One year on:
THE WORLD IS STILL HEADING FOR ONLY 'JUST BELOW' 2°C IF ALL LONG-TERM PLEDGES ARE FULFILLED

The 1.5°C target is not lost, but the world seems to be choosing an expensive and higher impact path to achieving it

Briefing paper

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Image Credit

Trails in the sand by Harold Hollingsworth, CC-BY SA 2.0, https://flic.kr/p/BM16r.
With different pathways ahead, it feels like the world is stuck in the sand – with emission levels approximately constant out to 2030 under the current climate pledges – not making a decisive turn.

Version
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The 1.5°C target is not lost, but the world seems to be choosing an expensive and higher impact path to achieving it.

Key points

- **One year on:** Last year, at COP26 in Glasgow, countries gave themselves a year to enhance their 2030 NDCs. The world got distracted and 2030 pledges are still way off.
- **Have we lost the 1.5°C target?** No, the goal of limiting end of century warming to 1.5°C remains valid, even if we slightly overshoot and then reach it “from above”.
- **Are we going to see 1.5°C warming?** Yes, the IPCC projects that by the early 2030s, the long-term average is going to be (best-estimate) around 1.5°C warmer than 1850-1900. Individual years may be 1.5°C warmer than 1850-1900 before this (i.e., in the 2020s or early 2030s).
- **Did countries enhance their pledges over the last 12 months?** It seems like countries have been distracted. There has been limited enhancement of pledges and subsequent improvement in projected temperature outcomes in the 12 months since COP26, although 29 countries have submitted updated NDCs in that time.
- **Is it 2.5°C or 1.9°C warming we are going to see?** Best-estimate warming is still just below 2°C (we estimate 1.9°C), if all pledges (i.e., 2030 NDCs plus long-term targets) are fulfilled. When only considering commitments relevant to 2030 emissions, specifically NDCs, and not considering long-term targets, then projected warming in 2100 is between 2°C and 3°C (and rising). That projection assumes that emissions between 2030 and 2100 remain consistent with the emissions trajectory between now and 2030 implied by NDCs.

Summary

Countries' emission reduction commitments, considering updates over the 12 months since COP26, result in a best-estimate of warming of around 1.9°C, if all NDC and long-term pledges are met in full and on-time. This has barely changed from our estimates following COP26 a year ago, published in Nature in April 2022 (Meinshausen et al., 2022)[1].

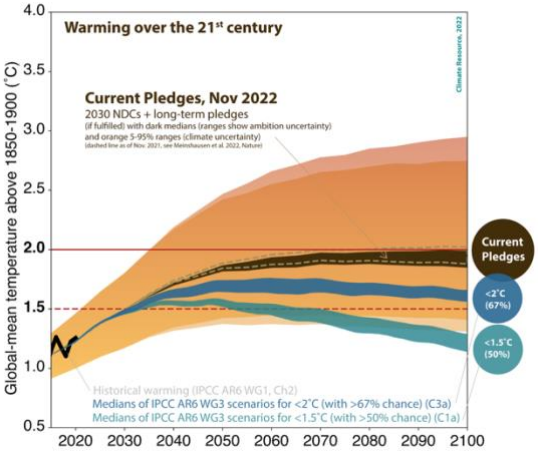


Figure 1 - Projected warming over the 21st century. *Best-estimate projections following current 2030 (NDC) and long-term pledges (if they are all implemented) (brown dark range) and including climate system uncertainty (orange ranges). For comparison, best-estimate warming for IPCC-assessed scenarios that would likely limit warming to below 2°C (67%) or limit warming to below 1.5°C (50%) by 2100 are shown in dark blue and teal ranges, respectively.*

If global emissions remain on the trajectory implied by the 2030 targets in current NDCs, the best estimate of 2100 warming is much higher, i.e., 2.2°C-2.9°C, also largely unchanged from our assessments based on commitments in November 2021.

The difference in these two warming projections, one that only considers 2030 NDCs and one that also considers the long-term targets, is stark. Among other things, the difference highlights that the near-term targets for 2030 are not yet in line with the long-term targets, nor with an ambition of keeping warming close to 1.5°C. Of utmost importance are faster emissions reductions over the next 8 years to change the trajectory to 2030. However, the fact that the net-zero targets bring us substantially closer to our target highlights that mid-century net-zero CO_2 and, even better, net-zero GHG pledges are still important milestones for which nations should aim in addition to improving their 2030 pledges.

Without enhanced 2030 targets, the world (in 2030) will have most likely missed the chance to limit warming to around 1.5°C. Increasing the pace of decarbonisation now is also necessary to make the pace of change required to meet long-term commitments and avoid warming of >2°C after 2030 more feasible.

Climate Resource estimates are broadly consistent with analyses recently provided by the UNFCCC NDC Synthesis Report[2], the IEA WEO 2022[3] and the UNEP Gap report[4]. For the public and decision makers, distinguishing between the temperature projections that take long-term targets into account from those that do not is probably the biggest challenge when interpreting the various temperature ranges reported in the media. To aid understanding, we provide a comparison across the various studies with explicit separation by targets considered and uncertainties reported (Figure 5).

[1] Meinshausen, M., Lewis, J., McGlade, C. et al. Realization of Paris Agreement pledges may limit warming just below 2 °C. Nature 604, 304–309 (2022). https://doi.org/10.1038/s41586-022-04553-z
[2] https://unfccc.int/ndc-synthesis-report-2022
[3] https://www.iea.org/reports/world-energy-outlook-2022
[4] https://www.unep.org/resources/emissions-gap-report-2022

1. Introduction

This briefing provides an update of temperature projections - taking into account NDCs and climate pledges as of 5th November 2022. We principally use the same methodology as in our previous assessment, based on climate pledges as of November 2021 (Figure 2).

