOX 01: Net Zero objectives and negative emissions

Meeting Net Zero emission targets is above all a question of reducing emissions. However, emissions may be too costly or difficult to reduce to absolute zero in some sectors, such as in energy-intensive areas of heavy industrial activities. While the heavy lifting needs to come from reducing emissions throughout the economy, under Net Zero targets, some emissions can remain if they are balanced out by removing an equivalent amount of CO₂ from the atmosphere.

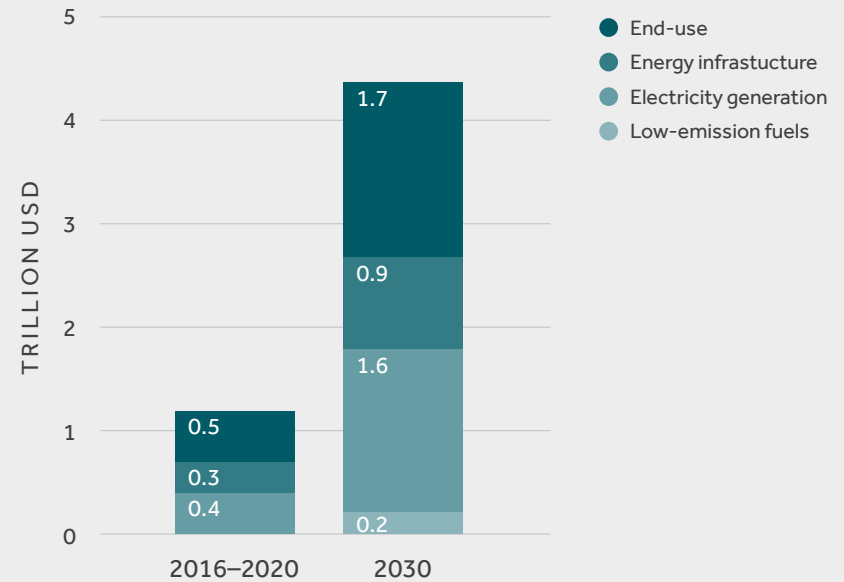
Carbon can be removed from the atmosphere through either natural or technological means. The most promising methods¹³ include afforestation and reforestation, land management, bioenergy with carbon capture and storage (BECCS), and direct air capture and carbon storage (DACCS).¹⁴ However, costs and side effects vary widely across these “negative emissions technologies” (NETs), as do the permanence of their removals beyond 2050. Such risks mean that diversified NETs portfolios are likely to be the best way to remove carbon from the atmosphere, while hedging against their risks.

NETs are not without controversy. They have been criticized of being used as an excuse to delay or avoid cutting gross emissions through relying on high levels of assumed future carbon removals. Yet, all the scenarios identified by the IPCC as being consistent with the objectives of the Paris Agreement rely upon using carbon removals to some extent. Based on different countries’ climate-related policies and NDC commitments, the world is also currently not on track to meet either a 1.5°C and 2°C warming pathway, making the objectives of the Paris Agreement increasingly dependent on NETs.¹⁵

Investors are critical enablers for these mitigation strategies through allocating capital to rapidly scale existing solutions, helping to bring emerging decarbonization technologies to market, and through engagement strategies to promote decarbonization throughout the economy.¹⁶ According to the International Energy Association (IEA), a 1.5°C trajectory requires annual investment in the power sector alone to increase from an average of USD 1.2 trillion over the last five years to USD 4.4 trillion by 2030 – the equivalent of growing annual investment in clean energy from 1.5% to 4% of global GDP. (Chart 04).

The lesson for investors from the IEA's analysis is that no new oil, gas or coal fields should be exploited, and no existing fields should be expanded, if the world is to meet the goal of Net Zero emissions by 2050. In this regard, Net Zero objectives that will be discussed in the next section send critical messages to private actors of the direction of travel in markets. Every investor, company and consumer should know that fossil fuels will largely disappear from our economic system by 2050.

Chart 04: Need for rapid growth in annual clean energy investment to align with a Net Zero trajectory in 2050¹⁷



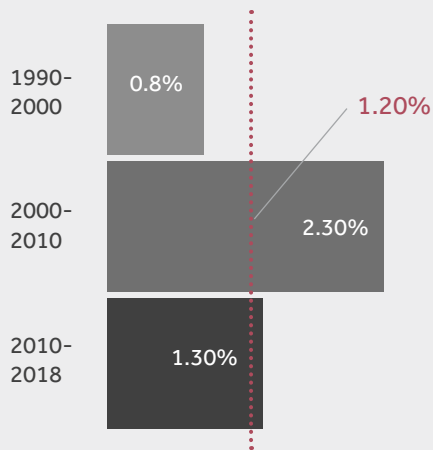
Source: based on IEA data.

Chart 05: Historical trends of sectoral GHG emissions at global level (yearly growth rate)

GHG emissions growth per annum
 -1% 0% 1% 2% 3% 4% 5%
 Average growth

Total GHG emissions in 2018

GHG emissions growth per annum

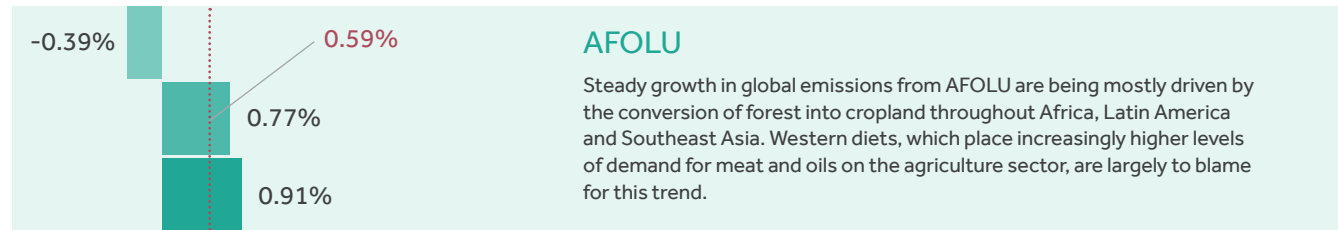


Source: FTSE Russell & Beyond Ratings Research based on Lamb et al. (2021) (the GHG emissions produced by generating electricity and heat are included in the Energy Systems sector, contrary to Chart 02).



INDUSTRY

Industry was responsible for around a third of global emissions in 2018, making it the largest emitting economic sector. Industrial energy efficiency has improved significantly since the 1990s, but the sector's emissions are expected to grow due to a combination of few practical mitigation technologies and increasing demand for industrial goods, particularly from emerging economies.



AFOLU

Steady growth in global emissions from AFOLU are being mostly driven by the conversion of forest into cropland throughout Africa, Latin America and Southeast Asia. Western diets, which place increasingly higher levels of demand for meat and oils on the agriculture sector, are largely to blame for this trend.



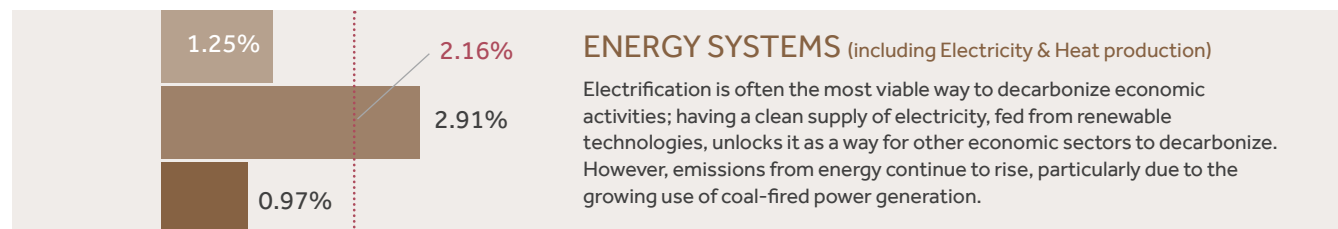
BUILDINGS

Emissions from buildings are following different trajectories based on the region; while they are falling in North America, Europe, and APAC, they continue to grow in the rest of the world, driven by population growth, a larger stock of buildings, buildings with more floor space.



TRANSPORT

Over the last three decades, not one region has achieved a sustained reduction in emissions from transport. Energy efficiency in the transport sector has steadily increased over time, mainly due to efforts in developed countries, but rising demand for heavy, emissions-intensive vehicles has continued to put upward pressure on global emissions from the sector.



ENERGY SYSTEMS (including Electricity & Heat production)

Electrification is often the most viable way to decarbonize economic activities; having a clean supply of electricity, fed from renewable technologies, unlocks it as a way for other economic sectors to decarbonize. However, emissions from energy continue to rise, particularly due to the growing use of coal-fired power generation.

2

An Implied Temperature Rise (ITR) approach to assess national climate targets



This section introduces an innovative analytical framework that allows us to systematically evaluate national climate commitments based on calculating the associated Implied Temperature Rise (ITR). This provides a consistent, if highly stylized, metric to compare commitments across countries and over time and assess their alignment with global warming trajectories.

A sectoral lens is essential to understand the key pathways for a successful low carbon transition. However, governments – through their policies and international negotiations – are in many ways the principal agents in setting the pace of this transition.

This makes cross-country perspectives and an analysis of national commitments equally indispensable in taking stock of global transition efforts. Indeed, the same global climate crisis generates quite different policy responses in Berlin, Canberra or Delhi, shaped by their variable exposure to carbon intensive sectors, different political systems and stages of economic development.¹

This is further complicated by time inconsistencies of policy responses – what governments promise for 2050 is, in many cases, out of sync with the commitments for 2030 that are enshrined in the NDCs, which in turn may be incoherent with current policies that are implemented today.

This chapter introduces an innovative analytical framework that allows us to systematically compare such climate commitments. This is based on calculating the Implied Temperature Rise (ITR) associated with a specific national climate commitment, providing a consistent, if highly stylized, metric to compare commitments across countries and over time, and assess their alignment with global warming trajectories.

While much of the ITR literature has been developed in the context of assessments of investment portfolios (particularly focused on listed equity),² this report builds on our extensive existing work to develop analogous approaches to assess ITR for sovereign assets in fixed income markets.³

We empirically apply this methodology to climate commitments of G20 countries for 2050⁴ based on their mid-century Net Zero commitments; and for 2030 – both for their NDCs and Current Policies – the latter presenting emissions scenarios developed in an associated research project led by NewClimate Institute and IIASA researchers, which assumes that countries' current climate policies remain in place until 2030.⁵

On the eve of the COP26 in Glasgow, this allows for a systematic assessment of the complex landscape of national climate commitments, highlighting not only where countries' climate targets lag the goals of the Paris Agreement, but also where ambitious long-term targets are inconsistent with current policy and 2030 commitments.

Following an explanation of our analytical approach, the remainder of the chapter highlights the key findings of our comparative analysis, before the next section provides a collection of climate commitments profiles for each of the G20 economies.

2.1 Implied Temperature Rise (ITR) estimates for national carbon commitments

We calculate the Implied Temperature Rise (ITR) for each country and three scenarios (Net Zero targets, NDCs and Current Policies) in four steps.⁶

- 1** We first estimate the **annual GHG emissions per capita and population** of each country for 2030 (separately for NDCs and Current Policies) and 2045/2050/2060 (depending on the Net Zero target of the country considered). We calculate this based on the reductions implied by the announced NDCs and Net Zero targets, assuming that countries meet their goals. For Current Policies, this is based on detailed projections developed in Nascimento et al. (2021) that assume no additional mitigation action would be taken beyond the currently implemented policies (further detail on these calculations can be found in the annex).
- 2** We then assign the **percentage shares of the global annual carbon budget** in 2030 and 2045/2050/2060 to individual countries, based on the CLAIM model.⁷ This “share of the burden” calculation, based on a proprietary model, uses a statistical approach to simulate millions of possible “country shares” according to their climate and economic profile (historical emissions, energy intensity, GDP/capita, etc.). The model provides likely carbon budgets allocations, consistent with a 2°C scenario, whose global budget comes from the MESSAGE-GLOBIOM model used in the assessment reports of the IPCC.⁸
- 3** We then calculate the **implied global emissions** for each country’s Net Zero target, NDCs and Current Policies.⁹ This is based on the emissions projections and their percentage share of global emissions budget, i.e. the level of global emissions that would result from all other countries having the same implied level of effort as the country in question.
- 4** Finally, we calculate the **Implied Temperature Rise (ITR)** over pre-industrial levels, including the implied global emissions for each country and scenario respectively. These calculations are based on an equation translating GHG emissions volume into a temperature increase. This equation is calibrated on the recommendations of Rogelj et al. (2019)¹⁰ based on IPCC (2018),¹¹ see Emin et al. (2021) for more details.

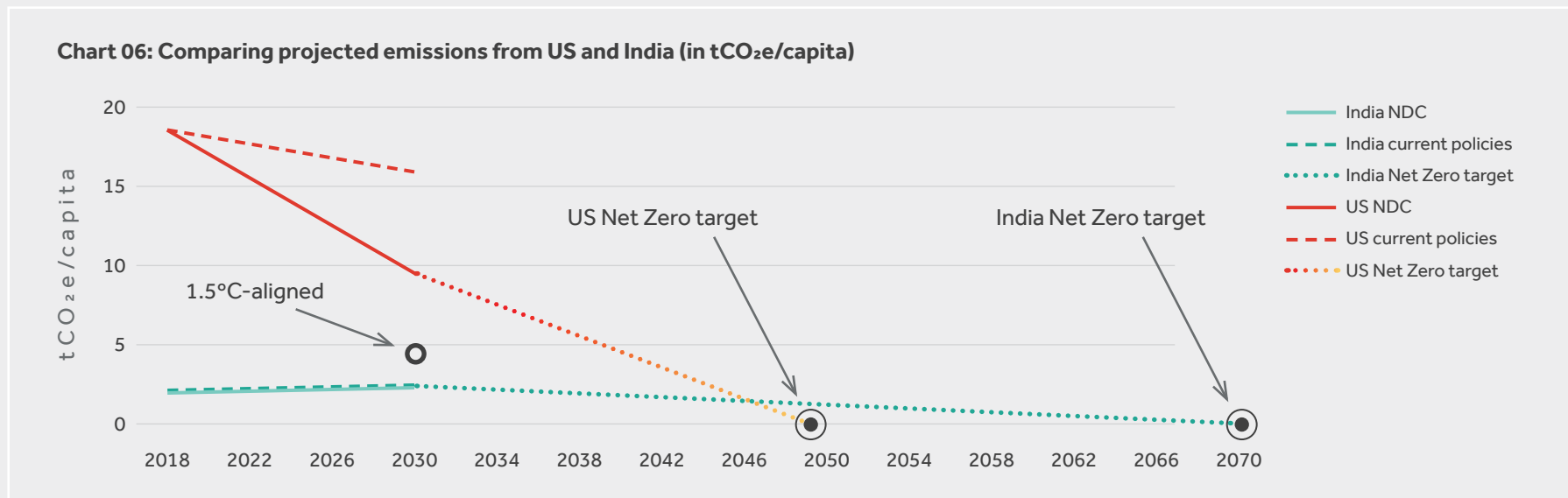
BOX 02: Interpreting ITR

Our country-level temperature metrics (denoted in °C) indicate the global “Implied Temperature Rise” if every country had 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.

In interpreting these temperature metrics, it is worth keeping in mind that, while the focus is on annual per capita emissions at a specific moment in time, a 1.5°C or 2.0°C aligned trajectory results from the extent of cumulative anthropogenic emissions over time. Therefore, a country with very high per capita emissions which has set a 2050 Net Zero target could, for example, have a 2°C+ ITR. Effectively, such a country would have consumed much of its carbon budget already and would need to decarbonize faster than 2050 to remain aligned with the goals of the Paris Agreement.

