CLIMATE ANALYTICS

Briefing

# 1.5°C is still in reach to reduce the worst climate risks – but only with immediate mitigation action and shifting finance

By Uta Klönne, Alexander Nauels, Claire Fyson, Carl-Friedrich Schleussner, William Hare

November 2022

The Glasgow Climate Pact is a commitment to the Paris Agreement's Long-Term Temperature Goal, as it “resolves to pursue efforts to limit the temperature increase to 1.5°C”, and “recognises that this requires accelerated action in this critical decade”.

The latest science from the Intergovernmental Panel on Climate Change (IPCC) is clear on the escalating adverse climate impacts and loss and damage with every additional increment of global warming, especially above 1.5°C.

Limiting warming to 1.5°C is still technically and economically feasible, and can be kept in reach with what the science tells us must be an immediate peaking of global greenhouse gas emissions, and a halving by 2030.

This will not happen unless energy investments are switched towards clean and away from fossil fuels, and unless fossil fuel subsidies are phased out. Mitigation investments need to increase 3-6 fold above recent levels by 2030 globally, and 4-7 fold in developing countries.

This briefing summarises the latest science on 1.5°C including from the IPCC, the International Energy Agency (IEA) and other key reports.

**Necessary mitigation options are available. Fossil fuels must be phased out.**

The IPCC has found that there are mitigation options available in all sectors to deliver emissions reductions in line with 1.5°C.

The costs of several low-emissions technologies including solar energy, wind energy, and lithium-ion batteries have fallen continuously, in some cases below those of fossil fuels, accompanied by an exponential increase in the adoption of these technologies[1].

The IEA recently updated its Net Zero Emissions by 2050 roadmap and found that despite discouraging developments in relation to continued investment in fossil fuel infrastructure, the pathway to net zero by 2050 "remains narrow but still achievable"[2].

The era of fossil fuel growth may soon be over: the IEA in its 2022 World Energy Outlook for the first time foresees a peak or plateau in global demand for each of the fossil fuels this decade under current policies[2]. This is a promising development, but a plateauing is not sufficient to align with 1.5°C.

Key milestones for 1.5°C:

- The Working Group III (WGIII) contribution of the IPCC Sixth Assessment Report (AR6) states that global coal use must fall by between 67% and 82% in this decade and effectively stop by 2050 across all sectors, with the power sector taking the lead.

- Coal power plants need to be phased out by 2030 at the latest in OECD countries, and by 2040 globally. This has to be accompanied by steep declines in the use of oil and fossil gas, and an acceleration in the deployment of renewables.

- In its 2022 update of the Net Zero Emissions by 2050 roadmap the IEA shows that total fossil gas use globally needs to decline by 30% by 2030 and 60% by

[1] IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla et al. (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.
[2] IEA, 2022: World Energy Outlook 2022.

2035. This is substantially faster than estimated in 2021 due to the ongoing declines in the costs of renewables, storage and efficiency.

- Fossil gas power generation needs to be effectively phased out globally by 2040[3].
- Developing any new oil and gas fields is incompatible with keeping warming to 1.5°C, concludes a comprehensive review by the International Institute for Sustainable Development (IISD), echoing previous conclusions by the IEA[4].

**There is sufficient global capital, but this must shift to align with 1.5°C**

Financial flows currently fall short of the levels needed to achieve mitigation goals, with public finance still skewed towards fossil fuels. But there is sufficient global capital and liquidity to close global investment gaps in clean energy[1].

