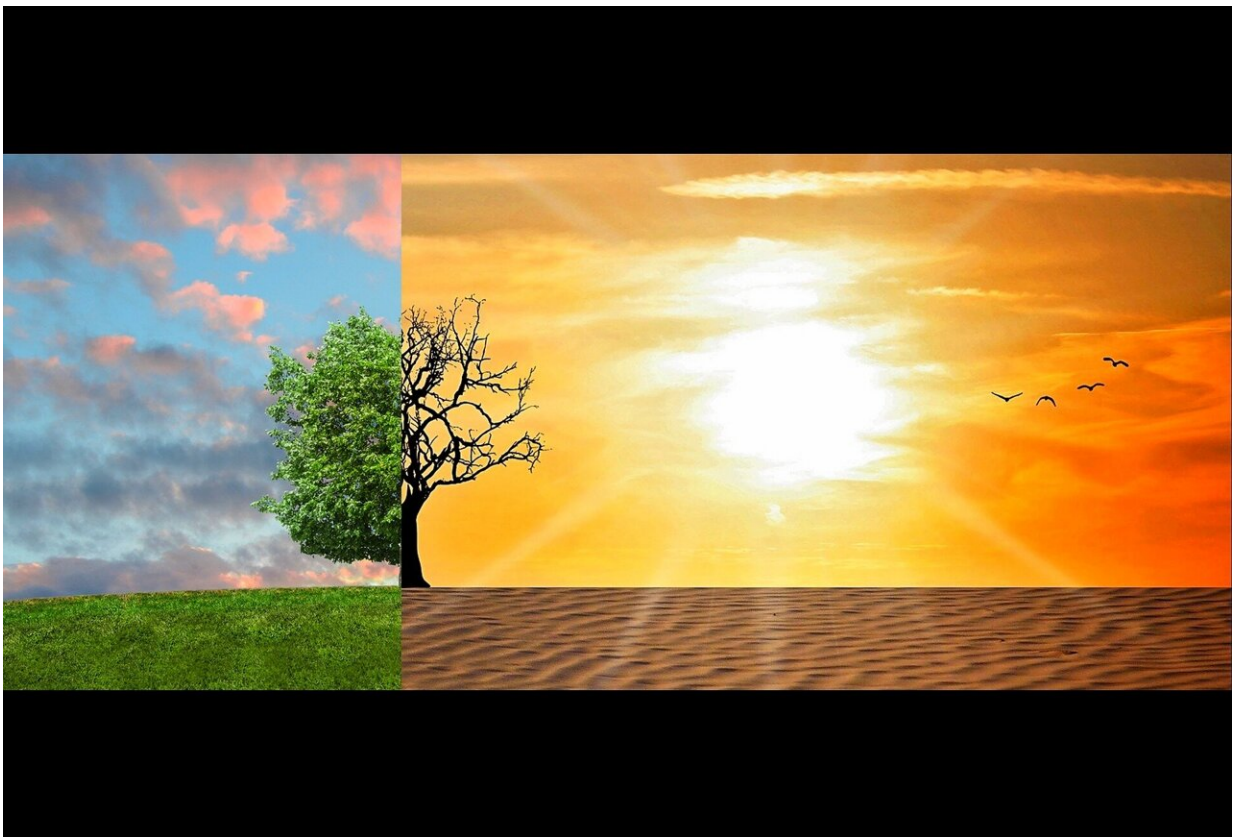


Window to avoid 1.5°C of warming will close before 2030 if emissions are not reduced, study shows

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Without rapid carbon dioxide emission reductions, the world has a 50% chance of locking in 1.5°C of warming before 2030, according to a

study led by Imperial College London researchers.

The study, published in *Nature Climate Change*, is the most up-to-date and comprehensive analysis of the global carbon budget. The carbon budget is an estimate of the amount of carbon dioxide emissions that can be emitted while keeping [global warming](#) below certain temperature limits.

The Paris Agreement aims to limit global temperature increase to well below 2°C above preindustrial levels and pursue efforts to limit it to 1.5°C. The remaining carbon budget is commonly used to assess global progress against these targets.

The new study estimates that for a 50% chance of limiting warming to 1.5°C, there are less than 250 metric gigatons of carbon dioxide left in the global carbon budget.

The researchers warn that if carbon dioxide emissions remain at 2022 levels of about 40 metric gigatons per year, the carbon budget will be exhausted by around 2029, committing the world to warming of 1.5°C above preindustrial levels.

The finding means the budget is less than previously calculated and has approximately halved since 2020 due to the continued increase of global greenhouse gas emissions, caused primarily from the burning of fossil fuels as well as an improved estimate of the cooling effect of aerosols, which are decreasing globally due to measures to improve air quality and reduce emissions.

Dr. Robin Lamboll, research fellow at the Center for Environmental Policy at Imperial College London, and the lead author of the study, said, "Our finding confirms what we already know—we're not doing nearly enough to keep warming below 1.5°C.

"The remaining budget is now so small that minor changes in our understanding of the world can result in large proportional changes to the budget. However, estimates point to less than a decade of emissions at current levels.

"The lack of progress on emissions reduction means that we can be ever more certain that the window for keeping warming to safe levels is rapidly closing."

Dr. Joeri Rogelj, Director of Research at the Grantham Institute and Professor of Climate Science & Policy at the Center for Environmental Policy at Imperial College London, said, "This carbon budget update is both expected and fully consistent with the latest UN Climate Report.

"That report from 2021 already highlighted that there was a one in three chance that the remaining carbon budget for 1.5°C could be as small as our study now reports.

"This shows the importance of not simply looking at central estimates, but also considering the uncertainty surrounding them."

The study also found that the carbon budget for a 50% chance of limiting warming to 2°C is approximately 1,200 metric gigatons, meaning that if [carbon dioxide emissions](#) continue at current levels, the central 2°C budget will be exhausted by 2046.

There has been much uncertainty in calculating the remaining carbon budget, due to the influence of other factors, including warming from gases other than carbon dioxide and the ongoing effects of emissions that are not accounted for in models.

The new research used an updated dataset and improved climate modeling compared to other recent estimates, published in June,

characterizing these uncertainties and increasing confidence around the remaining [carbon budget](#) estimates.

The strengthened methodology also gave new insights into the importance of the potential responses of the climate system to achieving net zero.

"Net zero" refers to achieving an overall balance between global emissions produced and emissions removed from the atmosphere.

According to the modeling results in the study, there are still large uncertainties in the way various parts of the climate system will respond in the years just before net zero is achieved.

It is possible that the climate will continue warming due to effects such as melting ice, the release of methane, and changes in ocean circulation.

However, carbon sinks such as increased vegetation growth could also absorb large amounts of [carbon](#) dioxide leading to a cooling of global temperatures before net zero is achieved.

Dr. Lamboll says these uncertainties further highlight the urgent need to rapidly cut emissions. "At this stage, our best guess is that the opposing warming and cooling will approximately cancel each other out after we reach net zero.

"However, it's only when we only when we cut emissions and get closer to net zero that we will be able to see what the longer-term heating and cooling adjustments will look like.

"Every fraction of a degree of warming will make life harder for people and ecosystems. This study is yet another warning from the scientific community. Now it is up to governments to act."

More information: Robin Lamboll, Assessing the size and uncertainty of remaining carbon budgets, *Nature Climate Change* (2023). [DOI: 10.1038/s41558-023-01848-5](https://doi.org/10.1038/s41558-023-01848-5).

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Provided by Imperial College London

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