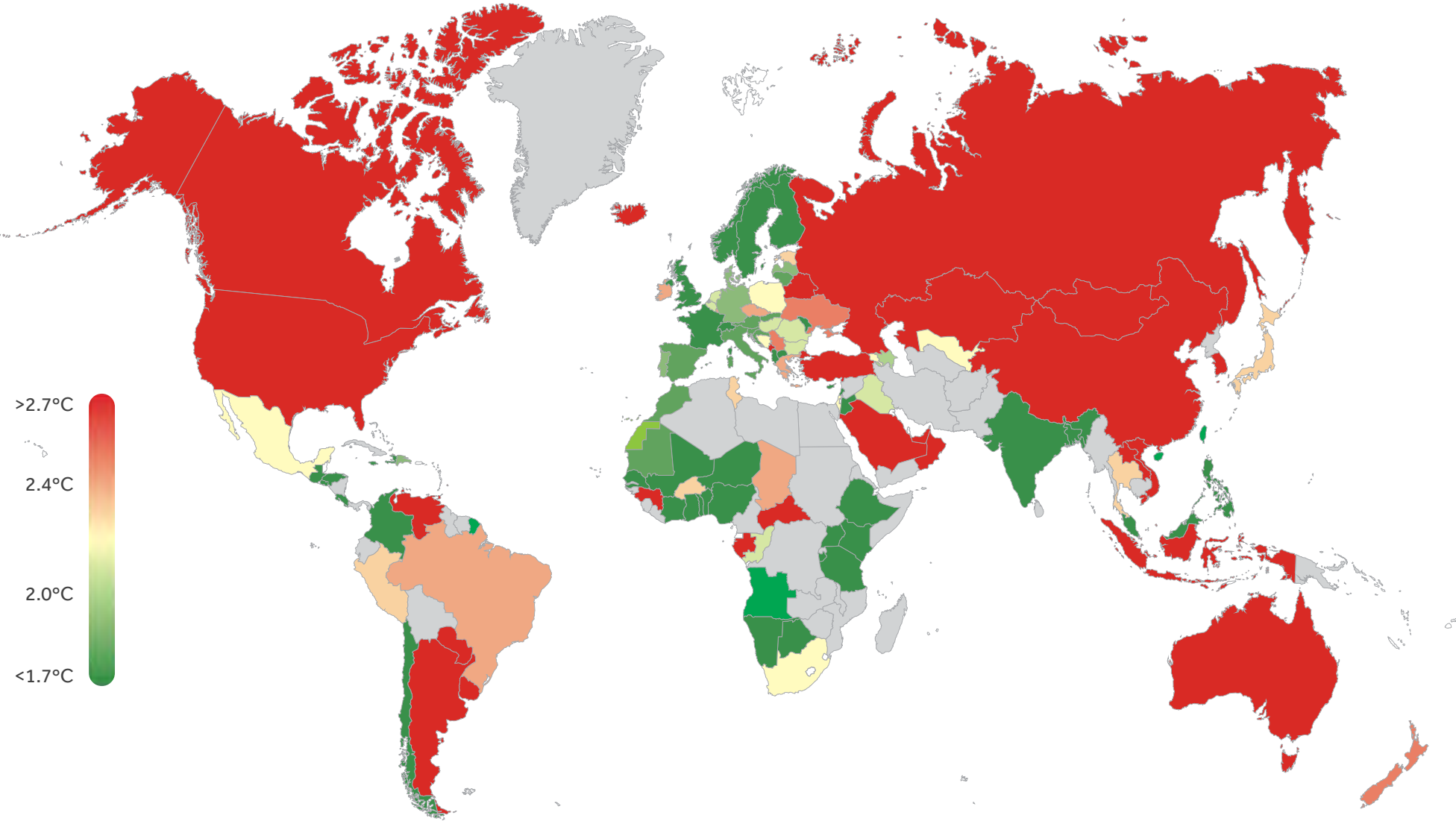
When comparing the temperature results from the United States and India for instance, we find very large differences between the ITR associated with their NDC targets (respectively 2.9°C vs. 1.6°C). It may indeed seem counterintuitive that a country, that has already engaged in decarbonization of its energy system and projects to cut its emissions by 45% in 2030 compared to 2018, can have a much higher ITR than a country planning to build new coal power plants and is projected to increase its emissions by 28% over the same period.

However, it is important to note that under NDC projections, the US would continue to emit 9.5 tCO₂e/capita in 2030, while India would emit only 2.5 tCO₂e/capita. In order to maintain a Paris-aligned trajectory post-2030 and hit its Net Zero target, India would have to reverse emissions growth and eventually converge towards net zero emissions by mid-century, see Chart 06.



Source: FTSE Russell & Beyond Ratings Research.

Chart 07: Implied Temperature Rise of every country with a quantifiable NDC target¹²



Source: FTSE Russell & Beyond Ratings Research.

2.2 New Net Zero targets set the tone at COP26, but are not necessarily aligned with a 1.5°C trajectory

Perhaps the most notable development ahead of COP26 were new commitments from a number of the world's largest economies to reach net-zero emissions by mid-century – notably from the US, the EU and Japan in 2050, China in 2060, and India in 2070 (see Chart 08). These new long-term Net Zero targets now complement the more medium term NDCs – the primary national climate commitments.

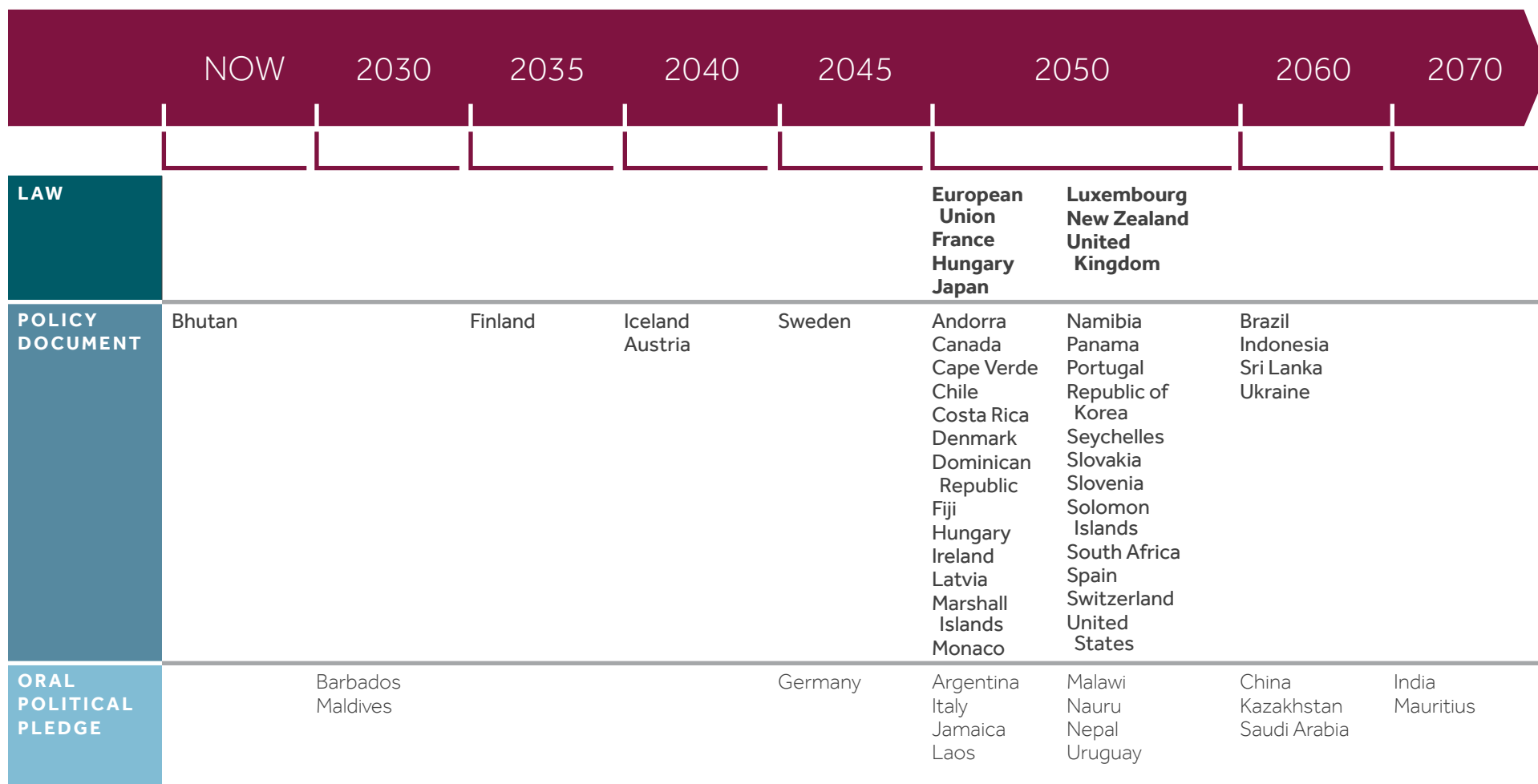
However, Net Zero targets have not yet been universally embraced. At the time of writing, G20 members were yet to commit to a Net Zero target, with notable absences, including from Australia, Mexico, and Russia.

Furthermore, our ITR calculations show that a mid-century Net Zero target is not necessarily enough to deliver the objectives of the Paris Agreement. Rather, these targets need to be evaluated in light of each country's remaining carbon budget. We estimate that the ambition of the current national Net Zero targets would on average lead to a global temperature rise of 2.1°C,¹³ well above a 1.5°C trajectory. Among G20 countries, we find India and the UK have the most ambitious Net Zero targets (aligned with 1.4°C and 1.5°C respectively) and Saudi Arabia, the least ambitious Net Zero target (aligned with 2.9°C).



We estimate that the ambition of the current national Net Zero targets would on average lead to a global temperature rise of 2.1°C , well above a 1.5°C trajectory.

Chart 08: National Net Zero commitments



G20 COUNTRIES WITH NO TARGET: Mexico, Russia

Sources : FTSE Russell & Beyond Ratings Research based on Climate Watch data and Nascimento et al. (2021)

Note: 1) Singapore committed to reaching net-zero GHG emissions between 2050 and 2100; 2) Bhutan has already declared itself to be carbon neutral and commits to remain carbon neutral¹⁴ as part of its NDC.¹⁵ 3) Our assessments do not cover some of the Net Zero commitments recently announced due to time constraints, including Turkey (2053), Australia (2050) and United Arab Emirates (2050). These new targets would not significantly change our overall evaluation of the Net Zero targets.

2.3 Mind the ambitions gap: NDCs are often inconsistent with long-term Net Zero targets

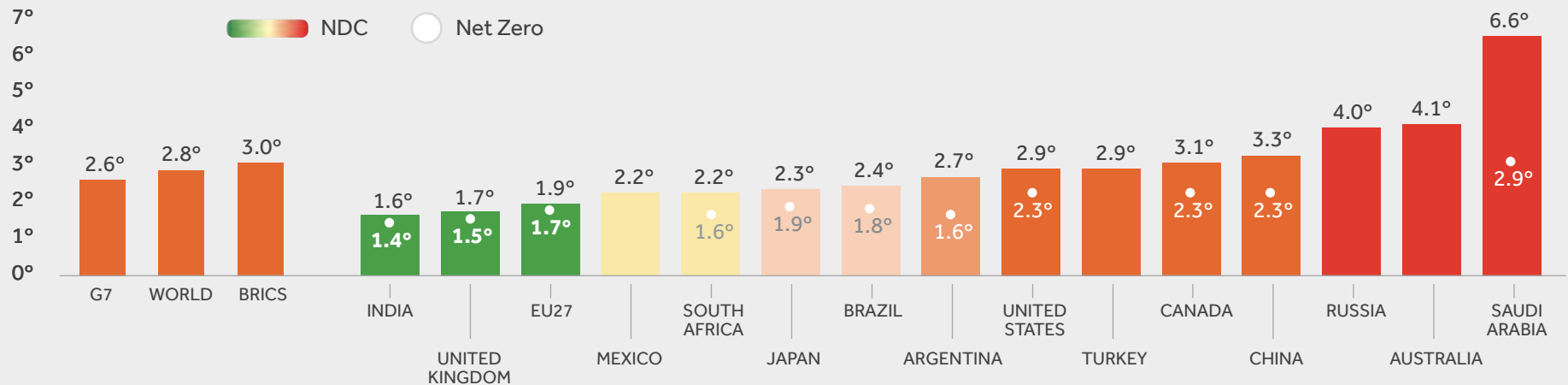
A key feature of the Paris Agreement is a mechanism to ratchet up national commitments through periodic updates of the NDCs, with the first round of updates due ahead of COP26.¹⁶

One of the main results of our analysis remains that, with a few exceptions, existing NDCs are not aligned with Net Zero commitments, with the NDCs on average implying 0.7°C higher temperature increases than the corresponding Net Zero pledges – see Chart 09. According to our analysis, France, India, the

UK and Italy are the only G20 countries with 2030 targets in line with the Paris Agreement, whereas Australia, Russia, China and Canada all have NDCs with a temperature alignment above 3°C.

We estimate that the global ITR of the latest NDCs is 2.8°C (very similar to the UNFCCC’s estimate of 2.7°C in its September 2021 ‘Synthesis Report’).¹⁷ This would lead to a slight increase in per capita emissions to 6.4 tCO₂eq on our projections, while they would have to drop to 4.0 tCO₂eq by 2030 to be in line with a 1.5°C trajectory according to the IPCC.¹⁸

Chart 09: Implied Temperature Rise for selected countries based on unconditional NDCs and Net Zero targets



Source: FTSE Russell & Beyond Ratings Research.

Note: Implied Temperatures for G7, World and BRICS are based on country temperatures weighted by their 2018 territorial GHG emissions (including LULUCF).

2.4 Like NDCs, current policies are not aligned with the Paris Agreement

On average, we find countries' policies only slightly lagging NDC commitments – we estimate current global policies to align with a 3.0°C warming trajectory (vs. 2.8°C for the NDCs), significantly off track from the goal of the Paris Agreement to limit global temperature increases to well below 2.0°C.

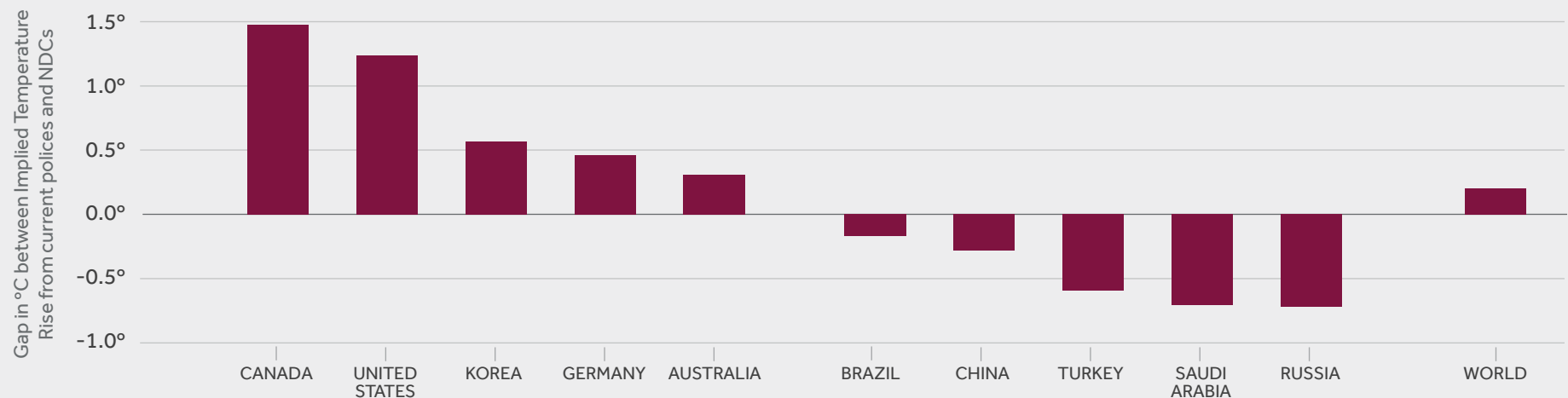
However, we find significant variability across countries. A number of emerging economies appear reluctant to commit to more ambitious NDCs, even though their Current Policies are on track to deliver significantly greater emissions reductions. This includes, for example, Russia (with Current Policies aligning to a 0.7°C lower trajectory than its NDCs), Turkey (0.6°C) and China (0.3°C), see Chart 10.

In contrast to this, Current Policies for several advanced economies are significantly off track when measured against their more ambitious NDCs. This is

particularly apparent in the cases of US and Canada, where Current Policies are tracking towards a 4°C+ trajectory, while 2030 NDC commitments are aligned to a much lower 3°C trajectory. But this also applies to other developed countries – Germany and South Korea, for example, would struggle to meet their NDCs based on Current Policies, which are aligned with temperature pathways that are 0.5°C and 0.6°C higher than what is implied by their NDCs.

These results also suggest that it is probably very challenging for highly carbon intensive countries like the US, Canada or Australia, to align their territorial emissions with a 1.5°C scenario over the course of a decade. In order to align with the Paris objective, it is conceivable for such countries to complement their territorial mitigation efforts through the mechanisms provided by Article 6 of the Paris Agreement, which allows for transfers of mitigation outcomes between countries. A recent example is the agreement between Switzerland and Peru to collaborate in that framework.¹⁹

Chart 10: Gap between Implied Temperature Rise from Current policies and NDCs



Source: FTSE Russell & Beyond Ratings Research.

Note: We estimate that the ITR of Canada's Current Policies is 1.5°C above the ITR of its NDC.

3

Climate ambition profiles



Our Climate Ambition Profiles for each of the G20 countries provide a summary of their national climate commitments, key climate-related policies, and the associated Implied Temperature Rise for each.

Argentina

Argentina's 2050 Net Zero target is Paris-aligned. However, its NDC and current policies align with a 2.5°C-3.0°C trajectory.



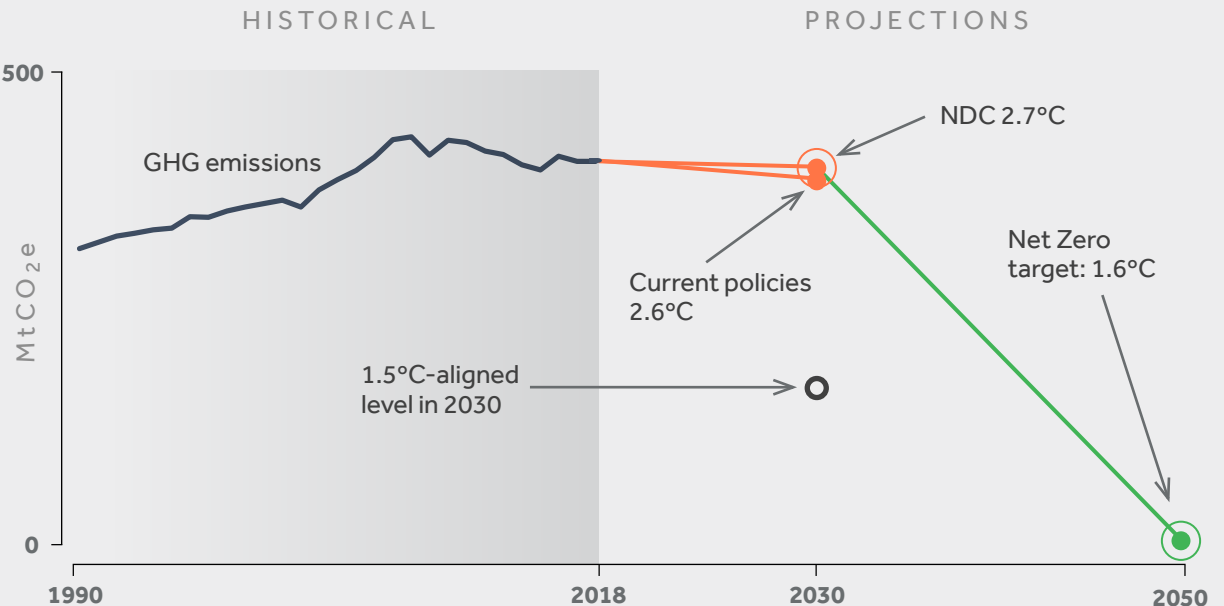
Argentina has set a 2050 Net Zero target¹ which we estimate to align with a 1.6°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. However, Argentina's latest NDC for 2030² implies a warming of 2.7°C, broadly in line with the Implied Temperature Rise of its current policies at 2.6°C.