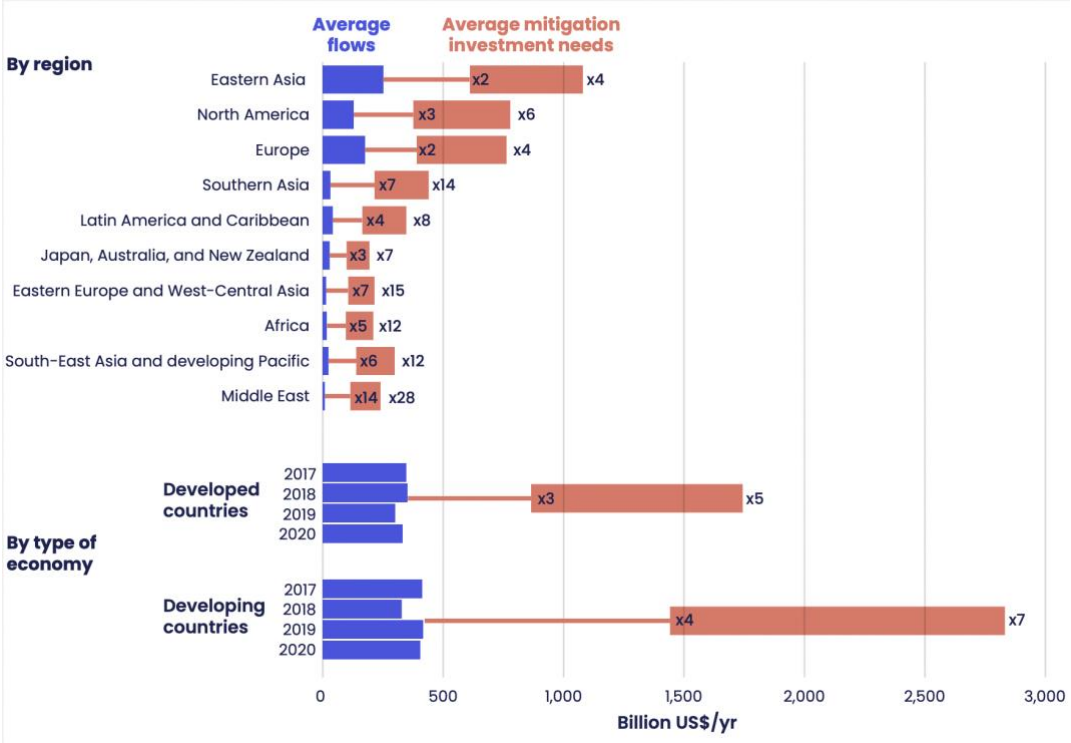


***Figure 1:*** *Average mitigation investment flows and investment needs until 2030. Source: IPCC AR6 WGIII technical summary (figure TS.25) (ref. [1]), State of Climate Action, 2022[5].*

[3] Climate Analytics, 2021: Why gas is the new coal.

[4] IISD, 2022: Navigating Energy Transitions. Mapping the road to 1.5°C.

[5] Boehm, S. et al., 2022: State of Climate Action 2022. Berlin and Cologne, Germany, San Francisco, CA, and Washington, DC: Bezos Earth Fund, Climate Action Tracker, Climate Analytics, ClimateWorks Foundation, NewClimate Institute, the United Nations Climate Change High-Level Champions, and World Resources Institute.

The challenge of closing gaps is largest in developing countries – the IPCC found that mitigation investments need to increase 3-6x globally and 4-7x in developing countries (Figure 1).

The recent State of Climate Action report[5] found that total climate finance needs to increase to USD 5 trillion by 2030 – requiring an acceleration over 10 times faster than recent increases. Currently climate finance is categorised in this report as being "well off track", signalling that governments are failing to achieve the Paris Agreement's goal of aligning financial flows with 1.5°C.

A major challenge is that "[p]ublic and private finance flows for fossil fuels are still greater than those for climate adaptation and mitigation"[1]. IEA and OECD data show that governments' support for fossil fuels almost doubled to USD 697 billion in 2021, compared to USD 362 billion in 2020, as energy prices rose[6] (Figure 2). G20 countries gave record levels of production subsidies in 2021[7]. Consumption subsidies are projected to increase even further in 2022.

To limit warming to 1.5°C such subsidies need to be phased out. According to the IPCC, removing fossil fuel subsidies alone can reduce greenhouse gas (GHG) emissions by up to 10% by 2030[1].