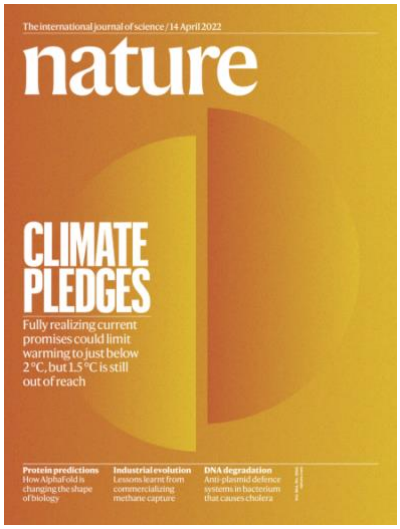


***Figure 2** - Nature cover story as of 15th April 2022, providing methodological details and a comparison point for climate pledges as of Nov. 2021. In short, not much has changed since. See https://www.nature.com/articles/s41586-022-04553-z*

The methodology has been kept the same, other than that we now compare the warming projections against the newly released IPCC AR6 WG3 scenarios. Again, we provide detailed country-by-country data assessments online, available at: https://www.climate-resource.com/tools/ndcs

2. Key findings

Updates to commitments in 2022 have not moved the world materially closer to limiting warming to 1.5°C: We analyse the climate pledges and emissions of all 193 Parties to the Paris Agreement, plus international aviation and shipping. 29 parties have submitted formal updates to NDCs in the 12 months since 11 November 2021[5] including countries in the top 30 global emitters such as Brazil, Indonesia, Thailand, Egypt, and Australia. Fifteen parties have submitted updated long-term low-emissions development strategies (LT-LEDS) since 11th November 2021. Some of the new NDCs or LT-LEDS do not target lower emissions compared to their previous pledges. In the case of India, the updated pledge was included in the Climate Resource 2021 assessment based on the announcements at COP26. The updates over the last 12 months do not move the needle sufficiently to change our best estimate of peak warming, which remains at 1.9°C if all NDC and longer-term commitments are met on time and in full.

Last year, commitments made in the lead up to and at COP26 delivered an historic moment: For the first time in history, in November 2021 the aggregate effect of the combined pledges by 193 countries delivered a best-estimate of projected peak warming of 1.9°C-2.0°C warming with around a 50% chance. This highlighted the significant progress of countries' emissions reduction ambition since the Paris Agreement, when the best estimate of peak warming was above 3°C. It also made clear that faster reductions between 2021 and 2030 are critical if the world is to limit end of century warming to 1.5°C. With emissions constant at 2019 levels, the 1.5°C remaining carbon budget estimated by IPCC (i.e. 500 $GtCO_2$ eq from the beginning of 2020) would be almost completely used up by 2030.

[5] The cut-off date for the Nature study was 11 November 2021. This cut-off date for this briefing for NDCs was 5 November 2022 for NDCs and 5 October 2022 for LT-LEDs. Eight of the parties with new LT-LEDS submitted before our cut-off date.

The temperature projections hinge on the assumption that the pledges are achieved: Effective climate, energy and land use policies and actions are required to underpin the pledges. Many are not yet backed by policy. All the conditional NDCs also require appropriately scaled-up climate finance and adequate support in order to be implemented.