Argentina

Argentina's key climate-related policies:

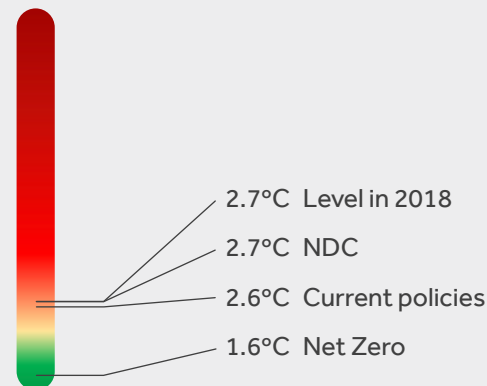
- **Carbon tax on energy (2017)**⁴: The tax targets emissions from transport fuels and coal at a rate of USD\$10/tCO₂. It excludes natural gas consumption and shale gas production, and it is reviewed each trimester.
- **Renewable Energy Law**⁵: By 2023, 18% of Argentina's electricity must be supplied by renewable sources, rising to 20% by 2025.
- **Biofuels Law (2016)**⁶: From 2016, the law mandates blending 10% biodiesel with petrodiesel and 12% ethanol with gasoline.
- **National plan for the restoration of native forests (2019)**⁷: By 2030, plan aims to restore 20 million hectares of native forest.

GHG emissions trajectories



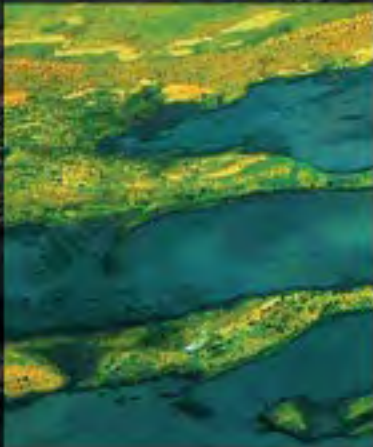
Evolution of GHG emissions per capita

Under Argentina's latest NDC, we estimate greenhouse gas emissions per capita would fall from 9.2 tons of CO₂e in 2018 to 8.2 by 2030. Its current policies imply a reduction to 8.0 tons over the same period.³



Australia

Australia has no long-term or Net Zero target. We estimate its NDC and current policies to align with a 4°C+ trajectory.



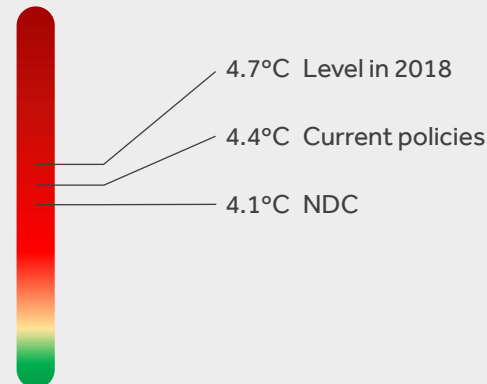
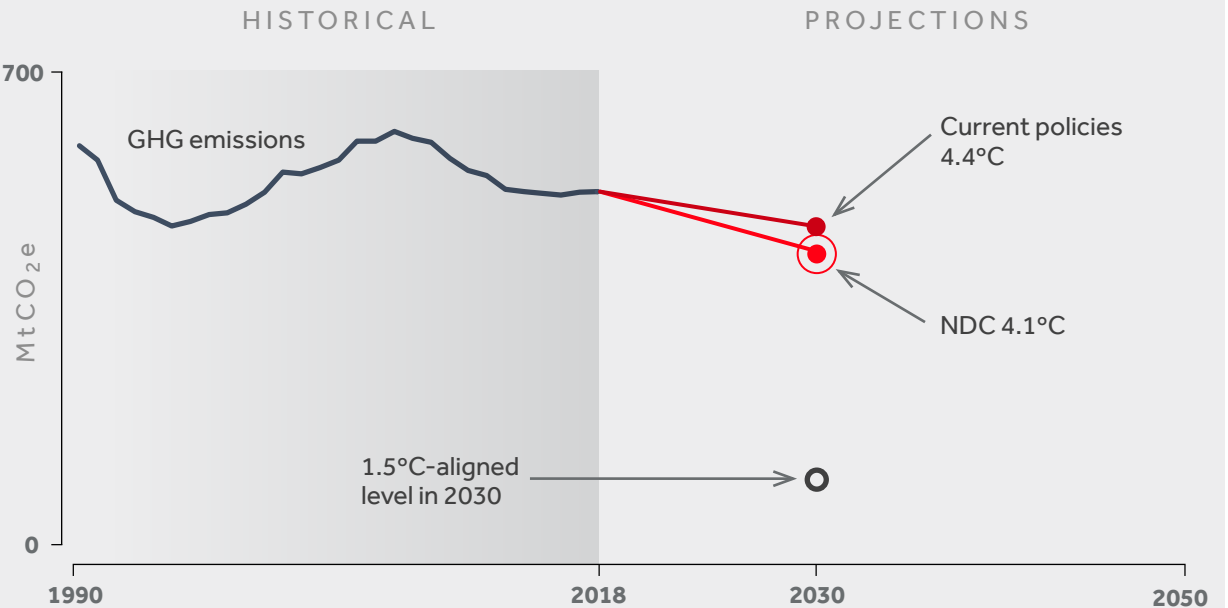
Australia has not set a Net Zero target. We estimate that Australia's latest NDC for 2030⁸ implies a warming of 4.1°C, broadly in line with the Implied Temperature Rise of its current policies at 4.4°C.

Australia

Australia's key climate-related policies:

- **State-level renewable energy targets¹⁰:**
Australia does not have a national renewables target, but its territories' targets equate to an approximately 35% share by 2025 and 50% by 2030 at the federal level¹¹.
- **Emissions Reduction Fund (ERF) (2014)¹²:**
Renamed the Climate Solutions Fund in 2019, this reverse auction mechanism is designed to reduce emissions at the lowest available cost. The government purchases carbon credits generated by companies that voluntarily reduce their emissions.
- **Fuel tax (2006, last amendment in 2019)¹³:**
A fuel tax for diesel and gasoline set at AUD 0.418 per litre.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Australia's latest NDC, we estimate greenhouse gas emissions per capita would fall from 21.1 tons CO₂e in 2018 to 15.5 tons by 2030. Its current policies imply a reduction to 16.7 tons over the same period.⁹

Brazil

Brazil's 2050 Net Zero target is Paris-aligned. However, we estimate its NDC and current policies to align with a 2°C+ trajectory.



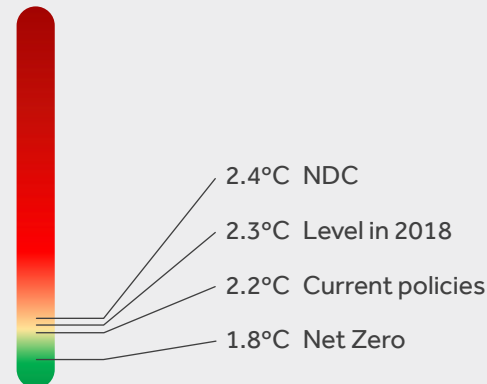
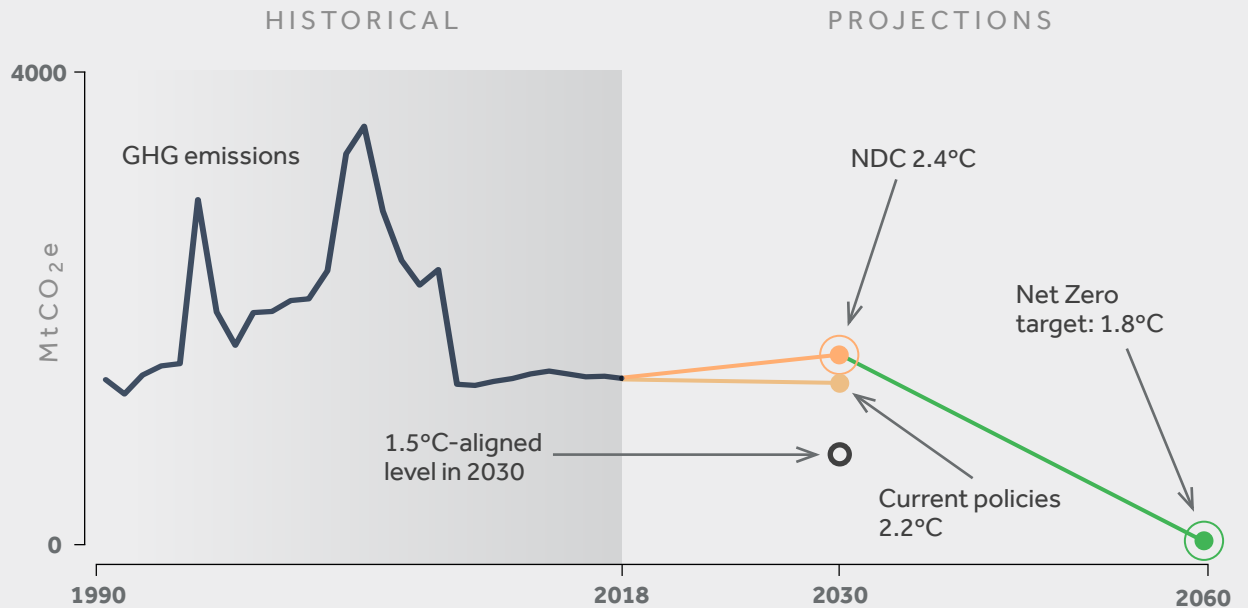
Brazil has set a 2050 Net Zero target¹⁴ that we estimate to align with a 1.8°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. However, Brazil's latest NDC for 2030¹⁵ implies a warming of 2.4°C, broadly in line with the Implied Temperature Rise of its current policies at 2.2°C.

Brazil

Brazil's key climate-related policies:

- **10-Year National Energy Expansion Plan (PDE) (2011/2019)**¹⁷: By 2029, the plan targets 48% of total primary energy supply to come from renewables (36% excluding hydropower) and 22% of total electricity generation (excluding hydropower).
- **RenovaBIO (2017)**¹⁸: The policy aims to reduce the carbon intensity of biofuels by 7% between 2017 and 2028, reaching 66.8 grams of CO₂ per megajoule (gCO₂/MJ) in 2028.
- **Biodiesel blending mandates (2020-2021)**¹⁹: In March 2020, the Brazilian government raised the biodiesel blending mandate from 11% to 12%. It plans to raise this further to reach 15% by 2023.
- **National Plan on Climate Change (2008)**²⁰ and **Forest code (2012)**²¹: These plans aim to reduce illegal deforestation rates in all Brazilian biomes to zero as well as restore 12 million hectares of forests by 2030.

GHG emissions trajectories




Evolution of GHG emissions per capita

Under Brazil's latest NDC, we estimate greenhouse gas emissions per capita would rise from 6.8 tons CO₂e in 2018 to 7.2 by 2030. Its current policies imply a reduction to 6.2 tons over the same period.¹⁶

Canada

Canada's 2050 Net Zero target aligns with a 2°C+ scenario. However, we estimate its NDC and current policies to align with a 3°C+ and 4°C+ trajectory respectively.



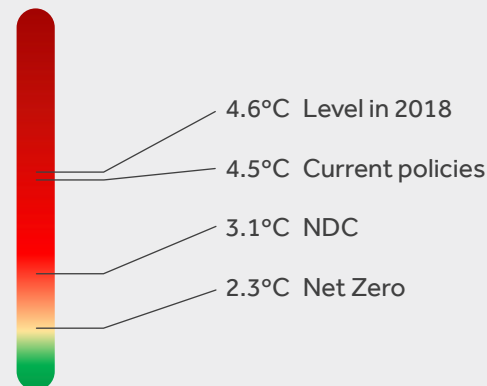
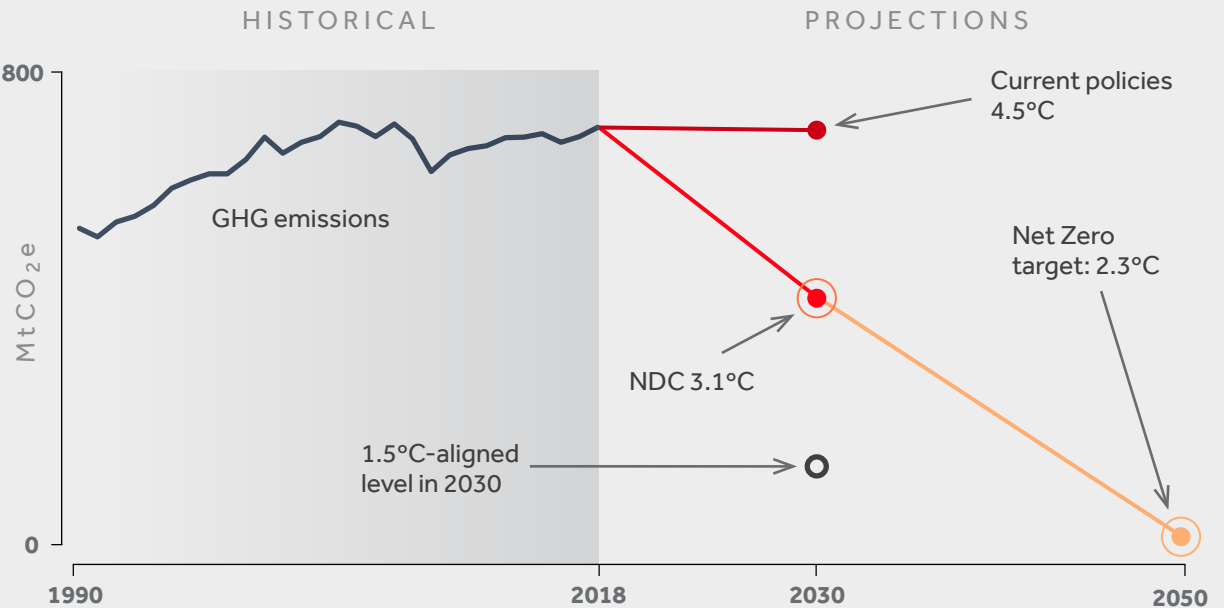
Canada has set a 2050 Net Zero target²² that we estimate to align with a 2.3°C temperature increase above pre-industrial levels, inconsistent with the Paris Agreement's goal. Canada's latest NDC for 2030²³ implies a warming of 3.1°C, significantly misaligned with the Implied Temperature Rise of its current policies at 4.5°C.

Canada

Canada's key climate-related policies:

- Zero Emission Vehicle Infrastructure Deployment (2020)²⁵:** This policy aims to ensure low-emissions vehicles comprise 30% of new light-duty vehicle sales by 2030, with an interim target of 10% by 2025 and a long-term goal of 100% by 2040.
- Greenhouse Gas Pollution Pricing Act (2018)²⁶:** The Act establishes a federal price on emissions, consisting of a carbon levy on small emitters (under 50 kt CO₂e/yr) and a cap-and-trade system/output-based pricing system on industrial facilities (over 50 kt CO₂e/yr).
- Regulations to address methane in the oil and gas sector (2018)²⁷:** Regulation aims to reduce methane (CH₄) emissions from oil and gas by 40-45% by 2025, compared to 2012 levels.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Canada's latest NDC, we estimate greenhouse gas emissions per capita would fall from 19.1 tons of CO₂e in 2018 to 10.2 tons by 2030. Its current policies imply a lower reduction to 17.2 tons over the same period.²⁴

China

China's 2060 Net Zero target aligns with a 2°C+ trajectory. We estimate its NDC and current policies to align with a 3°C+ trajectory.



