CLIMATE POLICY

Credibility gap in net-zero targets leaves world at high climate risk

Looking at policies instead of promises shows global climate targets may be missed by a large margin.

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Global climate policy is undergoing a rite of passage. What used to be a conversation about ambitious target-setting now focuses increasingly on implementation and interventions to put these targets in good stead. This liminal transition from ambition to implementation is complex, and presents deep ambiguities that are challenging for scientists to communicate and decisionmakers to fathom. A critical question to understand is whether we can believe that countries will deliver on the commitments they have made. By evaluating policy characteristics of countries' net-zero targets we can assign the targets credibility ratings, then estimate how greenhouse gas (GHG) emissions and temperature are differentiated by our confidence in the targets. When we consider the credibility of current climate pledges, our assessment shows that the world remains far from delivering a safe climate future.

The drumbeat of climate impacts pounding vulnerable communities, the potential for further harm if climate change goes unchecked (*1*, *2*), and the incontrovertible scientific evidence of humanity's dominant contribution to these changes (*3*) have led the international community to adopt ambitious climate goals (*4*, *5*). These include holding global warming to well below 2 °C compared to preindustrial levels while pursuing efforts to limit it to 1.5 °C, and reducing global GHG emissions to net zero this century (*6*).

Policy roll-out at the country level is needed to deliver on these bold global targets. Under the Paris Agreement, countries pledge actions and emissions reductions that are to be achieved over the next decade (known as Nationally Determined Contributions, or NDCs, currently targeting 2030) and long-term strategies towards net-zero GHG emissions "by or around midcentury" (*5*). Then – crucially – they must adopt and implement domestic policies to achieve them. Even the recent wave of updated NDCs and net-zero targets (*7*) leaves deeply uncertain how much the world will actually warm (*8*). This uncertainty stems in large part from questions regarding the credibility of net-zero targets.

CREDIBILITY CREATES CLARITY

Communications about where global warming is heading have created a climate of confusion. More cautious analyses that only look at the current status of domestic policies and their influence on emissions in the medium term project global warming centering somewhere between 2.5 and 3 °C in 2100 – and continuing to increase thereafter (*8*, *9*) (Supplemental Material, SM, Table S1). On the other hand, analyses that factor in international commitments in NDCs and long-term pledges – taking them at face value regardless of how credible they are – suggest that global warming will stabilize somewhere between 1.5 and 2 °C and even gradually reverse towards the end of the century (*8–10*).

The two outcomes could not contrast more sharply: a world where climate change continues towards levels that undermine sustainable development (*2*) versus a world where losses and damages are capped at potentially manageable levels. The implications for risk management and adaptation planning differ vastly between these two worlds.

Decisionmakers and the general public alike need to understand where the tally is at, and which of these worlds current near- and long-term policy is committing us to. Current analyses do not provide such clarity.

Projecting emissions trajectories decades into the future is an inherently uncertain exercise (*11*). However, this uncertainty can be bounded by assessing the reliability and quality of each target, and adjusting projected GHG emissions and global temperatures based on the current credibility of their achievement.

Here we identify and evaluate three characteristics of individual net-zero targets: whether the target is legally binding, whether there is a credible policy plan guiding its implementation, and whether a country's near-term policies already put emissions on a downward path over the next decade (SM, Tables S3-5). We combine these metrics to produce a credibility rating of each country's net-zero target given current policy evidence. Each target is assigned a score of higher, lower, or much lower confidence. For example, the European Union has a legally binding target accompanied by a credible implementation plan and its projected 2030 emissions are lower than their 2020 levels. Its net-zero target is therefore assigned a higher confidence score. A less favorable assessment in any of the three dimensions would result in a lower confidence score. Finally, these ratings are used to develop projections of global GHG emissions and temperature that are differentiated by the assessed confidence level. These projections cover an as-of-yet-unprobed grey area between the extremes that have been explored in the literature.

In total, we present five scenarios, in order of most conservative to most optimistic: (A) current policies, which considers only domestic policies and disregards both NDCs and net-zero and other long-term targets; (B) current policies plus higher-confidence net-zero targets; (C) current policies plus higher- and lower-confidence net-zero targets; (D) current policies plus all net-zero targets; and (E) current policies plus all (unconditional and conditional) NDC targets and all net-zero targets (Fig. 1). All but case E implicitly consider the credibility of NDCs by assuming reductions by 2030 through policies that are already on the books and are being implemented. Case E is the only to assume both NDCs and all net-zero targets are fully implemented. For all cases, emissions estimates for the year 2030 are based on the UN Environment Program Emissions Gap Report (*8*).