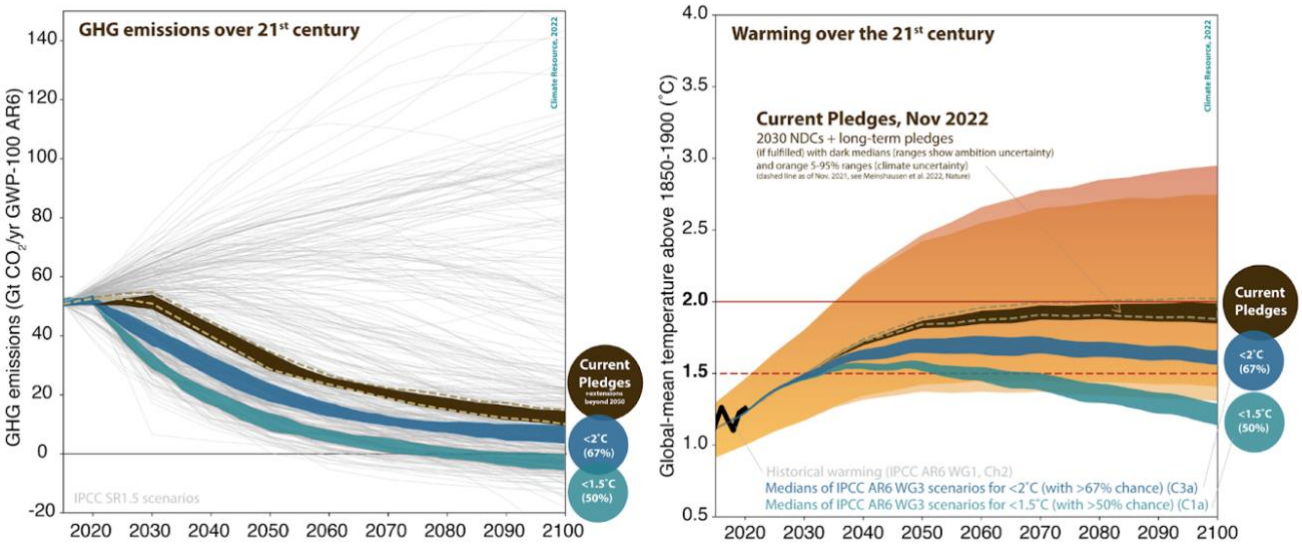


Figure 3 - Warming due to NDCs and long-term targets. *Global mean temperature projections based on all officially submitted NDCs and long-term targets as of 5 November 2022 compared to 11 November 2021 (see Meinshausen et al., 2022), with a sensitivity case considering full implementation of 2030 NDC targets (lower end of dark brown band) and only unconditional targets (upper end of dark brown band) in addition to the long-term pledges. In the full implementation case, the pledges have a roughly 60% chance of staying below 2 °C, whereas when only considering unconditional 2030 pledges and the long-term targets, there is only a 50% chance. Neither scenario has a likely 67% chance of staying below 2 °C and hence would be unlikely to qualify for a Paris-compatible 'well-below 2 °C and pursuing best efforts for 1.5C' stamp of approval. The dark blue and teal bands show the median ranges for the IPCC AR6 WG3 scenarios, classified as <2 °C with a likely (67%) chance and <1.5 °C with no or low overshoot with a 50% chance by 2100, respectively. The thin grey GHG emissions are the scenarios analysed in the IPCC Special Report on 1.5 °C.*[6]

When ignoring any long-term targets, the projected temperatures are well beyond 2°C. We estimate peak warming of 2.2°C-2.9°C based only on 2030 pledges. This is higher and broader than the 1.9°C warming we derive when taking into account both NDCs and long-term targets. This difference is crucial and gets overlooked when only comparing headline numbers.

- **The reason our 2030-only warming estimates (similar to the headline numbers of the UNFCCC Synthesis Report, UNEP Gap report etc.) are higher** is that the 1.9°C estimate includes 81 quantified long-term targets for either 2050, 2060 or 2070, now covering approximately 70% of global emissions. Thus, 70% of the world's emissions are constrained, many of which by net-zero targets so emissions are substantially lower than emissions derived based on extending the 2030 levels.[7]

[6] The data for the figures are freely available for reproduction here (Creative Commons Attribution Non Commercial Share Alike 4.0 International): https://data.climateresource.com.au/ndc/20221110-briefing/20221110_CR_scenario_summary.csv

[7] This estimate is dependent on the underlying emission source one choses. Officially reported data suggests a higher fraction of global emissions being covered, such as 79% as reported in the UNFCCC NDC Synthesis report, 2022 (available at: https://unfccc.int/documents/619180).

- **The reason that the 2030-only warming estimates are broader / more uncertain** is that the projected temperature rise resulting from 2030 commitments is subject to larger uncertainties. That is largely because one has to extrapolate emissions by 70 years beyond 2030 in order to derive warming estimates. The 2030 emission levels themselves are uncertain and even more so the longer-term extensions. The 2030 levels are uncertain largely due to the conditions attached to many 2030 pledges. However, they are also uncertain for other reasons, for example by being made with reference to a reduction below an unstated business as usual (BAU) reference scenario or an emissions intensity target in which the GDP projection is unknown or uncertain.