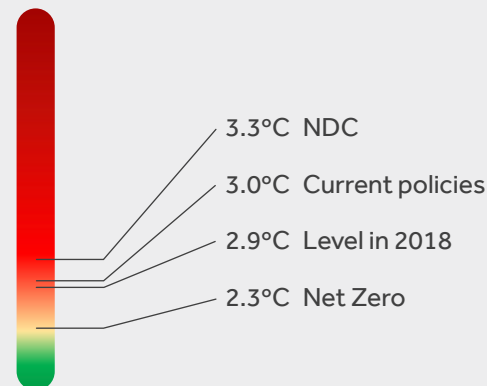
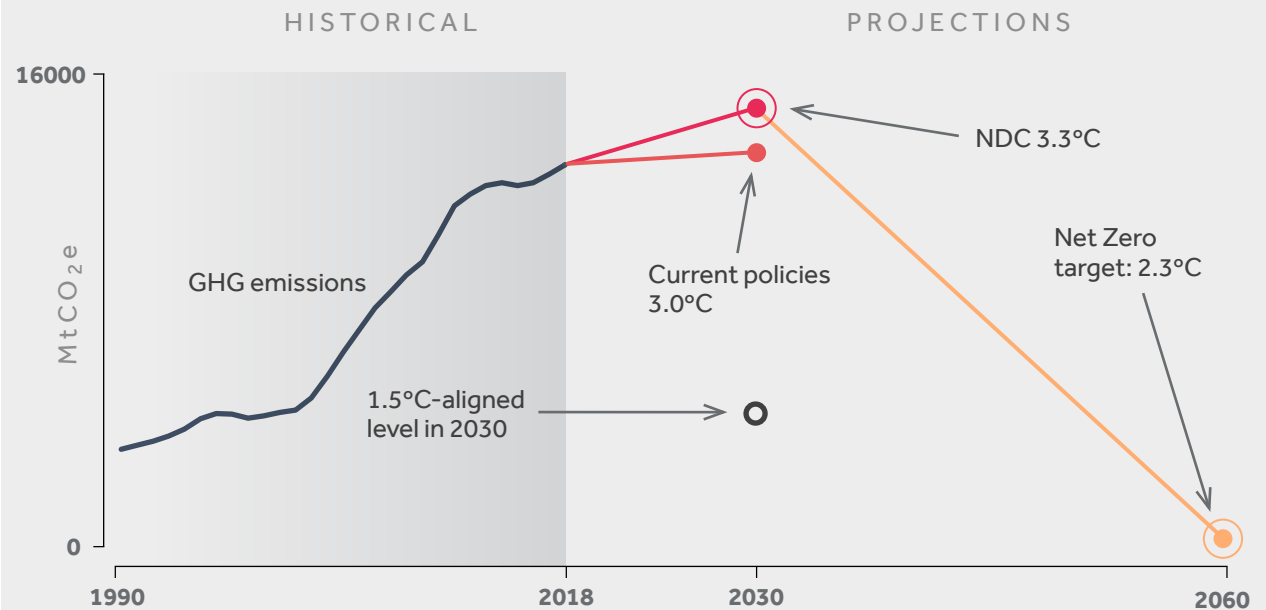
China has set a 2060 Net Zero target²⁸ that we estimate to align with a 2.3°C temperature increase above pre-industrial levels. China's latest NDC for 2030²⁹ implies a warming of 3.3°C, broadly in line with the Implied Temperature Rise of its current policies at 3.0°C.

China

China's key climate-related policies:

- **14th Five-Year Plan [2021-2025] (2021)**³¹: By 2025, the Plan is aiming for 20% of total primary energy supply to come from sources other than fossil fuels, and to reduce energy intensity by 13.5% and carbon intensity by 18%.
- **National Action Plan on Climate Change 2014-2020 (2014)**³²: The Plan targets emissions reductions, increases in the share of non-fossil fuels in primary energy consumption, and increases in forest areas. An emissions trading program has been operating in the power sector since July 2021.
- **Revision of Land Administration Law of the People's Republic of China (2019)**³³: The law, which became effective in January 2020, reaffirms a commitment to maintain a supply of at least 120 million hectares of arable land designated as permanent basic farmland.
- **15-year plan [2021-2035] to protect ecosystems (2020)**³⁴: Tasks include increasing forest cover to 26% by 2035, expanding grassland vegetation cover to 60%, and growing nature reserve areas to 18% of total national area.

GHG emissions trajectories

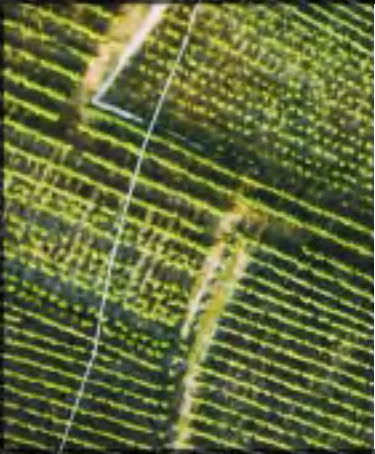


Evolution of GHG emissions per capita

Under China's latest NDC, we estimate greenhouse gas emissions per capita would increase from 9.1 tons of CO₂e in 2018 to 10.2 tons by 2030. Its current policies imply a smaller increase to 9.3 tons over the same period.³⁰

France

France's 2050 Net Zero target is Paris-aligned. We estimate that its NDC target and current policies broadly align with this trajectory.



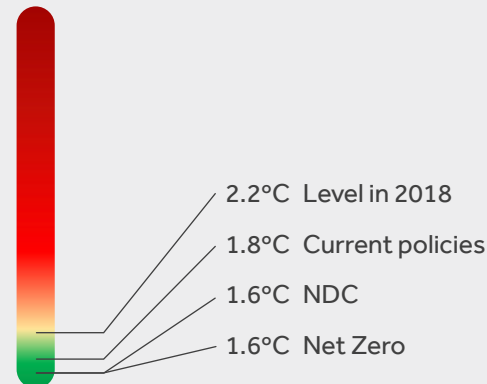
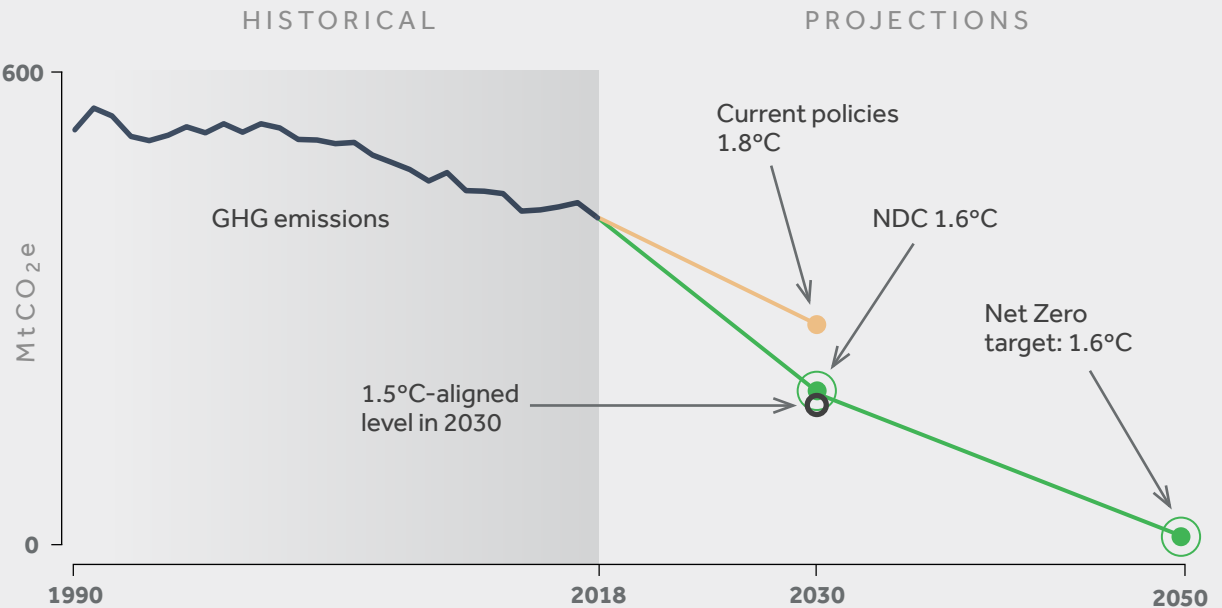
France has set a 2050 Net Zero target³⁵ that we estimate to align with a 1.6°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goals. France's latest NDC for 2030³⁶ also implies a warming of 1.6°C, broadly in line with the Implied Temperature Rise of its current policies at 1.8°C.

France

France's key climate-related policies:

- **As an EU Member State** (see EU ambition profile): Relevant policies include the EU ETS Directive (2003/2018), Effort Sharing Legislation [2018/842] (2018), the European Green Deal (2019), the EU Farm to Fork Strategy (2019) and the LULUCF regulation (2018).
- **"France relance" plan³⁸**: Plan which allocates 30 billion euros of public funds to building energy retrofitting, transport infrastructure, and investment in low carbon innovation.
- **France's 2020 National Low-Carbon Strategy and Multiannual Energy Plan³⁹**: Plan to phase out coal by 2022, reduce emissions from power generation by 33% before 2030 (compared to 2015), reduce energy consumption from the building sector by 28% in 2030 (compared to 2010) and achieve carbon neutrality for buildings by 2050 supported by mandatory building regulations.
- **Carbon tax on energy products (2018)⁴⁰**: The carbon tax was initially set at 7€/tCO₂ in 2014 and was intended to rise to 100€/tCO₂ by 2030. Since 2018 it has been frozen at 44.6€/tCO₂.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under France's latest NDC, we estimate greenhouse gas emissions per capita would fall from 6.5 tons of CO₂e in 2018 to 2.9 tons by 2030. Its current policies imply a reduction to 4.4 tons over the same period.³⁷

Germany

Germany's 2045 Net Zero target as well as its NDC are Paris-aligned. However, we estimate its current policies to align with a 2°C+ trajectory.



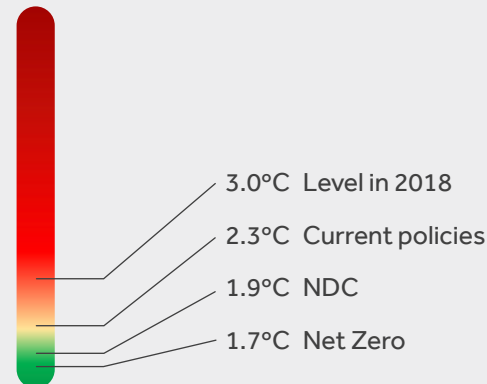
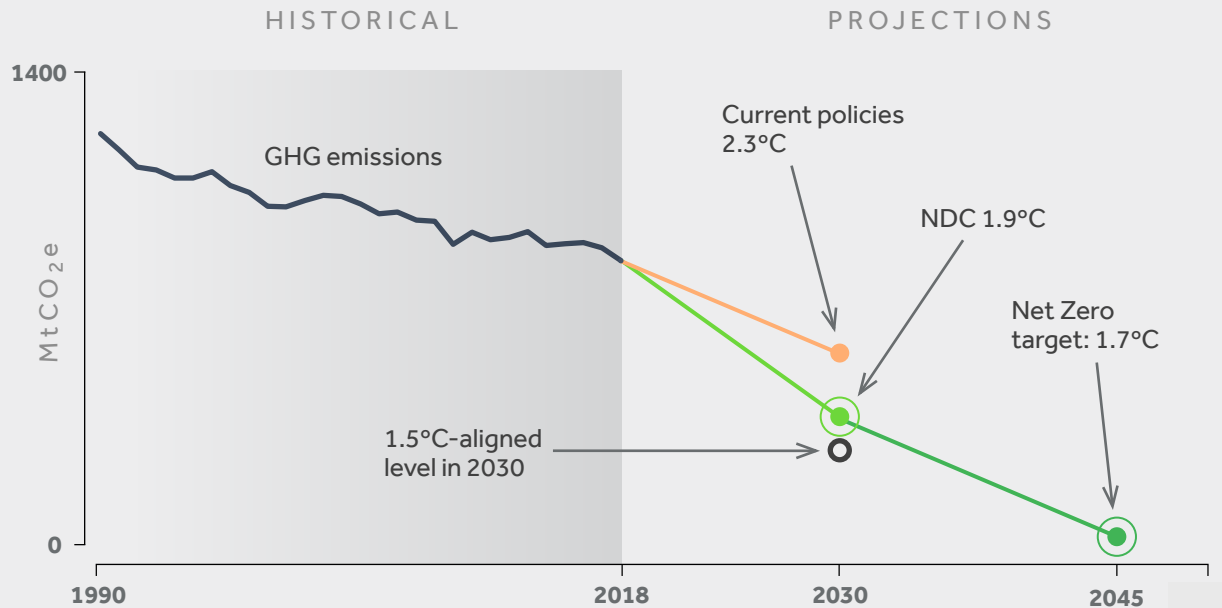
Germany has set a 2045 Net Zero target⁴¹ that we estimate to align with a 1.7°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. Germany's latest NDC for 2030⁴² implies a warming of 1.9°C, broadly in line with the Implied Temperature Rise of its current policies align at 2.3°C.

Germany

Germany's key climate-related policies:

- **As an EU Member State** (see EU ambition profile): Relevant policies include the EU ETS Directive (2003/2018), Effort Sharing Legislation [2018/842] (2018), the European Green Deal (2019), the EU Farm to Fork Strategy (2019) and the LULUCF regulation (2018).
- **National Energy and Climate Plan (NECP)⁴⁴**: The Plan is targeting 30% of gross final energy consumption to come from renewables by 2030, and a gradual phasing-out of coal-fired power generation by 2038 at the latest.
- **Energy Efficiency Strategy 2050⁴⁵**: Aims at a 30% reduction in primary energy consumption by 2030 (vs. 2008) and includes policies such as carbon pricing in the heating and transport sector, and an energy efficiency strategy for buildings.
- **German Fertilizer Ordinance (2017)⁴⁶**: Targets the reduction of nitrogen surpluses. This includes reducing ammonia emissions from agriculture, targeting a decrease in nitrous oxide emissions, improving nitrogen efficiency and expanding support for organic farming.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Germany's latest NDC, we estimate greenhouse gas emissions per capita would fall from 10.1 tons of CO₂e in 2018 to 4.4 tons by 2030. Its current policies imply a reduction to 7 tons over the same period.⁴³

India

India announced a new Net Zero target on the first day of COP26. Due to low per-capita emissions and a large carbon budget, we estimate that India's NDC, Net Zero target and current policies are Paris-aligned.



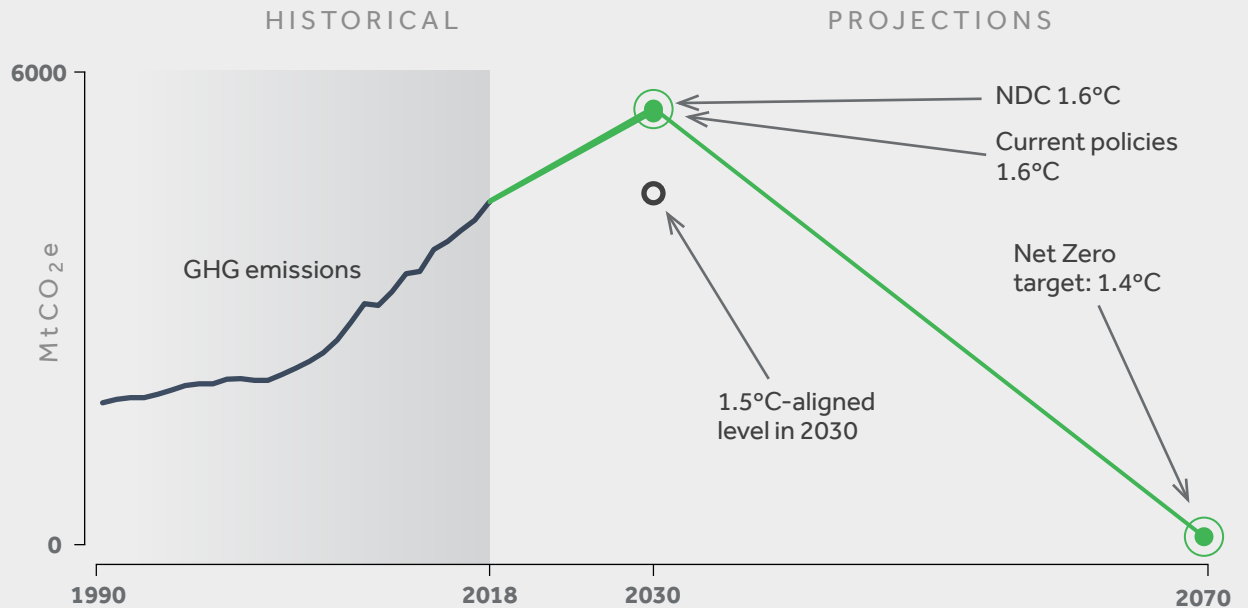
India's new Net Zero target corresponds to a 1.4°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. We estimate that India's latest NDC for 2030⁴⁷ implies a warming of 1.6°C, and estimate the Implied Temperature Rise of its current policies at 1.6°C due to a significant carbon budget and low per capita emissions (see page 18).

India

India's key climate-related policies:

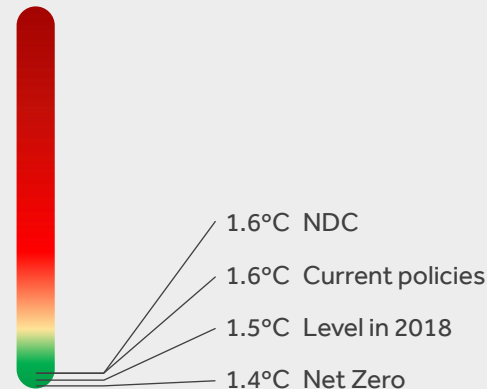
- **Clean energy cess (coal tax) (2010)⁴⁹:** Currently a tax of USD 3.2/tCO₂ is imposed on coal, lignite, and peat.
- **National Electricity Plan (2018)⁵⁰:** The Plan targets demand reductions and presents capacity additions for various energy technologies, including a slowdown in the installation of new coal fired power plants.
- **National Mission for Enhanced Energy Efficiency (2008)⁵¹:** Initiatives aiming to reduce emissions by 99 MtCO₂e/year compared to a business-as-usual scenario when fully implemented.
- **Energy efficiency in industry (PAT scheme) (2011)⁵²:** The scheme benchmarks designated companies' performance against best practice combined with a market mechanism to trade energy savings certificates.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under India's latest NDC, we estimate greenhouse gas emissions per capita would rise from 2.1 tons of CO₂e in 2018 to 2.5 tons by 2030. Its current policies imply a slightly larger rise to 2.6 tons over the same period.⁴⁸



Indonesia

Indonesia's 2060 Net Zero target is Paris-aligned. However, we estimate its NDC and current policies to align with a 2.5°C–3.0°C trajectory.