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CREDIBLY OFF TRACK

Our results show a much more transparent picture of where we are heading, how policy targets narrow the cone of future climate projections, and which uncertainties remain due to assumptions analysts must still make. The most conservative case A, which considers only current policies, disregarding NDCs as well as net-zero and other long-term targets, produces both the highest emissions and warming estimates and the largest uncertainty. This case is estimated to lead to global emissions of around 58 (range: 52–60) $GtCO_2e$/yr by 2030 (*8*), and the ambiguity about how they continue thereafter results in projected global GHG emissions in 2100 ranging from about zero to 90 $GtCO_2e$/yr, with a best estimate of around 50 $GtCO_2e$/yr (see SM for details). Global warming projections mirror this uncertainty, with best estimate emissions leading to a median temperature projection for the year 2100 of 2.6°C, with a range of 1.7–3.0°C depending on how policies are assumed to continue after 2030 (Fig. 1, Table S6).

In the most forgiving case E, where all country promises regarding NDCs and net-zero targets (even those with much lower credibility) materialize, emissions, warming, and their uncertainties are all much smaller. Best-estimate future emissions in this case produce a median peak warming of 1.7°C over the course of the 21st century, with a much narrower uncertainty range due to smaller emission projection variations of 1.6–2.1°C. Although these figures may suggest that the Paris Agreement climate goals are well within reach, the fact that about 90% of assessed net-zero targets score a lower or much lower confidence of achievement confirms that, in reality, concrete and credible efforts to achieve these low temperature projections remain a long way off.

When only higher-confidence net-zero targets are included on top of current policies (case B), global warming is projected to increase to 2.4°C by 2100 (range due to emissions projection uncertainties: 1.7–3.0°C) – missing global climate goals by a long way. Warming is also projected to continue after 2100, as global emissions of long-lived GHGs would not yet have reached near-zero levels under these assumptions. Only when net-zero targets with lower (case C) or much lower (case D) confidence scores are also considered do median temperature projections become markedly lower, at 2.0°C and 1.9°C, respectively – still exceeding some or all of the global warming limits set out in the Paris Agreement (Fig. 1). Although our assessment builds on stylized modelling methods, the qualitative insights of our credibility assessment that shows that the world is still on a high-risk climate track are robust across a wide range of sensitivity cases that explore variations in model assumptions and structure (SM, Tables S6–10).

Uncertainties in how strongly the climate will warm in response to humanity's past and future GHG emissions add a final level of uncertainty that we uncover here. The numbers reported above present the median estimate of the climate response. However, for risk assessments it is essential to also consider how much warming can be expected at the tails of the distribution (*12*, *13*) (Tables S6,8). For example, case B, which assumes only higher confidence targets are met, results in a 1-in-3 chance of 2.6°C of warming (range: 1.9–3.2°C) and a 1-in-10 chance of 3.2°C (range: 2.3–3.8°C). Even for the most optimistic case E, the tails of the distributions illustrate the risk of warming exceeding 2°C.

Uncertainty about policy delivery and ambiguity about its continuation throughout the century are, together with the spread in the climate response, the main factors affecting projections of where global warming is heading. For example, the difference in median warming projections between the most conservative and most optimistic cases A and E is of the order of 1°C and the difference between their 10th and 90th percentile warming estimates is 1.3°C for case A and 0.8°C for case E (Tables S6, S8). Further uncertainty contributions exist. For example, models can differ in their structure and socioeconomic assumptions, which in turn affect emissions and temperature projections (Fig. S1). For example, median temperature projections based on four alternative model formulations can be 0.3–0.4°C higher than the results shown in Figure 1 (Table S10). In addition, many near- and long-term targets set a cap on total GHG emissions. In some cases, however, it is not clear which gases are covered, or what might happen to other gases when the target applies only to CO_2. This is an additional, yet second-order dimension causing variations in global warming projections of no more than 0.1°C globally (Table S7).

PATHWAYS TO IMPROVEMENT

The lack of confidence in most net-zero targets today does not preclude an important role for them in climate policy. On the contrary, it is natural that targets precede implementation – there is no additional ambition in setting targets whose achievement is a foregone conclusion. What is imperative is that implementation does follow target-setting, and that decisionmakers understand the degrees of warming at stake if it does not.

Our analysis shows that if only the highest-confidence net-zero targets are achieved, global temperature is expected to exceed the Paris Agreement limits. Reflecting net-zero targets in domestic legislation, formulating plans to implement them, and then translating those plans into policies and measures that drive emission reductions in the near-term are critical steps to ensure the achievement of all net-zero targets, and would therefore markedly improve the outcomes presented here.

Legally binding targets promote policy durability (e.g., as an insurance against political turnover), compliance, and cross-government coordination. Several countries, including the UK, Australia, Canada, Chile, Japan, and Nigeria, as well as the EU, have already reflected their net-zero targets in law. Most, however, have not. When net-zero legislation accompanies net-zero target-setting, national institutions will tend to support implementation, particularly in those countries with strong governance and institutions.

Implementation plans shed light on what changes are needed at the sector and subsector level to achieve net-zero emissions, and can also identify necessary resources and assign responsibility for action. The Glasgow Climate Pact outlines a role for the long-term strategies that countries submit to the UN. It highlights that they can guide implementation, and urges parties to develop long-term strategies "towards just transitions to net-zero emissions by or around mid-century" (*5*). To improve the credibility of their net-zero targets, countries should ensure their long-term strategies lay out a clear pathway to net zero, and accompany these with detailed domestic implementation plans as appropriate (*6*). The US, for example, plans to release a National Climate Strategy focusing on "the immediate policies and actions" it needs to deliver the technology and infrastructure for achieving the net-zero-by-2050 target (*14*). Implementation plans should identify an emission pathway towards the target year, key emission reduction measures to reach net zero, and include sector-specific details (*15*).