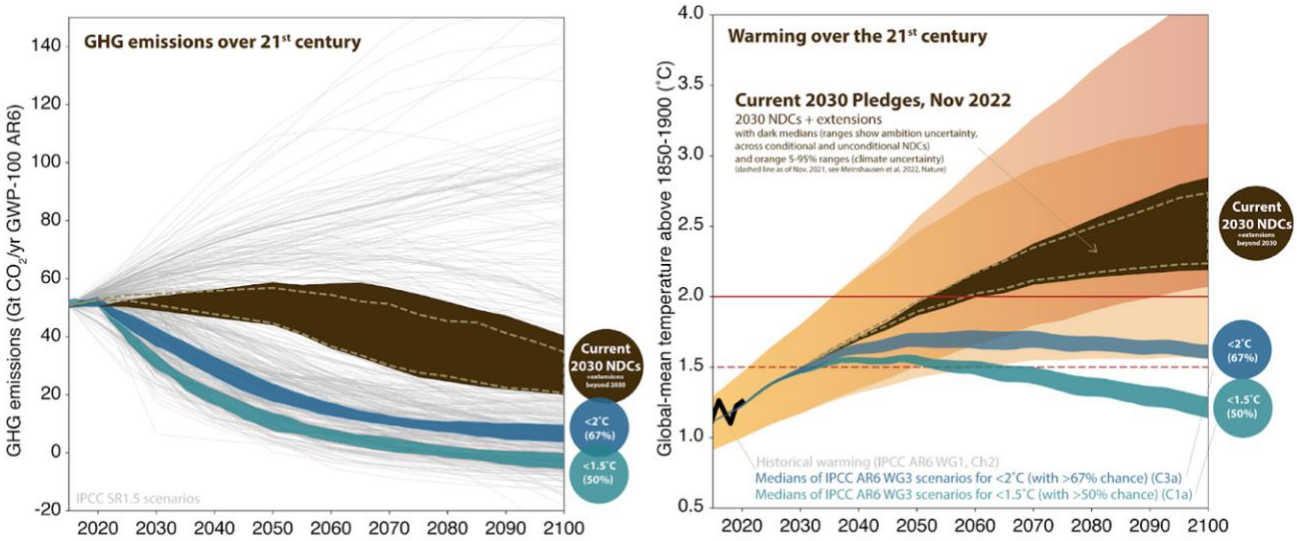


Figure 4 - Global mean temperature projections based only on 2030 NDCs and emission extrapolations for the period from 2030 to 2100. These result in a wider range and higher-level of warming compared to projections that also consider longer-term commitments. Global mean temperature projections based on all officially submitted NDCs of 5 November 2022 (dark brown ranges) are compared to those submitted until last year (11 November 2021) that were published by Meinshausen et al., (2022). The lower end of the shown ranges is a sensitivity case considering the best-case scenario of a full implementation of NDC targets and the upper end is (the top end of) an implementation that only considers unconditional 2030 NDC targets. Extrapolation between 2030-2100 is based on continuing growth rates (derived on the growth rate from 2025-2030) out to 2050, and from 2050-2100 using comparable scenarios from the SR1.5 Database (as described in Meinshausen et al., 2022). For comparison, the right panel shows the IPCC AR6 WG3 scenarios that limit warming to below 2°C with a likely chance and those that limit warming to around 1.5°C with a low overshoot before returning below 1.5°C before 2100. The right panel shows IPCC SR1.5 GHG emission trajectories.

As the world meets in Sharm-el-Sheikh at COP27, we are still a long way from a pathway consistent with 1.5°C: The combined pledges of countries, both the conditional ones, and certainly the unconditional ones, are far from sufficient to limit end of century warming to 1.5°C. Using probabilistic projections, the exceedance probability for 1.5°C is still around 90% even in our most optimistic scenario. Every bit of warming matters and higher temperatures mean wide scale increases in extreme climate events and the associated toll on many millions of people and the demise of fragile ecosystems including coral reefs, unless the pace of transition to net-zero emissions accelerates rapidly.

3. Is the 1.5°C target lost?

Say goodbye to 1.5°C? The recent edition of The Economist titled just ahead of COP27 "Say goodbye to 1.5°C" with the main article entitled "The world is going to miss the totemic 1.5°C climate target - It needs to face up to the fact". While there are quite a few useful analysis pieces in the Economist and the reporting generally is miles different to what it was 10 years ago, there is one major issue with this. Many people reading the Economist would understand it to say that we should give up on the 1.5°C target. Such logic is similar to saying, "Somebody broke the 100km/h speed limit on the highway, so let's get rid of the speed limit".

Mixed progress. Yes, continuously rising global GHG emissions since the UNFCCC's inception in 1992 have not put the world on the right path. On the other hand, there are quite a few underlying metrics that are early indicators for a swift energy transition, for example electric vehicle uptake and electrification of other sectors. Part of this trend is thanks to new renewable energy making fossil fuel energies more and more uneconomic. However, at the moment, we are certainly not on track to halve our emissions this decade and substantially more effort is needed. The IEA provides an excellent set of tracking indicators for the path to net-zero: https://www.iea.org/topics/tracking-clean-energy-progress.

Yes, our best-estimate is that we are going to see 1.5°C warming, or even 1.6°C - even in the strongest mitigation scenarios. There is a good chance that we are going to see an El Nino year this decade that is going to push global-mean and annual-average warming for the first time beyond 1.5°C in a single year. By the early 2030s, the IPCC's AR6 best estimate is that we will reach 1.5°C over a 20-year average in all scenarios. Thus, there is no question that adaptation efforts have to assume that 1.5°C warming is the absolute minimum warming we are going to face. That is not a new insight. Even at the time of the Paris Agreement, when 1.5°C entered the negotiations, the UNEP GAP report, for example, classified emission scenarios as 1.5°C scenarios if they stayed around 1.5°C warming (even with the potential for a small overshoot) and then returned below 1.5°C by the end of the century.

The 1.5°C target is not lost, but we seem to be choosing a less cost-efficient and higher impact path to achieve it. In fact, as the Art. 2 of the Paris Agreement is referred to as one temperature goal (see e.g., Art. 4.1, where it says "In order to achieve the long-term temperature goal set out in Art. 2, …"), the possibility of a slight overshoot of 1.5°C is built into the Paris Agreement Art. 2 itself. Simply speaking, Paris Agreement Art. 2 says that we aim to stay at all times well below 2°C and pursue best efforts to limit warming to below 1.5°C. Even if we are going to 1.6°C warming, the 1.5°C target is not lost, not less relevant and not a pipe dream. If we continue to reduce emissions and achieve net-zero

GHG emissions (as Art. 4.1 of the Paris Agreement asks us to do), then we can still lower temperatures again after the peak and get to below 1.5°C warming by 2100. As one of the IPCC side events on "overshoot" at COP27 pointed out[8] - if you consider "overshoot" as something evil or not depends on your counterfactual. Once we are at 1.6°C, we have two choices: stay at 1.6°C or above, or return back down. Returning below 1.5°C will avoid many reversible impacts down the line compared to a scenario in which we do not reduce temperatures at all. And the 1.5°C goal can and should be still our guidepost - no matter whether we are at 1.2°C or 1.6°C. Thus, even if warming exceeds 1.5°C, the 1.5°C goal is not lost. If we compare a path that limits warming to 1.5°C "from below" (i.e. without overshoot) to one that limits warming to 1.5°C "from above" (i.e. after a temporary overshoot), the latter is a path towards 1.5°C that comes with less cost efficiency (it tends to be cheaper to avoid emissions in the first place rather than having to get them out of the atmosphere later again via negative emissions) and higher climate impacts.