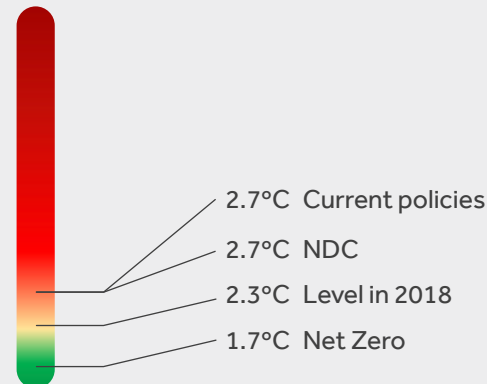
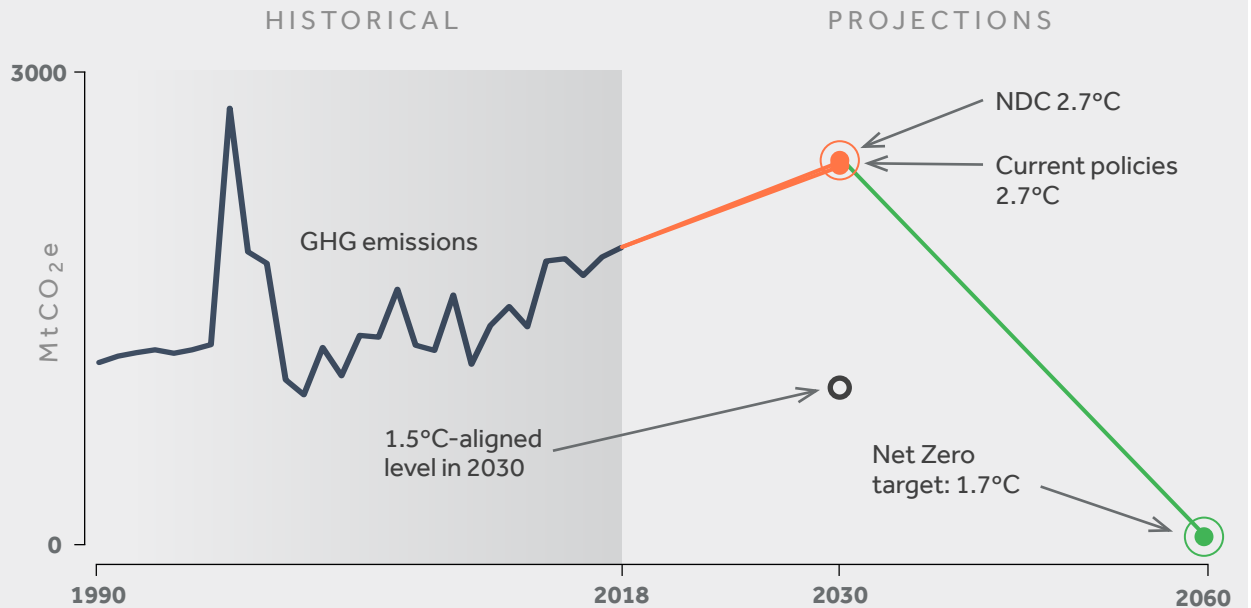
Indonesia has set a 2060 Net Zero target⁵³ that corresponds to a 1.7°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. However, Indonesia's latest NDC for 2030⁵⁴ implies a warming of 2.7°C, in line with the Implied Temperature Rise of its current policies, also at 2.7°C.

Indonesia

Indonesia's key climate-related policies:

- **National Energy Policy (2014)⁵⁶:** Aims to increase the share of new and renewable energy (including nuclear) to 23% of total primary energy supply by 2025.
- **Electricity Supply Business Plan (RUPTL 2019–2028)⁵⁷:** The plan aims to add new renewable electricity capacity between 2019 and 2028: 6,061 MW of hydropower, 4,607 MW of geothermal, 3,483 MW of solar and 2,563 MW of wind.
- **Biofuel targets (2013)⁵⁸:** The policy aims for a 15% share of biofuels in all transportation fuels by 2025. The biodiesel blending rate was raised to 30% in 2020 with a plan to achieve 40% by 2022.
- **Palm Oil Moratorium (2018)⁵⁹:** Formal ban on new palm oil permits expired on September 2021. However, the government indicated verbally that it will continue to ban new palm oil permits.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Indonesia's latest NDC, we estimate greenhouse gas emissions per capita would rise from 7 tons of CO₂e in 2018 to 8.1 tons by 2030. Its current policies imply a similar increase in emissions per capita over the period.⁵⁵

Italy

Italy's 2050 Net Zero target is Paris-aligned. While somewhat less ambitious, we estimate its NDC target and current policies are also aligned to a below 2.0°C trajectory.



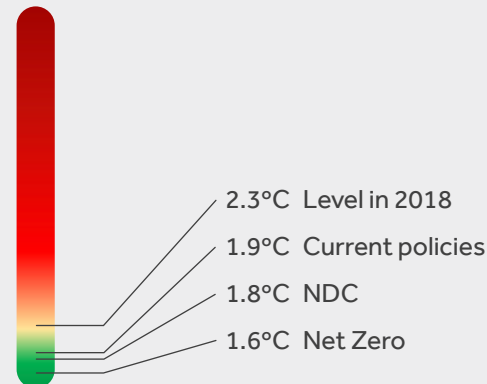
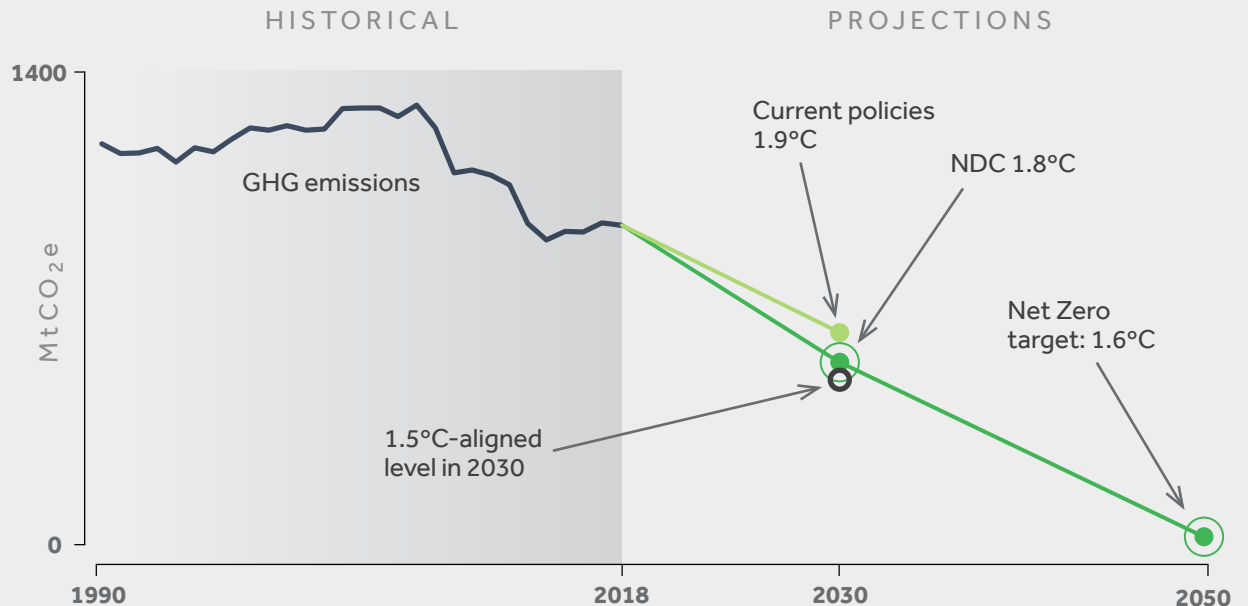
Italy has set a 2050 Net Zero target⁶⁰ that corresponds to a 1.6°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. Italy's latest NDC for 2030⁶¹ implies a warming of 1.8°C, broadly in line with the Implied Temperature Rise of its current policies at 1.9°C.

Italy

Italy's key climate-related policies:

- **As an EU Member State** (see EU ambition profile): Relevant policies include the EU ETS Directive (2003/2018), Effort Sharing Legislation [2018/842] (2018), the European Green Deal (2019), the EU Farm to Fork Strategy (2019) and the LULUCF regulation (2018).
- **Integrated National Energy and Climate Plan (2019)**⁶³: The Plan involves phasing out of coal by 2025, with 30% of gross final energy consumption coming from renewables and a 43% reduction in primary energy consumption by 2030.
- **National Plan for Electric Vehicle Charging Infrastructure (PNIRE - approved in 2012, updated in 2016 and new update ongoing)**⁶⁴: PNIRE has achieved its objectives to have 19,000 charging stations and 130,000 electric vehicles in circulation by 2020 and EV purchase subsidies has been increased in 2018 to support demand.
- **National Energy Efficiency Action Plan (2017)**⁶⁵: The Plan includes a 'white certificates' mechanism, which is designed to encourage energy efficiency gains via tradable certificates, as well as tax deductions for building renovations designed to improve energy efficiency.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Italy's latest NDC, we estimate greenhouse gas emissions per capita would fall from 6.7 tons of CO₂e in 2018 to 3.9 tons by 2030. Its current policies imply a fall to 4.7 tons over the same period.⁶²

Japan

Japan's 2050 Net Zero target is Paris-aligned. However, we estimate its NDC and current policies to align with a 2.5°C–3.0°C trajectory.



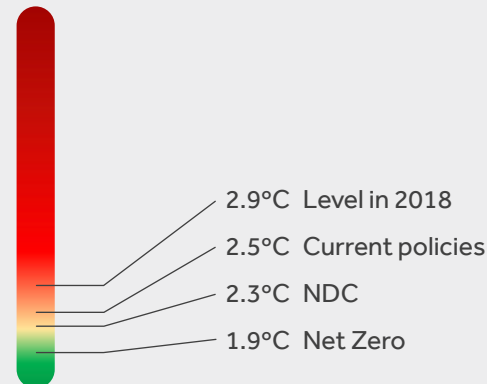
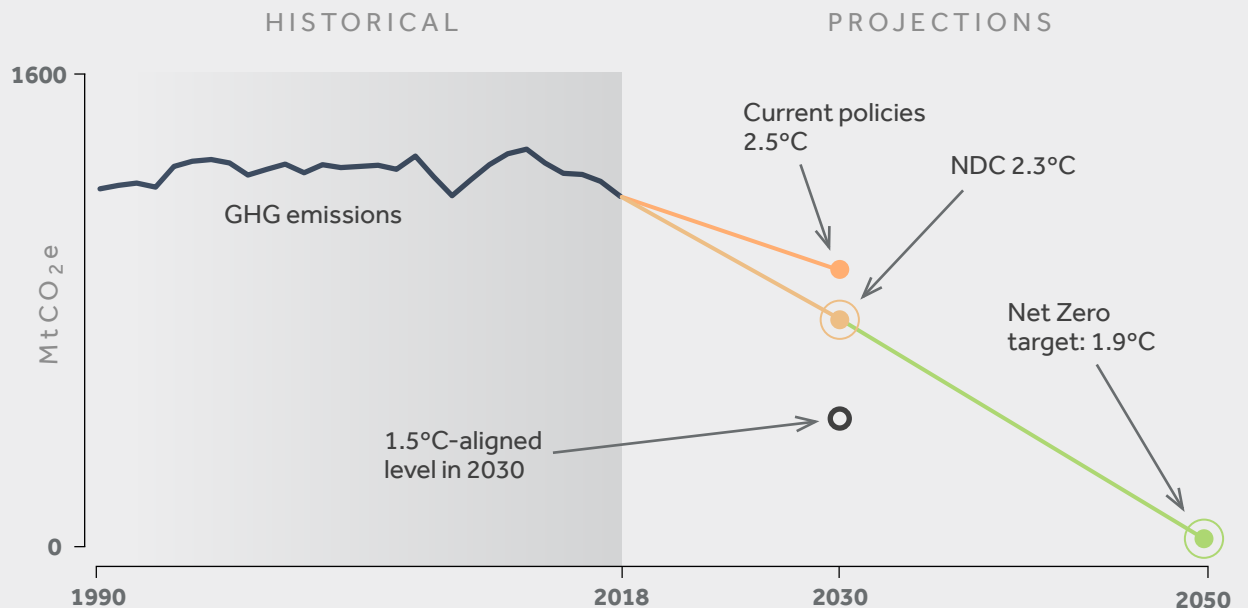
Japan has set a 2030 Net Zero target⁶⁶ that corresponds to a 1.9°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. However, Japan's latest NDC for 2030⁶⁷ implies a warming of 2.3°C, broadly in line with the Implied Temperature Rise of its current policies at 2.5°C.

Japan

Japan's key climate-related policies:

- **Green Growth Strategy (2021)**⁶⁹: The strategy provides sector and technology-level roadmaps to achieve Net Zero by 2050. This includes a target for electrified vehicles (including fuel cell vehicles and non-plugin hybrids) to make up 100% of new passenger car sales by 2035.
- **Basic Energy Plan (2021)**⁷⁰: The Plan aims to diversify the energy mix by increasing the share of electricity from renewable sources to 36-38% by 2030 (including large hydro).
- **Renewable Energy Act (feed-in tariff) (2012)**⁷¹: The Act requires electric utility operators to purchase electricity from renewable technologies at designated prices.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Japan's latest NDC, we estimate greenhouse gas emissions per capita would fall from 9.3 tons of CO₂e in 2018 to 9 tons by 2030. Its current policies imply a reduction to 7.7 tons over the same period.⁶⁸

Republic of Korea

Korea's 2050 Net Zero target aligns with a 2°C+ trajectory. We estimate its NDC and current policies to align with a 3°C+ trajectory.



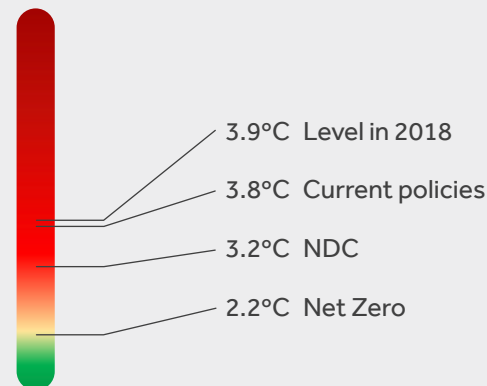
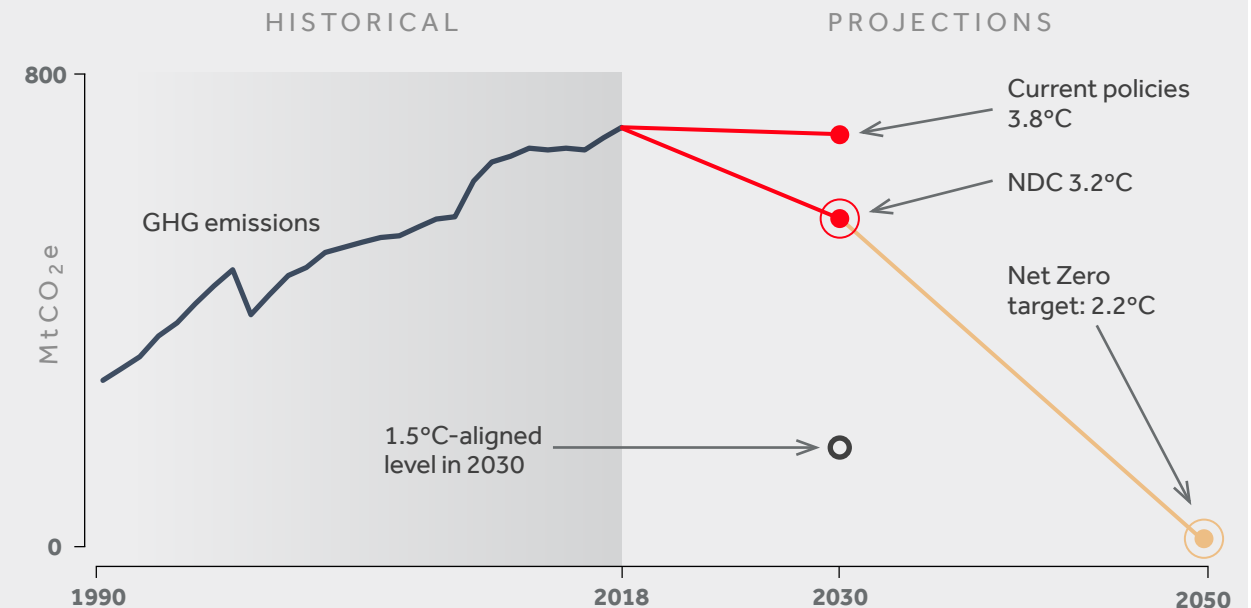
The Republic of Korea has set a 2050 Net Zero target,⁷² which we estimate to align with a 2.2°C temperature increase above pre-industrial levels, inconsistent with the Paris Agreement's goal. Korea's latest NDC for 2030⁷³ implies a warming of 3.2°C, while we estimate the Implied Temperature Rise of its current policies at 3.8°C.