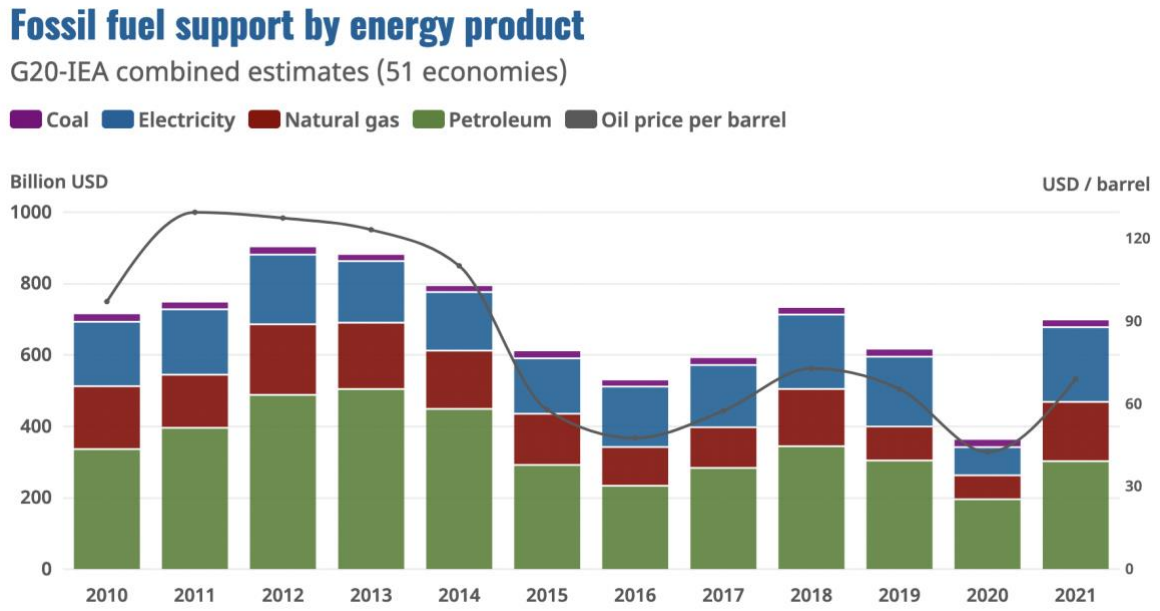


***Figure 2:*** *Support for fossil fuels (USD/barrel) in 51 economies. Source OECD-IEA estimates[6].*

[6] https://www.oecd.org/newsroom/support-for-fossil-fuels-almost-doubled-in-2021-slowing-progress-toward-international-climate-goals-according-to-new-analysis-from-oecd-and-iea.htm.
[7] Climate Transparency Report 2022. https://www.climate-transparency.org/wp-content/uploads/2022/10/CT2022-Summary-report.pdf.

**Economic benefits of mitigation in line with 1.5°C far outweigh costs**

The implications of mitigation on the gross domestic product (GDP) can only be assessed when accounting for economic co-benefits and avoided climate damages as well as mitigation costs.