Every tonne emitted, every bit of warming counts. We should keep in mind that all our quantifications rest on our current level of knowledge of how the Earth System is going to react to our greenhouse gas (GHG) emissions experiment. If the Earth system is 'angrier', i.e., responds with more warming to our GHG emissions than we expect (and as some of the 'hotter' climate models in CMIP6 suggest), then we will shoot past 1.5°C and possibly also 2°C based on the world's historical levels of fossil fuel burning alone. Every ton of emissions adds to the future damage and every bit of warming will go hand in hand with more dire climate change impacts. Given that we have the technical and economic options to reduce our emissions now, the best insurance policy against high future impacts is to use these options. No matter what temperature we end up at, every tonne emitted increases warming and every bit of warming counts

[8] See video recording here: https://youtu.be/LEUAp_u9FfY

4. Comparison of temperature projections

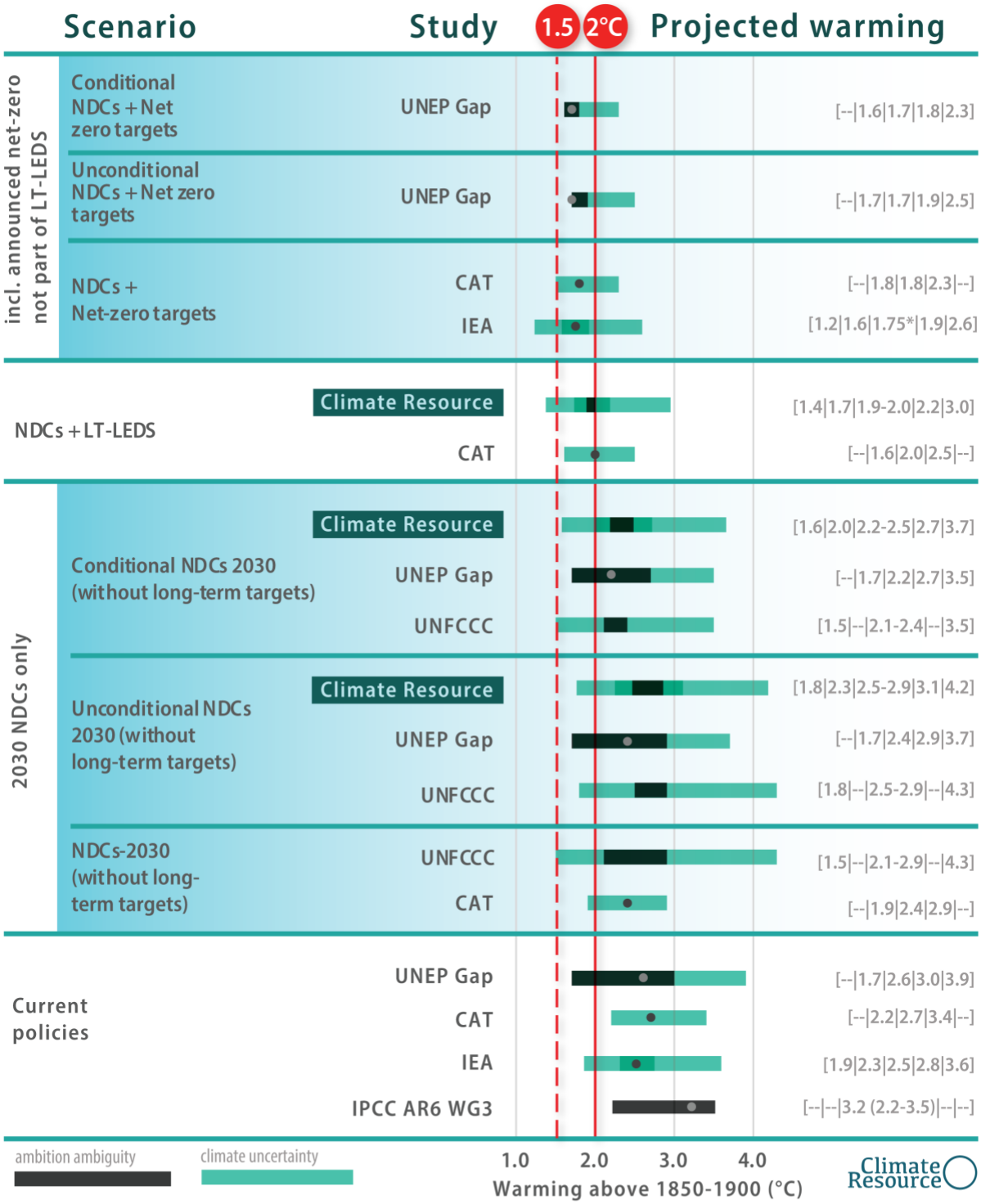
Recently, several temperature estimates for current pledges and climate policies were published that include 2022 updates of countries' NDCs and long-term targets. Here, we compare those recent studies to shed some light on where the differences come from. When comparing 'apples' with 'apples', all the estimates are similar. That is not the case when comparing the headline numbers, as they can refer to very different scenarios, warming percentiles or underlying key assumptions. For example, when the headlines say that the UN projects 2.5°C of warming[9], that is not inconsistent with other studies that project 'just below 2°C' warming levels. They are looking at different things (i.e., either excluding or including long-term targets). This section is intended to shed light on these differences and compare 'apples with apples'. For a good overview of temperature projections from the time of COP26, see the brief by Zeke Hausfather and Piers Forster[10].