Republic of Korea

The Republic of Korea's key climate-related policies:

- **Emissions Trading System (2015)**⁷⁵: A system that covers 68% of Korea's national GHG emissions involving nearly 600 companies from 23 sub-sectors. The current caps for 2021–2025 are set to align with the government's 2030 emissions target.
- **Renewable energy targets/3rd Energy Master Plan (2019)**⁷⁶/**8th Basic Plan for Long-term Electricity Supply and Demand (2017)**⁷⁷: These plans set renewable generation targets as a proportion of electricity supply (20% by 2030 and 30–35% by 2040) as well as for specific technologies (2.1GW for hydropower, 17.7GW for wind, 33.5GW for solar power, 1.7GW for biomass and 0.3GW for waste-to-energy).
- **Fuel efficiency standard (2014)**⁷⁸: A regulatory standard for the maximum carbon intensity of transport fuel, falling from 140 gCO₂/km in 2015 to 97 gCO₂/km by 2020.
- **Second Comprehensive Plan for Improvement of Carbon Sinks (2018)**⁷⁹: Targets for increasing national forest carbon stocks by 2.1 GtCO₂ by 2022 (vs. 1.8 GtCO₂ in 2015) and expanding carbon storage in domestic harvested wood products (HWP) by up to 36 MtCO₂ by 2022, compared to 23 MtCO₂ in 2017.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under the Republic of Korea's latest NDC, we estimate greenhouse gas emissions per capita would fall from 13.9 tons CO₂e in 2018 to 10.6 by 2030. Its current policies would imply only a small reduction to 13.6 tons over the same period.⁷⁴

Mexico

Mexico has not yet set a long-term or Net Zero target. We estimate its NDC and current policies to align with a 2°C+ trajectory.



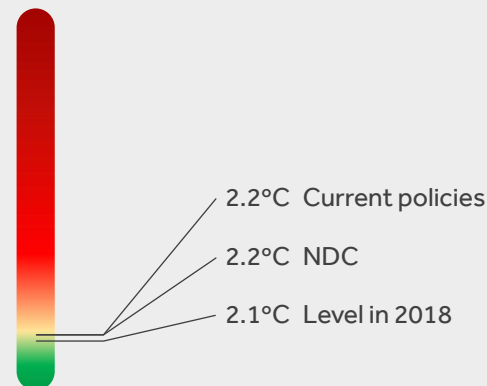
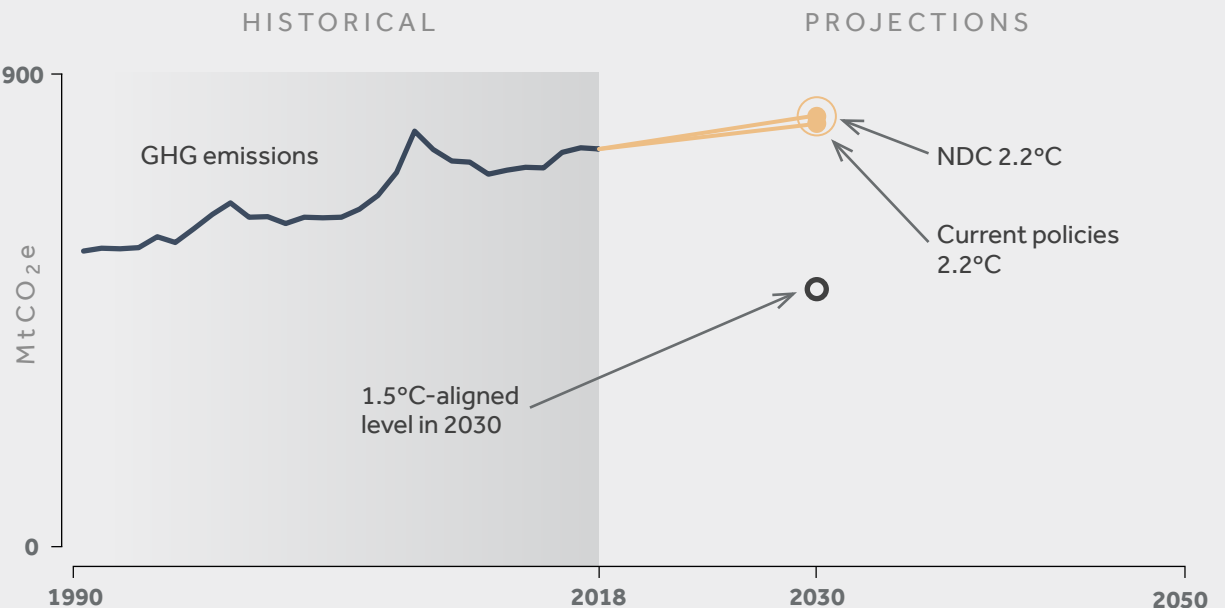
Mexico has not yet set a Net Zero target. We estimate that Mexico's latest NDC for 2030⁸⁰ implies a warming of 2.2°C, in line with the Implied Temperature Rise of its current policies, also at 2.2°C.

Mexico

Mexico's key climate-related policies:

- **Emissions Trading Scheme (ETS) (2018)⁸²:** A pilot national ETS began in 2020, teeing up its final regulatory framework to be fully in operation by 2023.
- **Energy Transition Law (2015)⁸³:** A regulatory framework targeting clean electricity, energy efficiency and emissions reductions. It targets 'clean energies' (including efficient gas-fired cogeneration) to make up 35% of power generation by 2024. It also introduces a number of climate-friendly policy instruments, such as power auctions for wind and solar generation.
- **Electric Industry Law (LIE, [+]) (2014/2021)⁸⁴:** A law that establishes a market regime in Mexico's electricity industry.
- **National Forestry Programme PRONAFOR (2014)⁸⁵:** A 2021 amendment allows fossil fuel power plants to obtain tradeable clean energy certificates that were originally reserved only for renewable electricity suppliers.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Mexico's latest NDC, we estimate greenhouse gas emissions per capita would fall from 6 tons of CO₂e in 2018 to 5.8 tons by 2030. Its current policies imply a reduction to 6 tons over the same period.⁸¹

Russia

Russia has not set a long-term or Net Zero target. We estimate its NDC and current policies to align with a 3.0°C-4.0°C trajectory.



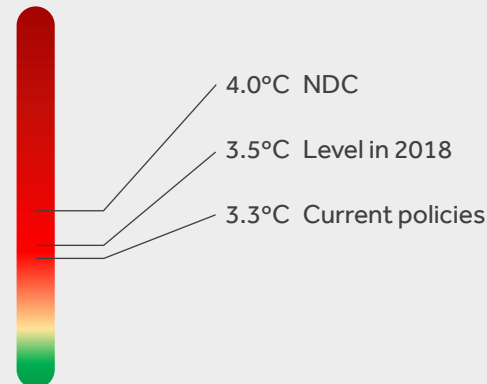
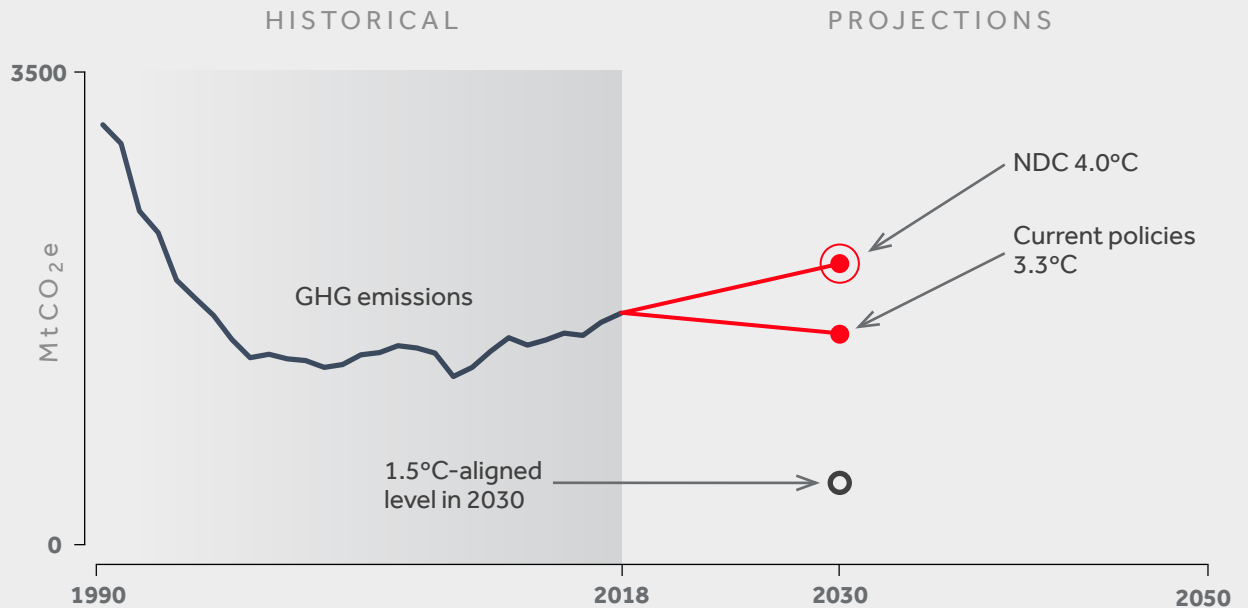
Russia has not set a Net Zero target. We estimate that Russia's latest NDC for 2030⁸⁶ implies a warming of 4.0°C, in line with the implied temperature increase of its current policies at 3.3°C.

Russia

Russia's key climate-related policies:

- **Federal Law on Saving Energy and Increasing Energy Efficiency Increase [Law 261-F3] (2009)⁸⁸:** The law creates a general framework for managing energy efficiency via a ban on using inefficient incandescent light bulbs and mandatory energy efficiency targets for companies that are backed up by incentives to adopt energy efficiency measures.
- **Renewable energy targets (Governmental resolution No. 512-r of 2013, 2015 amendment to the Decree No. 1-r of 2009)⁸⁹:** Regulation that sets a target for 4.5% of total electricity generation to come from renewable sources by 2024 (excluding hydropower larger than 25 MW).
- **System of Green Project Financing (2021)⁹⁰:** Preparations for launching schemes to finance green projects and initiatives, including sustainable development and mitigating the emission of pollutants and greenhouse gases.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Russia's latest NDC, we estimate greenhouse gas emissions per capita would rise from 11.8 tons of CO₂e in 2018 to 14.6 tons by 2030. Its current policies imply a reduction to 11 tons over the same period.⁸⁷

Saudi Arabia

Saudi Arabia's 2060 Net Zero target aligns with a 2.5°C–3.0°C trajectory. We estimate its NDC and current policies to align with a c. 6.0°C trajectory.



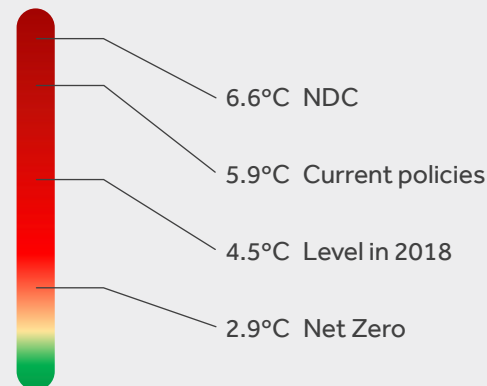
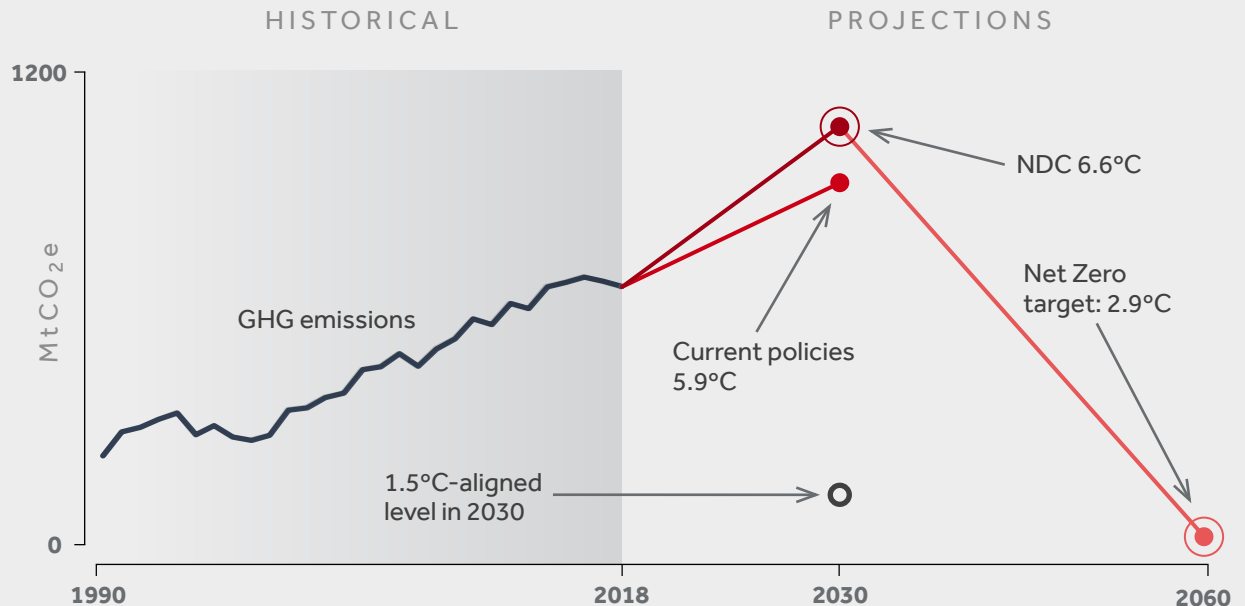
Saudi Arabia has set a 2060 Net Zero target⁹¹ which we estimate to align with a 2.9°C temperature increase above pre-industrial levels. We estimate that Saudi Arabia's latest NDC for 2030⁹² implies a warming of 6.6°C, in line with the Implied Temperature Rise of its current policies at 5.9°C.

Saudi Arabia

Saudi Arabia's key climate-related policies:

- Saudi Arabia's Vision 2030 (2016/2019)⁹⁴:** The "Vision 2030" strategy aims to reform and diversify Saudi Arabia's oil-dependent economy through measures such as reducing fossil fuel subsidies. At its launch in 2016, the strategy called for 9.5 GW of renewable power capacity by 2023. In 2019, this target was revised to 58.7 GW by 2030.
- Saudi Green Initiative (2021)⁹⁵:** A strategy for combatting climate change, specifically by raising the share of electricity supply from renewables to 50% by 2030.
- Fossil fuel price reform (2017)⁹⁶:** A series of reforms to the country's fiscal policies towards fossil fuels, including reducing cuts to fossil fuel subsidies in order to reach parity with international gasoline prices, increasing the price of diesel via taxes to up to 90% of international prices, as well as raising the price of other fuels between 2018 and 2025.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Saudi Arabia's latest NDC, we estimate greenhouse gas emissions per capita would rise from 19.5 tons of CO₂e in 2018 to 27.1 tons by 2030. Its current policies imply an increase to 23.5 tons over the same period.⁹³

South Africa

South Africa's 2050 Net Zero target is Paris-aligned. However, we estimate its NDC and current policies to align with a 2°C+ trajectory.



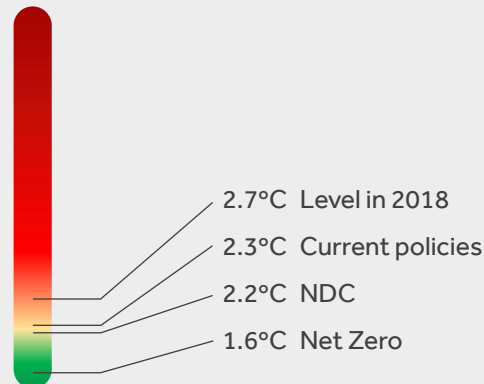
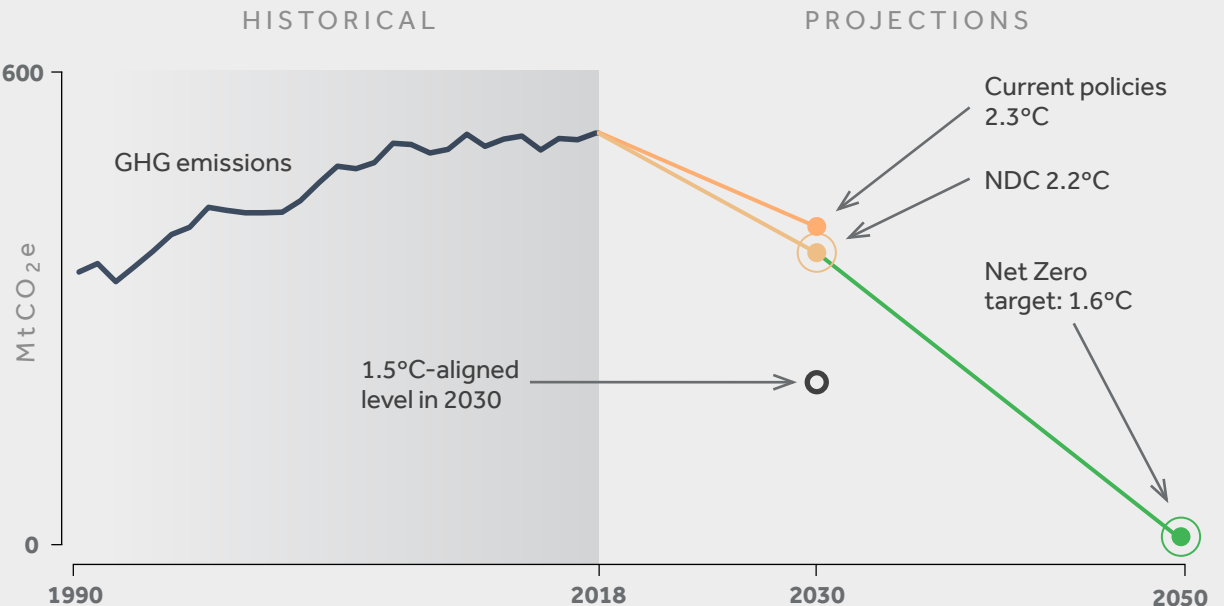
South Africa has set a 2050 Net Zero target⁹⁷ that we estimate to align with a 1.6°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. However, South Africa's latest NDC for 2030⁹⁸ implies a warming of 2.2°C, broadly in line with the implied temperature increase of its current policies at 2.3°C.