Finally, neither legally binding targets nor implementation plans guarantee that targets will be achieved. It is therefore crucial that net-zero implementation plans are subsequently translated into domestic near-term policy targets and measures to ensure emissions peak as soon as possible (in countries where they are still on the rise) and then rapidly decline across the board.

Irrespective of these improvements, climate risks won't be eliminated entirely (Fig. 1). Our results clearly illustrate that the best way to hedge against climate uncertainties and their potential disastrous impacts on nature and society is to set, implement and achieve the promised near- and long-term targets.

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Supplemental material
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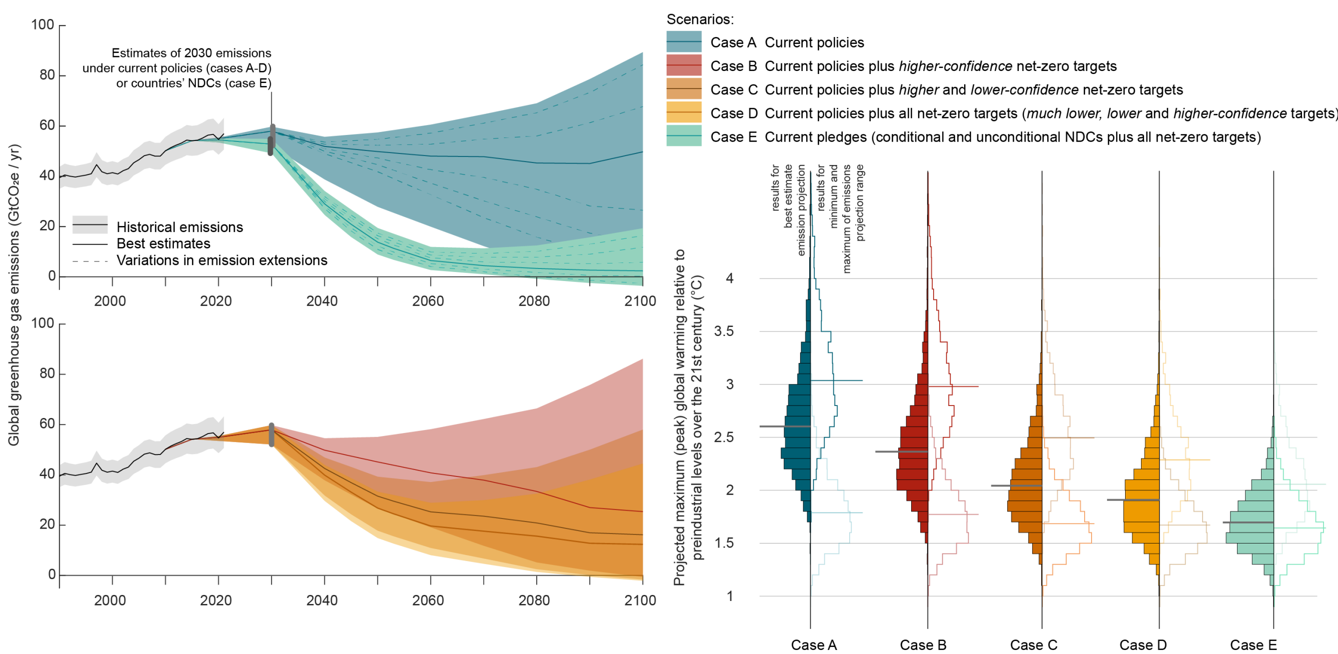

Fig. 1. Emissions and peak temperature projections of five scenarios that reflect varying levels of target achievement. (Left panel) Historical and projected global greenhouse gas emissions (from the IPCC Sixth Assessment Report, aggregated with 100-year Global Warming Potential values, GWP-100). The top-left panel shows cases A and E, the bottom-left cases B, C, and D, based on the MESSAGE-GLOBIOM model. Colors of the ranges reflect the different cases. Best estimate emissions projections are shown in solid lines. Grey ranges show the 90% confidence interval for historical emissions. The shaded ranges reflect the full modelled spread due to uncertainty in near-term emissions by 2030 and ambiguity in their forward projections for each case. Each dashed line in the top-left panel illustrates an alternative assumption about how climate policy is continued after 2030. (See Supplemental Material, SM, for a discussion of additional projection uncertainties.) (Right panel) Peak global warming outcomes for best estimate emissions projections (solid histograms) and for the minimum and maximum emissions projections for each case (line histograms). Thin horizontal lines in histograms indicate the median estimate. Global warming outcomes for the year 2100 are shown in Supplemental Fig. S2 (Data sources and detailed methods can be found in SM).