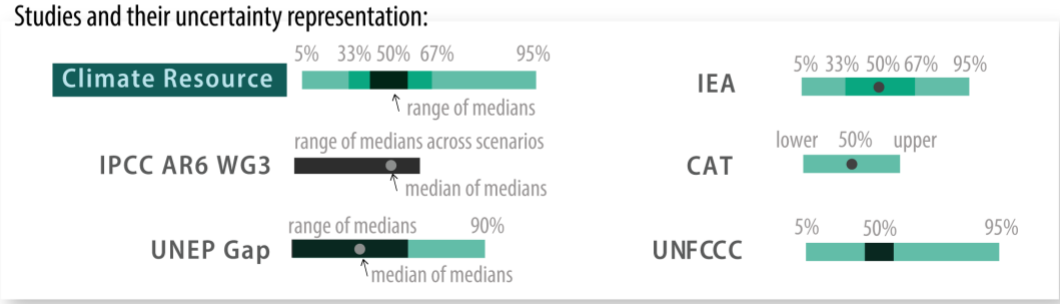
In summary, when comparing this year's IEA, the UNEP Gap report, the UNFCCC Synthesis Report, the Climate Action Tracker study and our own, the studies are very consistent. Differences in headline numbers mainly arise from different scenarios being reported or different warming ranges.

The reason for some big differences is whether long-term targets included or not. The UNFCCC NDC Synthesis Report (2022)[11], and the UNEP Emissions Gap Report (2022)[12], released in the last two weeks, contain projections of the temperature rise associated with countries meeting their 2030 emission reduction commitments. Their headline numbers reported in the media were hence the warming projections that did not consider the long-term targets. That is a legitimate approach, as the legal nature, specificity and underpinning in climate policies is vastly different between 2030 targets and long-term targets. Take the example of Australia. When the previous Morrison government proposed a net-zero long-term target, the supporting analysis presented did not actually aim for net-zero emissions nor contain sufficient detail to make that long-term pledge credible. We also quantify several scenarios that only consider 2030 NDCs and then assume 'similar effort' emission projections for after 2030 - with our results largely matching the UNFCCC (2022) and UNEP (2022) reports.

There is a small difference between announced net-zero targets and officially submitted long-term targets (whether net-zero or not). The UNEP Emissions Gap report (2022), the IEA World Energy Outlook (2022)[13], and the Climate Action Tracker (Nov 2022) also contain projections of the temperature rise associated with the achievement of all climate pledges, including longer-term commitments. All three organisations' projections are broadly consistent with our assessment. Some are even a bit lower than our headline number of 1.9°C. The reason is that additional net-zero pledges are taken into account by the IEA and CAT, while we are only considering long-term targets that have been officially submitted to the UNFCCC in the form of either an NDC or a LT-LEDS submission (Figure 5). An additional small cooling effect is also part of the UNEP Gap report numbers, as that report uses a different climate emulator compared to all the other studies shown.

[9] See e.g. https://www.carbonbrief.org/daily-brief/cop27-world-on-crash-course-to-2-5c-of-warming-un-warns/
[10] https://www.carbonbrief.org/analysis-do-cop26-promises-keep-global-warming-below-2c/
[11] https://unfccc.int/ndc-synthesis-report-2022
[12] https://www.unep.org/resources/emissions-gap-report-2022
[13] https://www.iea.org/reports/world-energy-outlook-2022





* 1.75°C in underlying WEO2022 Extended dataset, reported as 'about 1.7°C'

Figure 5 (previous page) - Comparison of our warming projections (dark teal label) with key other studies for different scenarios. Shown are the IPCC AR6 WG3 estimates for current policy implications (as of end of 2020)[14], the UNEP Emission Gap report 2022[15], the IEA WEO 2022 report[16], the Climate Action Tracker assessment as of November 2022[17], and the UNFCCC NDC Synthesis Report[18] as of October 2022. Note that the uncertainty representation of both the ambition ambiguity (black ranges) and climate uncertainty (teal ranges) is different in the different studies (see legend)[19]. Studies also vary in terms of their cut-off dates, the number of countries they explicitly analyse[20], the set of pledges they take into account, or whether they "cap" pledges at "current policy" or reference emission projections (i.e., include "hot air")[21]. All shown studies (except the UNEP Gap report this year) use the MAGICC7 model (see live.magicc.org) to produce the reported climate projections and uncertainties[22]. For most of the analysed scenarios shown here, the distinction between peak and 2100 temperatures does not matter, but studies differ in terms of their reported headline numbers.[23]

[14] See IPCC AR6 WG3 SPM section C1.3. The reported range is the range of the medians across all scenarios that quantify the trend from currently implemented climate policies.

[15] The UNEP Emission Gap report is available at https://www.unep.org/resources/emissions-gap-report-2022. The headline numbers are the 66% climate percentiles in the UNEP gap report. For comparability with other studies, we here show the medians (black ranges) and also the upper end of the 90% climate uncertainty range, as provided in Table 4.5 of the UNEP Emission Gap report 2022.

[16] See Figure 1.19 in IEA WEO 2022, available at: https://www.iea.org/reports/world-energy-outlook-2022

[17] The Climate Action Tracker Nov 2022 Assessment is available here: https://climateactiontracker.org/publications/massive-gas-expansion-risks-overtaking-positive-climate-policies/.

[18] The UNFCCC Synthesis Report (2022) provides temperature assessment in Paragraph 151 and Footnote 52.

[19] If ambition ambiguity is reported for a particular study, we report the 5% or 33% percentiles (if available) that are corresponding to the more ambitious end of the scenarios, and likewise the upper 67% and upper 95% percentiles, corresponding to the less ambitious quantification provided.