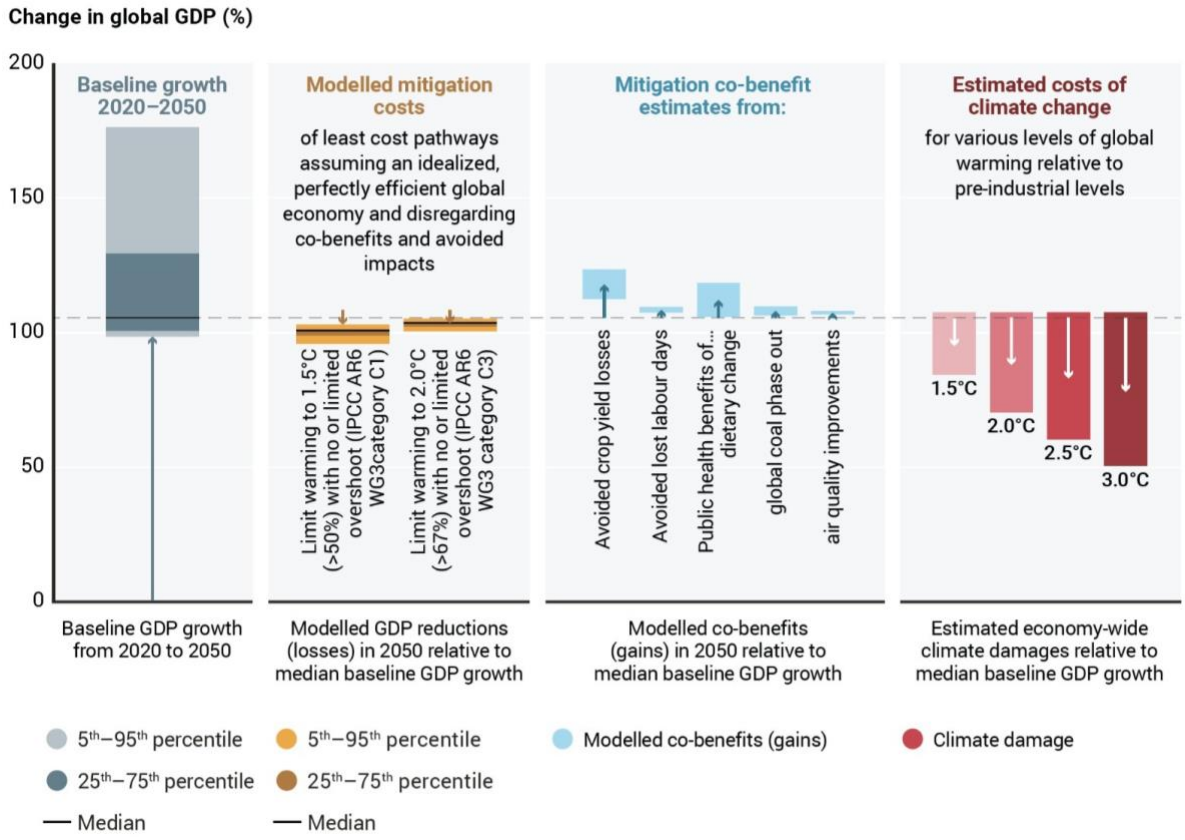


***Figure 3:*** *Estimated implications for global GDP of mitigation measures in 1.5°C and 2°C pathways (second panel), mitigation co-benefits (third panel), and climate damages (fourth panel), in relation to baseline 2020-2050 GDP growth (first panel). From ref. [8], their Figure 4.1.*

The economic co-benefits of stringent mitigation in line with 1.5°C would outweigh the costs, with gains in areas such as agriculture, health, and air quality[8]. For example, the economic benefits for human health alone can be as large as, or larger than, mitigation costs[1].

The number of new jobs created in clean energy would outweigh job losses in fossil fuel industries[2]. And in the near-term, investments in line with a 1.5°C pathway provide for the best opportunity for economic recovery out of the global economic crisis[9].

[8] United Nations Environment Programme (2022). Emissions Gap Report 2022: The Closing Window — Climate crisis calls for rapid transformation of societies. Nairobi.

[9] Pollitt, H. et al., 2020: Modelling the economic effects of COVID-19 and possible green recovery plans: a post-Keynesian approach, Climate Policy, 21(10).

Estimated costs from climate change damages would already be significant at 1.5°C of global warming relative to the baseline growth, but would be much lower at 1.5°C than for even higher levels of warming, including 2°C[8].

Global GDP is projected to at least double over 2020-2050, regardless of the level of mitigation. Any mitigation costs are small in comparison: 1.5°C-compatible mitigation would reduce global GDP in 2050 by a few percent[1].

**Adverse impacts and loss and damage are significantly lower at 1.5°C**

The latest science from the IPCC shows that at current levels of global warming of over 1.1°C, there is unequivocal evidence that climate change, including weather and climate extremes, has caused widespread adverse impacts and loss and damage[10].

The IPCC states that adverse impacts and loss and damage "escalate with every increment of global warming" [11] and that limiting global warming to close to 1.5°C would substantially reduce these, but cannot eliminate them all.

More and more human and natural systems will reach adaptation limits. For example, regions dependent on glaciers and snow-melt and small islands will face potential hard limits to adaptation above 1.5°C through limited freshwater resources.

The IPCC is clear that climate resilient development will be limited even further than today if global warming levels exceed 1.5°C and it will not be possible in some regions if warming exceeds 2°C.

This reaffirms the scientific basis of the Paris Agreement's 1.5°C temperature limit – the United Nations Framework Convention on Climate Change (UNFCCC) 2013-2015 First Periodic Review[12], which concluded that the "concept, in which up to 2°C of warming is considered safe, is inadequate".

Limiting peak warming to 1.5°C would come with significant benefits in the light of the ultimate objective of UNFCCC to "prevent dangerous anthropogenic interference with the climate system".

[10] Climate Analytics, 2022: What does the IPCC say on losses and damages?

[11] IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner et al. (eds.)]. Cambridge University Press.

[12] UNFCCC, 2015: Report on the structured expert dialogue on the 2013–2015 review.