South Africa

South Africa's key climate-related policies:

- Integrated Resource Plan for electricity (2011/2019)¹⁰⁰:** A plan that sets out the country's planned sources of electricity out to 2030. This includes maintaining the supply from nuclear (1,860 MW) as well as series of 2030 capacity targets for renewable generation technologies: hydropower to increase to 4,600 MW from 2,100 MW; solar photovoltaic to reach 8,288 MW by 2030 (adding 6,000 MW beyond already committed/contracted capacity); wind to increase from around 3,300 MW to 17,742 MW; and concentrated solar power to double to 600MW.
- Petroleum Products Act (Biofuels Industrial Strategy) (2007)¹⁰¹:** Regulation that mandates from 2015 specific standards for blending biofuels: a 2-10% blend for bioethanol and a minimum of 5% blend for biodiesel.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under South Africa's latest NDC, we estimate greenhouse gas emissions per capita would fall from 9.3 tons of CO₂e in 2018 to 5.9 tons by 2030. Its current policies imply a reduction to 6.3 tons over the same period.⁹⁹

Turkey

Turkey has not yet officially set a long-term or Net Zero target. However, we estimate its NDC and current policies to align with a 2.0°C–3.0°C trajectory.



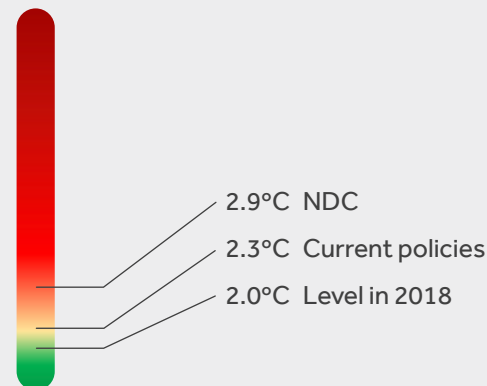
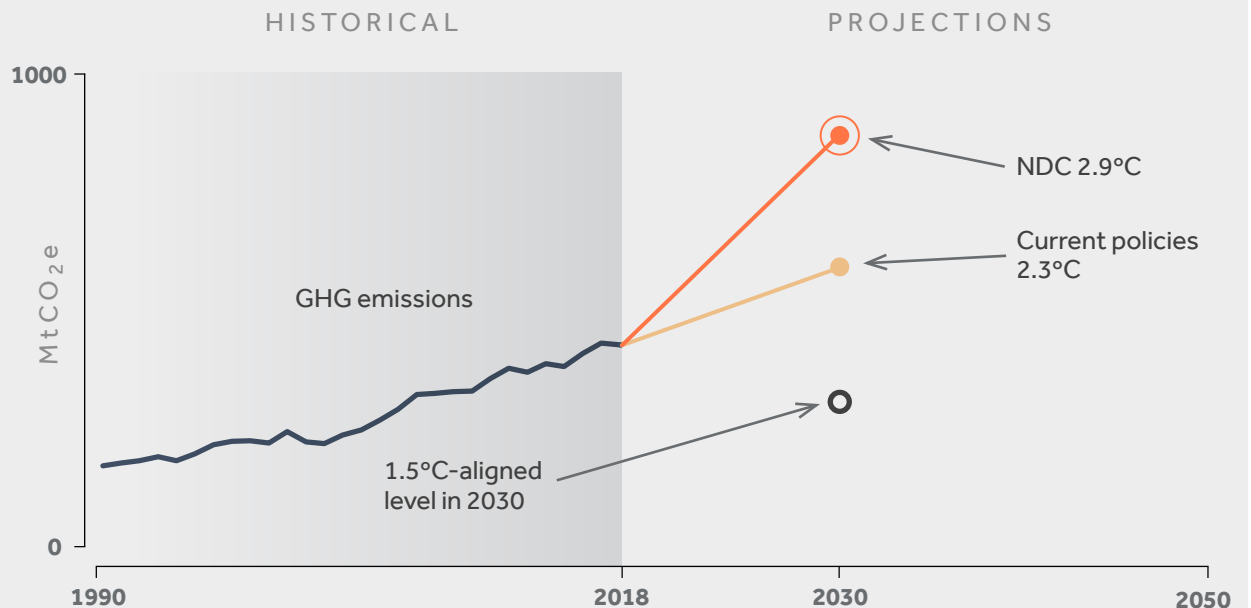
Turkey has not set a Net Zero target. We estimate that Turkey's latest NDC for 2030¹⁰² implies a warming of 2.9°C, in line with the Implied Temperature Rise of its current policies at 2.3°C.

Turkey

Turkey's key climate-related policies:

- **Energy Efficiency Law (2012)**¹⁰⁴: A target to reduce energy intensity (the amount of energy consumed per capita) by at least 20% by the year 2023.
- **Energy Efficiency Action Plan (2018)**¹⁰⁵: A target to reduce primary energy consumption by 14% compared to a 2021 business-as-usual scenario.
- **11th Development Plan (2019)**¹⁰⁶: The Plan sets a target for 38.8% of electricity production to come from renewables by 2023.
- **Renewable capacity target (Renewable Energy Action Plan) (2014)**¹⁰⁷: A target to increase renewable generation capacity to 61 GW by 2023, with sub-targets for five technologies: 34 GW of hydro, 20 GW wind, 5 GW solar, 1 GW geothermal and 1 GW biomass.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under Turkey's latest NDC, we estimate greenhouse gas emissions per capita would rise from 5.2 tons of CO₂e in 2018 to 9.8 by 2030. Its current policies imply an increase to 6.7 tons over the same period.¹⁰³

United Kingdom

The United Kingdom's 2050 Net Zero target as well as its NDC are Paris-aligned. We estimate its current policies to align with a 2.0°C trajectory.



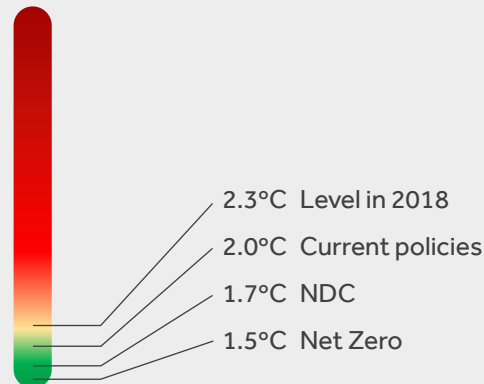
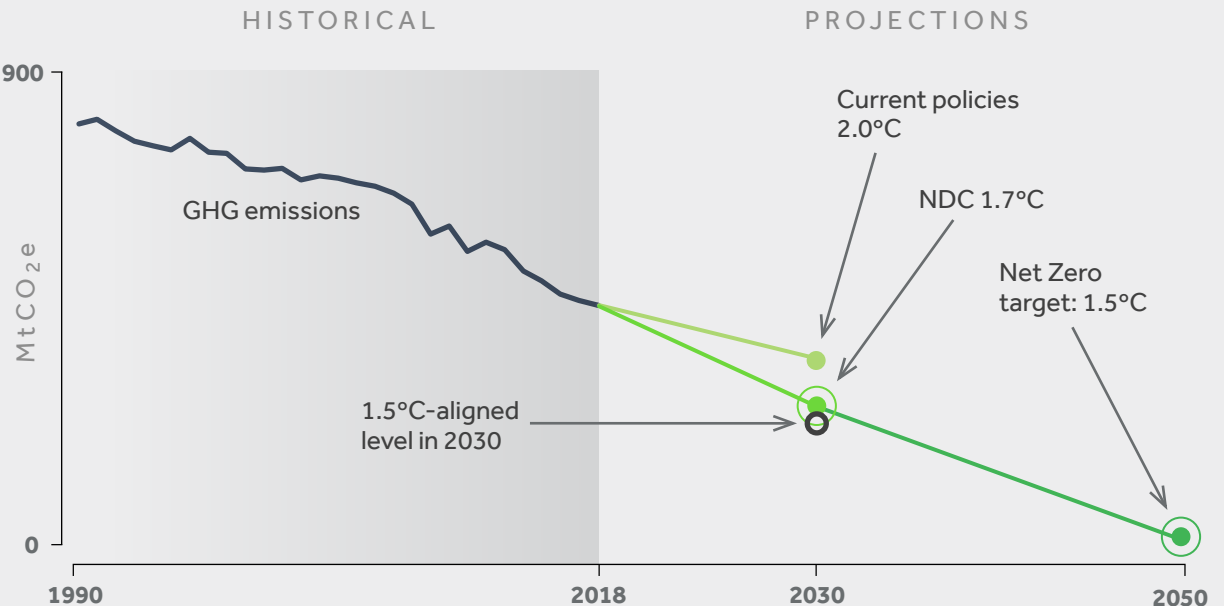
The United Kingdom has set a 2050 Net Zero target¹⁰⁸ that we estimate to align with a 1.5°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. The United Kingdom's latest NDC for 2030¹⁰⁹ implies a warming of 1.7°C, broadly in line with the implied temperature increase of its current policies at 2.0°C.

United Kingdom

The United Kingdom's key climate-related policies:

- **Climate Change Act (2008/2019)¹¹¹:** The UK's legal framework for managing climate change. The 6th carbon budget, proposed by the Committee on Climate Change (CCC), sets a GHG emission reduction target of 68% by 2030 compared with 1990 levels.
- **Ten Point Plan for a Green Industrial Revolution (2020)¹¹²:** The plan outlines policy interventions in the energy, buildings, transport, nature, and technology sectors.
- **Climate Change Levy (2001/2018)¹¹³:** A levy on the supply of energy to industry, commerce, and the public sector. It was amended in 2018 to gradually rise over time.
- **Environmental Bill (2021)¹¹⁴:** A legal framework for environmental policy, which includes provisions for fining products or commodities linked to 'illegal' deforestation.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under The United Kingdom's latest NDC, we estimate greenhouse gas emissions per capita would fall from 6.8 tons of CO₂e in 2018 to 3.7 tons by 2030. Its current policies imply a reduction to 5.2 tons over the same period.¹¹⁰

United States

The United States' 2050 Net Zero target is aligned with a 2°C+ warming trajectory. We estimate its NDC and current policies to align with a c. 3.0°C and 4.0°C+ trajectory respectively.



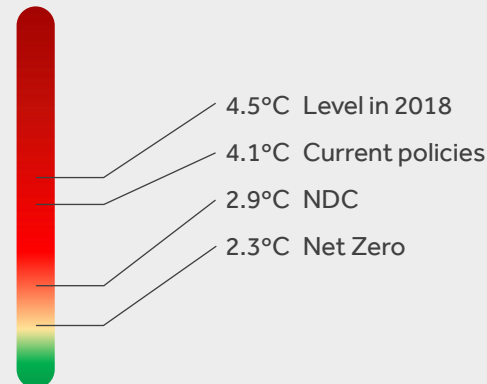
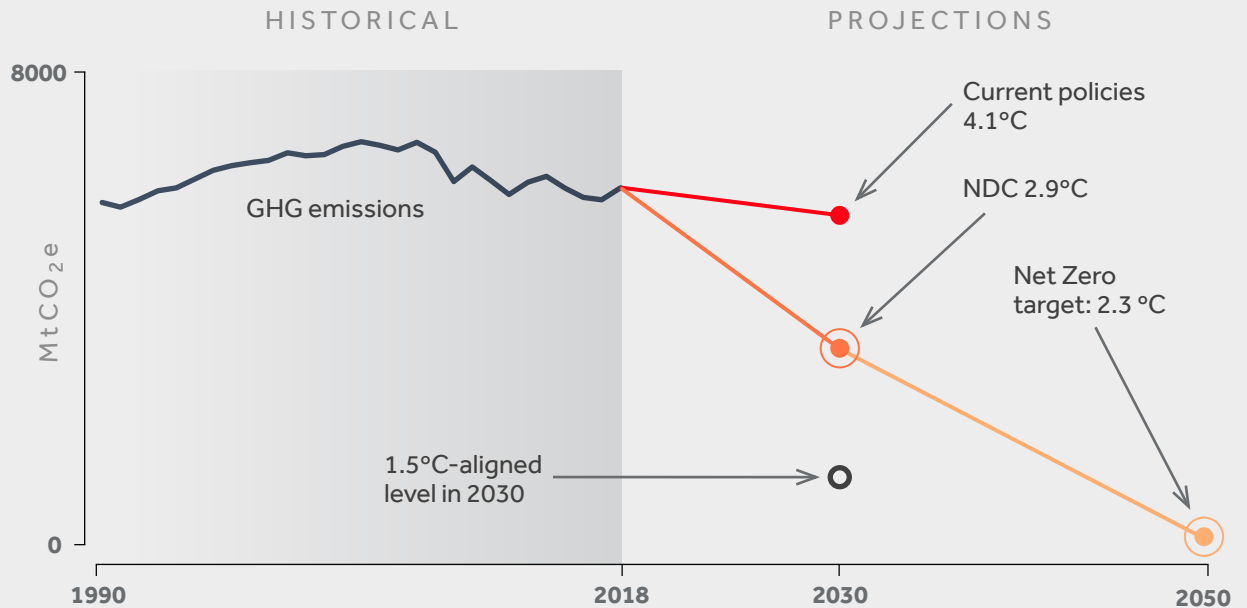
The United States has set a 2050 Net Zero target¹¹⁵ that we estimate to align with a 2.3°C temperature increase above pre-industrial levels, inconsistent with the Paris Agreement's goal. The United States' latest NDC for 2030¹¹⁶ implies a warming at 2.9°C, significantly misaligned with the Implied Temperature Rise of its current policies at 4.1°C.

United States

The United States' key climate-related policies:

- **Bipartisan Budget Act (2018)**¹¹⁸: The Act provides a tax credit for carbon dioxide captured by Carbon Capture and Storage (CCS) technologies (Section 45Q), including carbon dioxide used for enhanced oil recovery.
- **Renewable Fuel Standards (2015)**¹¹⁹: Requires a certain volume of renewable fuel to be blended into fossil fuel transportation fuel, heating oil or jet fuel (36 billion gallons by 2022).
- **Methane waste prevention rule (2016)**¹²⁰: Legal standards for oil and gas production to reduce CH₄ emissions by 35% by 2025 from a 2014 baseline.

GHG emissions trajectories



Evolution of GHG emissions per capita

Under the United States' latest NDC, we estimate greenhouse gas emissions per capita would fall from 18.4 tons of CO₂e in 2018 to 9.5 tons by 2030. Its current policies imply a lower reduction to 15.9 tons over the same period.¹¹⁷

European Union

European Union's 2050 Net Zero target is Paris-aligned, as is its NDC target. However, we estimate its current policies to align with a 2°C+ trajectory.