[20] Our study analyses 193 countries, as presented on https://www.climate-resource.com/tools/ndcs. Other studies focus on a subset of key countries.

[21] "Hot air" refers to the amount of emissions that a quantified NDC pledge for 2030 sits above a reference scenario projection or a "current policy" implementation projection. From an optimistic point of view, this 'hot air' can be termed 'overachievement' of the pledged climate targets. Most often however, the case is rather that pledged targets are substantially higher than reasonable 'no additional climate policy' scenarios, even though existing climate policy in a particular country is not very ambitious. The CAT and UNEP Gap report and our own Climate Resource estimate are studies that exclude 'hot air' in one form or another, whereas the UNFCCC Synthesis report for example does take NDC pledges at face value without "capping them".

[22] The UNEP Gap report this year uses the FaIR model which is closely comparable, yet possibly 0.1°C cooler for the low mitigation scenarios. See a comparison between MAGICC7, FaIR and other emulators as well as the IPCC assessed ranges in Cross-Chapter Box 7.1 in Chapter 7 of the IPCC AR6 WG1 report, available at: https://www.ipcc.ch/report/ar6/wg1/.

[23] The reason that peak and 2100 global-mean surface air temperatures are closely comparable is that emission extensions beyond 2050 generally do not assume (strongly) negative emissions, if any. Thus, peak temperatures are in most cases identical or very close to 2100 temperatures. The above table shows peak global-mean temperatures over the 21st century for Climate Resource, 2100 temperatures for IPCC AR6 WG3; 2100 temperatures (presumably) for the UNEP Gap report ("Emissions over the course of the twenty-first century"); 2100 temperatures for the IEA; 2100 temperatures for CAT; and peak temperatures of the UNFCCC NDC Synthesis Report.

The biggest divergence among studies is the quantification of "current policies". While the IPCC AR6 WG3 estimate (with an early cut-off date of 2020) tends to be on the high side, the comprehensive IEA WEO (2022) STEPS scenario with its central estimate of 2.5°C warming is closely in line with the estimates by the CAT and the UNEP Gap report (although the latter features a larger uncertainty range) (see bottom of Figure 5 above).

For 2030 unconditional pledges (not taking into account longer term pledges), UNEP (2022) reports a comparatively wide range (1.7°C-2.9°C) and a median of 2.4°C, which is close to the low end of the range reported by the UNFCCC (2.5°C-2.9°C), and Climate Resource (2.4°C-3.0°C). The UNEP Gap Report does not include 'hot air' in its assessment, whereas the UNFCCC does - one reason why the UNFCCC estimates do not encompass the lower end of the range in the UNEP Gap Report. For 2030 conditional pledges (also not taking into account longer term pledges), the assessed ranges are also closely aligned.

When all NDCs and longer-term pledges are taken into account, the IEA WEO (2022) and UNEP Emissions Gap Report (2022) projections are close at around 1.7°C, with the latter reporting a range of 1.6°C-1.9°C across its assessment of conditional and unconditional NDCs. These are slightly lower (~0.1°C) than assessments by both organisations in 2021, and also lower than our Climate Resource assessment. Our Climate Resource assessment projects 1.9°C (based on unconditional NDCs, excluding hot air, and an ambitious interpretation of ambiguous components of officially submitted pledges) to 2°C (conditional NDCs, including hot air, and a low ambition interpretation of ambiguous pledges). As aforementioned, our assessment is slightly higher than the 1.7°C or 1.8°C estimates, as we do not take into account any pledges that are not officially submitted yet. For the UNEP Gap report estimate, the different climate emulator also plays a role[24].

5. Detailed results and methods

Here, we provide more methodological detail to our warming assessments as well as the detailed scenario results. The scenario results correspond to key scenarios shown in the Extended Data Table 2[25] in the Nature April 2022 study of ours.

Data availability: The emission data for individual country pledges is provided here: climate-resource.com/tools/ndcs - free for re-use with a Creative Commons Attribution Non Commercial Share Alike 4.0 International license. GHG emissions and temperature quantifications from the Figures are also available[3], free for any reproduction with attribution to Climate Resource. Our optimistic (conditional, high ambition) quantification of the NDC and long-term pledge pathway (as of 10th November 2022) is also available in a more interactive mode[26].

Climate calculations: This analysis uses probabilistic climate model emulator projections in line with the IPCC AR6 WG1 report released in August 2021, specifically using the climate emulator MAGICC7, available at live.magicc.org, which is maintained by scientists and programmers at Climate Resource, the University of Melbourne and the International Institute for Applied Systems Analysis (IIASA). The model configuration used to quantify the projected temperature implications of NDCs and longer-term net-zero targets was also used by our team to assist the IEA to deliver the World Energy Outlook, and other scientific endeavours.

[24] See footnote 22.
[25] The extended data table 2 is available at https://www.nature.com/articles/s41586-022-04553-z/tables/2
[26] See e.g., here: https://live.magicc.org/public/scenarios/3f63ac84-8441-4896-88ea-48eeebcaef90

NDC quantifications: The NDCs are quantified in terms of their total GHG emissions. While several NDC pledges are difficult to quantify, we transparently provide 196 individual country factsheets for all current NDCs at climate-resource.com/tools/ndcs. This temperature projection is based on the NDCs as of 5 November 2022 - considering both conditional and unconditional elements. At Climate Resource, we were one of four global teams (PBL, Climate Action Tracker, and JRC) contributing to the quantitative assessment of NDC pledges in the IPCC AR6 WG3 report.