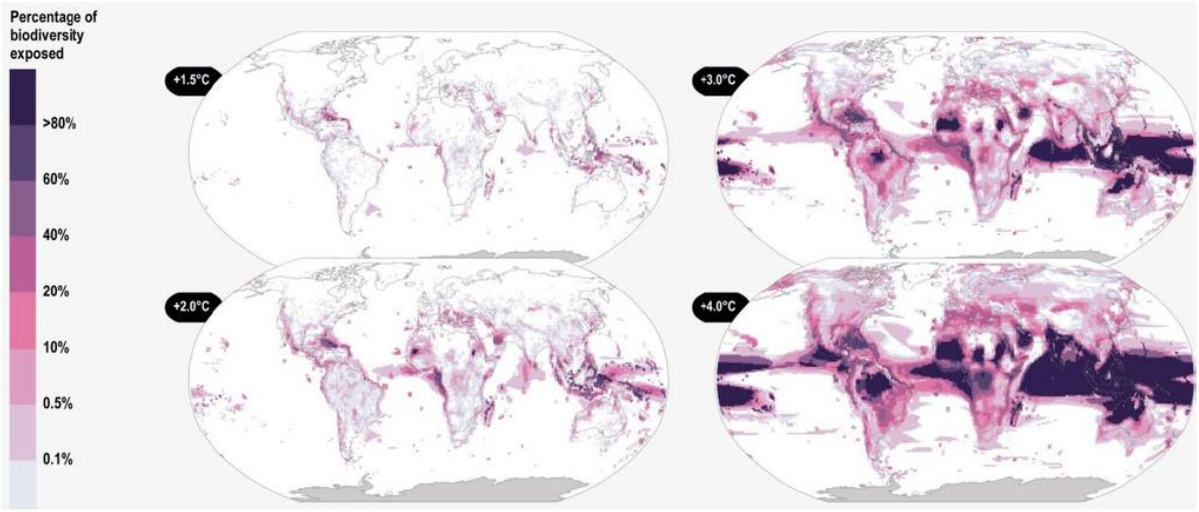


***Figure 4:*** *Species exposed to potentially dangerous climate conditions under different warming scenarios. From ref. [11], Figure AI.15, as used in ref. [13].*

**Even a temporary "overshoot"[14] of 1.5°C could cause irreversible impacts**

Even a temporary and seemingly small exceedance of 1.5°C will pose "additional severe risks" for humans and nature[11]. Overshoot will result in irreversible impacts including on coastal ecosystems, glacier melt, and sea level rise, and on associated livelihoods, settlements, and infrastructure. Some climate impacts, such as wildfires, themselves cause the release of additional GHGs, amplifying warming.

Every fraction of additional warming matters for future climate risks. This makes the case for avoiding an overshoot of 1.5°C in order to keep adverse impacts and loss and damage in check.

Among the future pathways assessed by the IPCC, very few stay within the 1.5°C limit with no overshoot at all. Those require even more immediate and deep emissions cuts than those with a “limited overshoot” of up to 0.1°C[1].

Anything above a 0.1°C overshoot of 1.5°C is classified as “high overshoot” by the IPCC and is not compatible with the Paris Agreement temperature goal because “high overshoot” pathways would breach the “well below 2°C” criterion of the goal when accounting for underlying uncertainties – because how the climate responds to emissions is still subject to some unknowns.

[13] UNFCCC, 2022: Summary report on the third meeting of the structured expert dialogue on the second periodic review of the long-term global goal under the Convention and of overall progress towards achieving it.

[14] Temperature "overshoot" occurs if a certain level of global warming is exceeded for a limited number of years, e.g., a few decades, and by a fraction of a degree but returns back below that level.