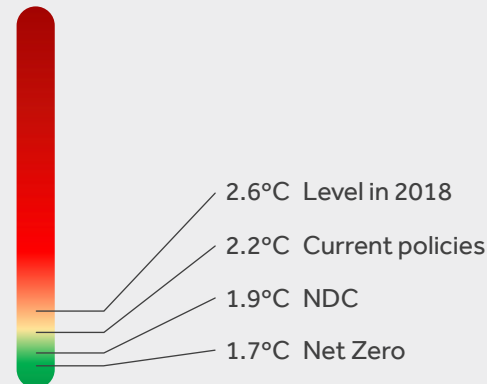
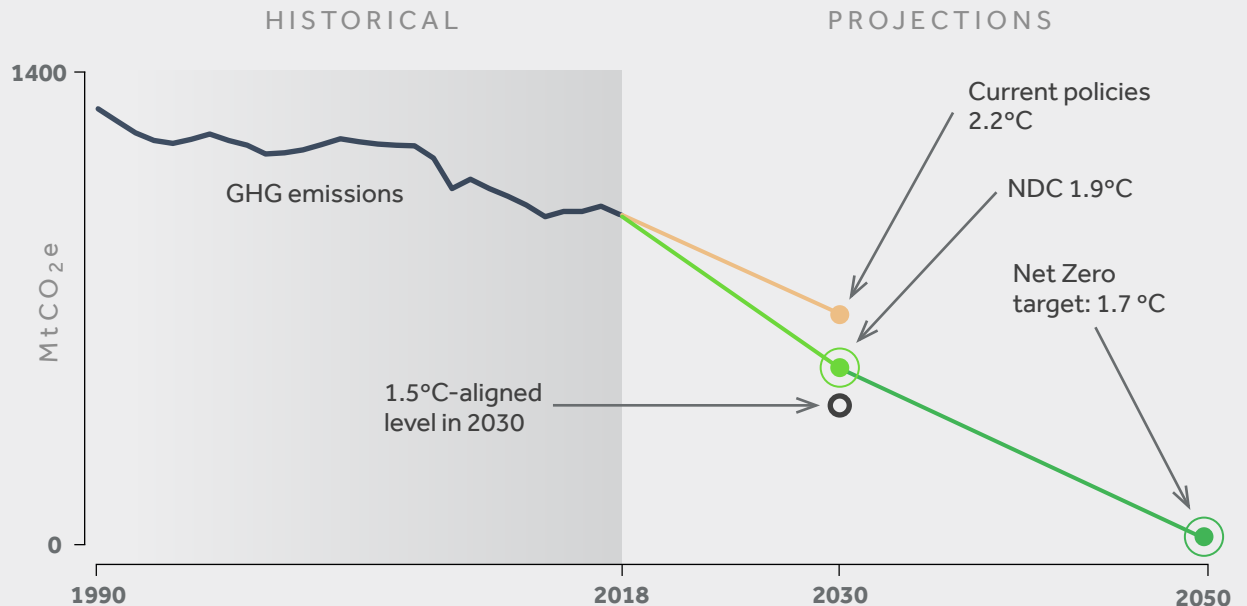
The European Union (EU) has a 2050 Net Zero target¹²¹ that we estimate to align with a 1.7°C temperature increase above pre-industrial levels, consistent with the Paris Agreement's goal. The EU's latest NDC for 2030¹²² implies 1.9°C warming, broadly in line with the Implied Temperature Rise of its current policies at 2.2°C.

European Union

The EU's key climate-related policies:

- **EU ETS Directive (2003/2018)¹²⁴**: A legal Emissions Trading Scheme that places a cap on the emissions from electricity/heat and industry of 43% below 2005 levels by 2030.
- **Effort Sharing Legislation [2018/842] (2018)¹²⁵**: Legislation establishes an emissions reduction target of 30% below 2005 levels by 2030 for Member States. It applies to emissions from sectors not included in the EU ETS.
- **European Green Deal (2019)¹²⁶**: A roadmap of key policies for achieving a transition to a low-carbon and sustainable economy, including the EU's climate neutrality by 2050 target.
- **EU Farm to Fork Strategy (2020)¹²⁷**: Part of the European Green Deal, it is a strategy published by the European Commission for promoting fair, healthy and environmentally friendly food systems.
- **EU LULUCF Regulation [2018/841] (2018)¹²⁸**: All Member States must ensure that they balance GHG emissions from the LULUCF sector with an equivalent amount of CO₂ removals from the atmosphere (following a specific accounting framework defined in the regulation).

GHG emissions trajectories



Evolution of GHG emissions per capita

Under the EU's latest NDC, we estimate greenhouse gas emissions per capita would fall from 7.9 tons of CO₂e in 2018 to 4.3 tons by 2030. Its current policies imply a reduction to 5.8 tons over the same period.¹²³

4

Annex - data and methodologies



This Annex includes a description of the data, methodologies and references used in our ITR evaluations.

A. CLAIM model

The methodology to define the national carbon budgets is critical in the determination of the Implied Temperature Rise. We rely on the CLAIM methodology developed by Beyond Ratings.¹ It enables the computation of national GHG budgets compliant with any average temperature target and time horizon (for this report a 2°C compliant scenario is selected).

The global budget sharing among countries is a source of scientific and diplomatic controversy. There are two main methodologies: (i) the egalitarian approach and (ii) the grandfathering approach. Hybrid approaches are also possible (see Giraud et al. 2017 for further details). The egalitarian approach consists of allocating to each and every human being the same right to emit carbon dioxide, while the grandfathering approach relies on the idea that the global carbon budget should be divided along the criterion of current carbon emissions, meaning that the weight of each country in global emissions remains stable over time.

The CLAIM approach does not assign a national budget following a unique criterion – such as “capacity” or “responsibility.” It offers a statistical, and non-normative, approach, which avoids choosing between egalitarian or grandfathering sharing that would be seen as non-consensual (see Giraud et al. 2017 for further details).

B. Database of decarbonization targets, trajectories and policies

The ambition assessments presented within this report focus on the G20 countries. However, we rely on a database covering a wider set of countries which allows for greater accuracy in the estimation of global Implied Temperature Rise.

Historical emissions

Our historical GHG emissions inventories are based on Grassi et al. (2021)² for the Land use, land-use change, and Forestry (LULUCF) sector and the Primap-hist database³ of the Potsdam Institute for other sectors (mostly industry and energy).

Net Zero targets

Our database currently covers 70 countries that have already set Net Zero commitments (see Table 02 – page 70), representing 72% of global GHG emissions.⁴ The database builds on the “Net Zero Tracker” from ClimateWatch⁵ and Nascimento et al. (2021).⁶ These Net Zero targets can appear in a number of forms with most countries presenting them as formal submissions to the UNFCCC or as national policy documents. However, commitments from several countries (including for example China) are currently only based on verbal pledges from political leaders.

Our Net Zero emissions trajectories are harmonized on our historical inventories and are calibrated on the “end point” announced by the countries, namely the horizon of their Net Zero target (most of time 2050, but some countries committed to achieve Net Zero emissions by 2060, like China, or 2045 like Germany).

NDC targets

The 194 country parties to the Paris Agreement have submitted a Nationally Determined Contribution (NDC), as required by the agreement. However only 117 of these NDCs are concrete enough to be quantifiable, representing 92.5% of global emissions. The commitments of some developing countries have both conditional (to financing) and unconditional parts. In our assessments we consider only unconditional component of the NDC targets.

As part of the Paris Agreement,⁷ countries have committed to update their NDCs prior to COP26. At the time of writing,⁸ only 121 countries⁹ representing 57.9% of global emissions, have submitted a new or updated NDC of which only 83 are quantifiable. Our NDC emissions trajectories are harmonized on our historical inventories and are calibrated on the “end point” in 2030 deduced from the information provided by the countries in their NDCs.

“Current Policies” trajectories

In this report we use “Current Policies” emissions trajectories constructed by the NewClimate Institute and IIASA that provide annual emissions estimates from 2021 to 2030. Both institutes have a long history in estimating the impact of

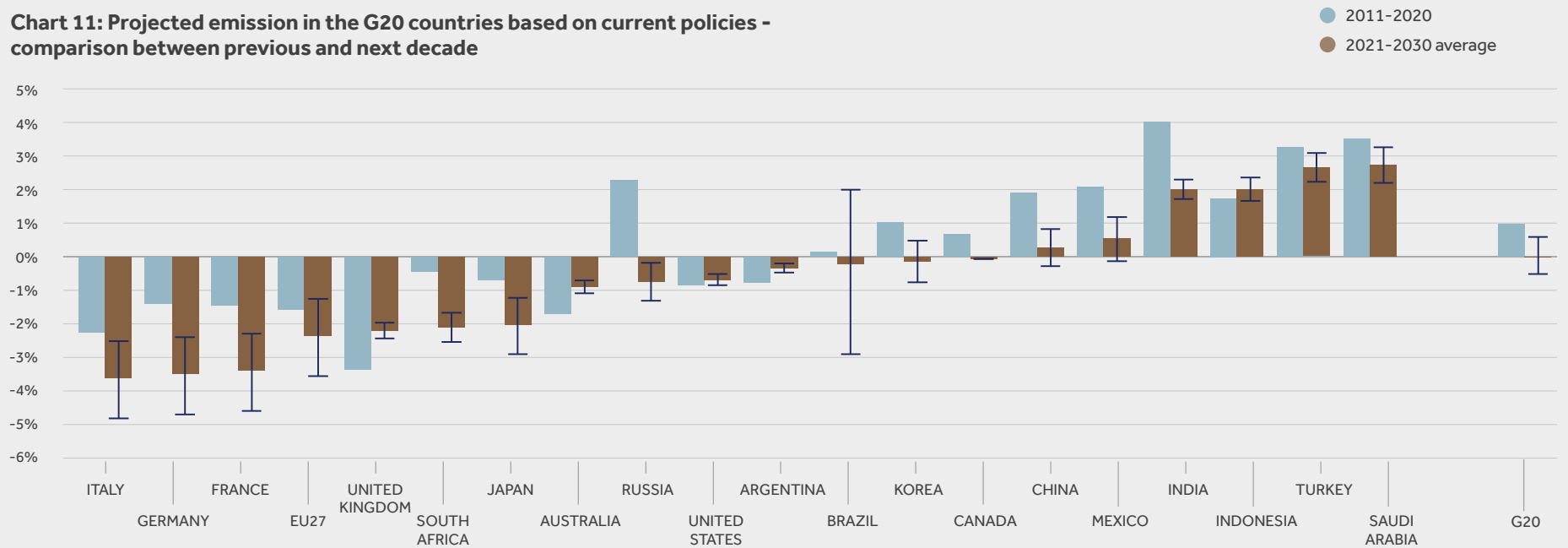
current policies on future GHG emissions. The methods used for developing the current policy scenarios are presented in detail in Nascimento et al. (2021) and described in detail elsewhere (Kuramochi et al., 2018,¹⁰ 2021;¹¹ den Elzen et al., 2019;¹² Fekete et al., 2021¹³)

The estimates assume that no additional mitigation action is taken beyond the currently implemented policies as of the end of 2020. This excludes publicly announced plans or strategies but includes policy instruments to implement such plans or strategies. Policies adopted in 2021 are excluded from the projections. The estimates include the effect of COVID-19 in the construction of the emission trajectories (see Nascimento et al. (2021) for details). The IIASA projections for the LULUCF sector have been developed utilising the GLOBIOM global land-use model (Frank et al., 2021¹⁴) and the G4M global forest model (Gusti et al., 2020¹⁵).

The NewClimate Institute/IIASA database of current policy trajectories covers 30 countries, accounting for 81% of global emissions. For France, Italy and Germany (which are only available in aggregated form as part of the EU27 in the NewClimate and IIASA datasets), we use the reference scenarios produced in the framework of the “Fit for 55” package.¹⁶

Our “Current Policies” emissions trajectories are based on the growth rates (between 2018 and 2030) deduced from the trajectories provided by NewClimate and IIASA (see Nascimento et al. (2021)) and harmonized on our historical inventories, see Chart 11 for illustration.

Chart 11: Projected emission in the G20 countries based on current policies - comparison between previous and next decade



Source: data from Nascimento et al. (2021), harmonized on FTSE Russell database.

Reader's note: Countries average emissions change rate per year in the 2010s compared to the projected change rate in the 2020s. The decadal growth rates exclude the years 2020 and 2021 due to the short-term effect of COVID-19 in the trends and other outliers.

Brazil's large range is due to high uncertainty in land use policy implementation. Our current policies scenario projections are highly dependent on the enforcement of implemented policies related to land use. IIASA developed two scenarios for the LULUCF policies, i.e. full enforcement of implemented LULUCF policies (leading to lower emissions) and partial enforcement of LULUCF policies (leading to higher emissions).

Table 01: Implied Temperature Rise for G20 countries

Country	IMPLIED TEMPERATURE RISE		
	Current policies (2030)	NDC targets (2030)	Net Zero targets (2050)
India	1.6°	1.6°	1.4°
France	1.8°	1.6°	1.6°
Italy	1.9°	1.8°	1.6°
United Kingdom	2.0°	1.7°	1.5°
Mexico	2.2°	2.2°	NA
European Union	2.2°	1.9°	1.7°
Brazil	2.2°	2.4°	1.8°
South Africa	2.3°	2.2°	1.6°
Turkey	2.3°	2.9°	NA
Germany	2.3°	1.9°	1.7°
Japan	2.5°	2.3°	1.9°
Argentina	2.6°	2.7°	1.6°
Indonesia	2.7°	2.7°	1.7°
China	3.0°	3.3°	2.3°
Russia	3.3°	4.0°	NA
Korea	3.8°	3.2°	2.2°
United States	4.1°	2.9°	2.3°
Australia	4.4°	4.1°	NA
Canada	4.5°	3.1°	2.3°
Saudi Arabia	5.9°	6.6°	2.9°

Table 02: Information available on projected emissions for country of our database (The cut-off date for taking into account new commitments was 4th October 2021.¹⁷)

Country	1st NDC	Updated/ new NDC before COP26	Current policies	Net-zero target
Albania	•			
Andorra				•
United Arab Emirates	•	•		
Argentina	•	•	•	•
Armenia	•	•		
Australia	•	•	•	
Austria	•	•	•	•
Azerbaijan	•			
Burundi	•			
Belgium	•	•	•	•
Benin	•			
Burkina Faso	•			
Bangladesh	•	•		
Bulgaria	•	•	•	•
Bosnia and Herzegovina	•	•		
Belarus	•			
Brazil	•	•	•	•
Barbados	•	•		•
Botswana	•			
Central African Republic	•			
Canada	•	•	•	•
Switzerland	•	•		•
Chile	•	•	•	•
China	•		•	•
Cote d'Ivoire	•			
Dem. Rep. of Congo			•	
Congo	•	•		
Colombia	•	•	•	•
Cabo Verde				•
Costa Rica	•	•		•
Cyprus	•	•	•	•
Czech Republic	•	•	•	•

Country	1st NDC	Updated/ new NDC before COP26	Current policies	Net-zero target
Germany	•	•	•	•
Denmark	•	•	•	•
Dominican Republic	•	•		•
Spain	•	•	•	•
Estonia	•	•	•	•
Ethiopia	•	•	•	
Finland	•	•	•	•
Fiji				•
France	•	•	•	•
Gabon	•			
United Kingdom	•	•	•	•
Georgia	•	•		
Ghana	•			
Guinea	•	•		
Greece	•	•	•	•
Guatemala	•			
Honduras	•	•		
Croatia	•	•	•	•
Haiti	•			
Hungary	•	•	•	•
Indonesia	•	•	•	•
India	•	•	•	•
Ireland	•	•	•	•
Iraq	•			
Iceland	•	•		•
Israel	•	•	•	
Italy	•	•	•	•
Jamaica	•	•		•
Jordan	•			
Japan	•	•	•	•
Kazakhstan	•		•	•
Kenya	•	•		

Country	1st NDC	Updated/ new NDC before COP26	Current policies	Net-zero target
Kyrgyz Republic	•			
Korea	•	•	•	•
Lao PDR	•	•		•
Lebanon	•	•		
Sri Lanka				•
Lithuania	•	•	•	•
Luxembourg	•	•	•	•
Latvia	•	•	•	•
Morocco	•	•	•	
Monaco				•
Moldova	•	•		
Maldives				•
Mexico	•	•	•	
Marshall Islands				•
North Macedonia	•	•		
Mali	•			
Malta	•	•	•	•
Montenegro	•	•		
Mongolia	•	•		
Mauritania	•			
Mauritius				•
Malawi				•
Malaysia	•	•	•	
Namibia	•	•		•
Niger	•			
Nigeria	•	•		
Netherlands	•	•	•	•
Norway	•	•	•	•
Nepal				•
New Zealand	•	•		•
Oman	•	•		
Panama				•

Country	1st NDC	Updated/ new NDC before COP26	Current policies	Net-zero target
Peru	•	•		
Philippines	•	•	•	
Poland	•	•	•	•
Portugal	•	•	•	•
Paraguay	•	•		
Romania	•	•	•	•
Russia	•	•	•	
Saudi Arabia	•		•	•
Senegal	•	•		
Singapore	•	•	•	
Solomon Islands				•
Serbia	•			
Slovak Republic	•	•	•	•
Slovenia	•	•	•	•
Sweden	•	•	•	•
Seychelles	•	•		•
Chad	•			
Togo	•			
Thailand	•	•	•	
Tajikistan	•			
Trinidad and Tobago	•			
Tunisia	•			
Turkey	•		•	
Tanzania	•	•		
Uganda	•			
Ukraine	•	•	•	•
Uruguay	•			•
United States	•	•	•	•
Uzbekistan	•			
Venezuela	•			
Vietnam	•	•		

Endnotes

Front matter

1. For more details and context, please refer to Nascimento, L., Forsell, N., Batka, M., Kuramochi, T., Illenseer, N., Subtil, C. and Lancesseur, N., 2021, Tracking climate mitigation efforts in 30 major emitters: Economy-wide projections and progress on key sectoral policies <https://newclimate.org/2021/11/02/tracking-30-major-emitters/>
2. Some Net Zero targets are defined at a 2045, 2060 or 2070 horizon.
3. See Nascimento et al (2021). Co-developed by researchers from NewClimate Institute, IIASA and FTSE Russell, the study focuses on the construction of the “Current Policies” emission trajectories that we use as a key input to our ITR calculations.
4. These pledges were made even though no provision in the Paris Agreement explicitly relates to national Net Zero objectives. Conversely, while Parties to the Paris Agreement were supposed to communicate long-term low greenhouse gas emission development strategies (LTS) by 2020, very few countries have submitted such LTS. These strategy plans are yet critical to give credibility to commitments at such a distant horizon.
5. For further details on countries’ climate commitments, please see Section III: Ambition Cards.
6. 30 countries were covered, representing 81% of global emissions, see Nascimento, L. et al., 2021, Tracking climate mitigation efforts in 30 major emitters: Economy-wide projections and progress on key sectoral policies.
7. Emin et al., 2021, How to measure the temperature of sovereign assets, FTSE Russell

Section 1

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India

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