Hot Air: In this analysis, we assume that NDC target levels that are higher than high reference scenarios (i.e. scenarios without additional climate or energy policies to reduce emissions) are not going to be reached, but "overachieved". (Overachievement is the wrong word, as the NDC targets are simply set too high). Specifically, we assume the country-downscaled and high-emission growth SSP5 reference scenarios, normalised with recent historical emissions, to be the maximal amount of emissions for any country[27]. This assumption does not make a difference for most countries, but it does for some (like Turkey or Pakistan). As a sensitivity test, we also compute GHG emissions and global-mean temperature projections without this cap on hot air. See Table 1 below.

Extension beyond 2030/2050: The peak and end of century temperatures obviously depend a great deal on the assumptions made beyond the horizon of a country's pledge, whether that is 2030 or 2050. With more and more net-zero targets, that influence of the methodological choice is diminishing, though. Here, we SSP5 - reference growth rates for sectors not covered by NDCs and constant 2025-2030 emission growth or decline rates for the period 2030 – 2050.

[27] Guetschow et al., 2021, available at: https://essd.copernicus.org/articles/13/1005/2021/

					Exceedance Probability for temperature level (%)				Peak Warming (C)					Year of Peak Warming					Warming in 2100 (C)				
Label	Ambition ambiguity (high or low)	Conditionalty (C = full implementation; U = unconditional only)	Country-level extension 2030-2050	Hot Air (E= excl.; I = Incl.)	1.5C	2.0C	2.5C	3.0C	5%	33%	Median	67%	95%	5%	33%	Median	67%	95%	5%	33%	Median	67%	95%
A	high	C	SSP1BL	exclude	0.89	0.38	0.12	0.02	1.38	1.73	1.89	2.05	2.75	2049	2070	2082	2093	2100	1.31	1.67	1.85	2.03	2.75
B	low	U	SSP1BL	exclude	0.92	0.5	0.16	0.04	1.46	1.83	2.00	2.19	2.95	2059	2093	2093	2094	2100	1.41	1.81	1.99	2.19	2.95
a	high	C	2030	exclude	0.97	0.67	0.25	0.1	1.58	2.00	2.19	2.39	3.23	2093	2094	2100	2100	2100	1.56	1.99	2.19	2.39	3.23
b	high	C	2030	include	0.97	0.63	0.24	0.09	1.56	1.97	2.16	2.36	3.18	2070	2094	2100	2100	2100	1.54	1.97	2.16	2.36	3.18
c	low	C	2030	exclude	1	0.84	0.48	0.18	1.78	2.27	2.48	2.71	3.66	2100	2100	2100	2100	2100	1.78	2.27	2.48	2.71	3.66
d	low	C	2030	include	0.99	0.82	0.46	0.17	1.76	2.24	2.45	2.68	3.63	2094	2100	2100	2100	2100	1.76	2.24	2.45	2.68	3.63
e	high	U	2030	exclude	0.99	0.82	0.46	0.17	1.76	2.25	2.46	2.69	3.63	2100	2100	2100	2100	2100	1.76	2.25	2.46	2.69	3.63
f	low	U	2030	exclude	1	0.96	0.74	0.4	2.07	2.61	2.85	3.10	4.18	2100	2100	2100	2100	2100	2.07	2.61	2.85	3.1	4.18
g	high	U	2030	include	1	0.86	0.51	0.19	1.80	2.29	2.51	2.74	3.70	2100	2100	2100	2100	2100	1.8	2.29	2.51	2.74	3.7
h	low	U	2030	include	1	0.98	0.82	0.5	2.19	2.74	2.99	3.25	4.37	2100	2100	2100	2100	2100	2.19	2.74	2.99	3.25	4.37

Table 1 - Detailed results for our climate assessment of current NDC pledges and long-term targets. *The scenarios correspond to the respective scenarios in the Extended Data Table 2 of Meinshausen et al., 2022[28].*

[28] Available at: https://www.nature.com/articles/s41586-022-04553-z/tables/2

6. Further reading and other reports.

There is a very useful collection of other reports and analysis out there on the question of what NDCs and long-term targets mean for future emissions of different countries and global temperatures. We contributed to many of these other analyses in one form or another. Those analyses are, for example, the below reports that often include last year's NDC updates (in addition, there are many scientific literature articles that come with a bit of a delay):

- The UNEP Emission Gap report[s] (Climate Resource was one of four global teams providing NDC quantifications)[29]
- The UNFCCC Synthesis Report[30]
- The IPCC AR6 WG3 report (we were one of four studies taken into account for the IPCC AR6 WG3 assessment, see section 4.2 and Table 4.3 in Chapter 4)[31]
- The Climate Action Tracker analysis as of Nov 2022 (We provide our MAGICC7 model to the CAT team)[32]
- The WRI Climate Watch tools[33]
- PBL NDC quantifications[34]

About Climate Resource:
Climate Resource was established in mid 2020. We use climate science to create tools that support decision makers to assess and respond to climate risk, and the opportunities in the transition to a net-zero emissions global economy. We're doing all we can to ensure the best science accelerates an effective global response to climate change.
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[29] https://www.unep.org/resources/emissions-gap-report-2022
[30] https://unfccc.int/ndc-synthesis-report-2022
[31] https://www.ipcc.ch/report/ar6/wg3/
[32] https://climateactiontracker.org/publications/massive-gas-expansion-risks-overtaking-positive-climate-policies/
[33] https://www.climatewatchdata.org/ndcs-explore
[34] https://themasites.pbl.nl/o/climate-ndc-policies-tool/