## The Paris Agreement's 1.5°C temperature limit

- The 1.5°C limit was included in the Paris Agreement's legally binding long-term temperature goal because 2°C of global warming was found not be safe by the first Periodic Review conducted under the UNFCCC. This is confirmed in the latest science.
- To achieve the long-term temperature goal (Article 2.1), Article 4.1 of the Paris is aimed at achieving a balance between sources and sinks of GHGs in the second half of this century – i.e., net zero GHG emissions.
- The **latest IPCC science** can inform how to achieve the Paris Agreement. Importantly, of the different categories of emissions pathways assessed by IPCC WGIII, only category C1a is Paris-compatible, as the pathways in it …
    - limit warming to 1.5°C with an overshoot of no more than 0.1°C, as every fraction of a degree matters for adverse impacts and makes the difference between "limited" and "high" overshoot,
    - have a 90% chance or more of limiting warming to 2°C, thus "holding" warming to "well below 2°C",
    - achieve net zero GHG emissions in the second half of this century.
- Article 2.1 means that peak warming needs to be limited to 1.5°C with no or limited overshoot, and Article 4.1 requires net zero emissions in the second half of this century, which implies a long-term *decline* in global temperatures. The IPCC AR6 pathway that corresponds to this (C1a) has net zero GHG emissions globally by 2070-2075 and warming drops to 1.2°C by 2100.
- IPCC pathway categories C2 and C3 would breach the Paris Agreement because neither meets the criterion to hold warming to "well below 2°C".

### A single year or a certain region above 1.5°C does not mean that the Paris Agreement limit is breached

- The Paris Agreement's 1.5°C limit is a *long-term* and *global* limit for temperature increase above pre-industrial levels (1850-1900), meaning that a 1.5°C temperature increase would have to be recorded as an average over two or three decades (standard climatological averaging period) and over all regions of the globe, before the limit can be considered breached.
- Reports that 1.5°C may be (temporarily) reached in one of the next few years do not take these important facts into account.
- The IPCC is clear that "the occurrence of individual years with global surface temperature change above a certain level […] does not imply that this global warming level has been reached"[15]. Any temperature limit breach can therefore with certainty only be assessed in retrospect.

[15] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte et al. (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.

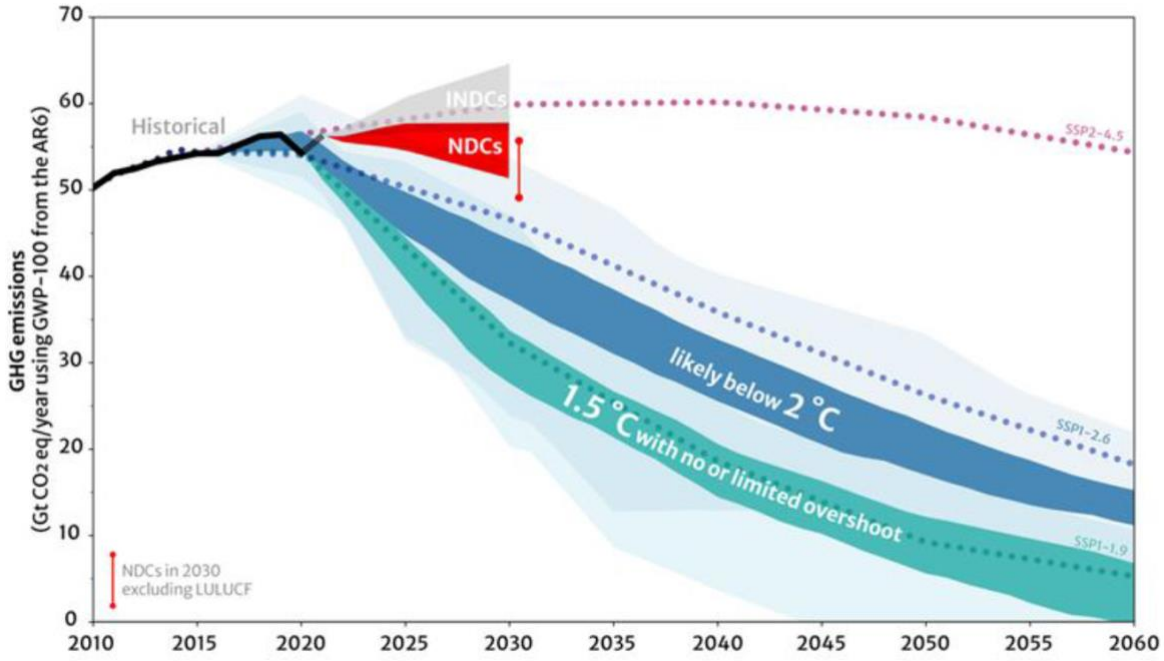


***Figure 5:*** *Comparison of scenarios assessed in the IPCC AR6 with projected global GHG emissions according to 2022 Nationally Determined Contributions (NDCs). From ref. [16].*

**Emissions must peak immediately and roughly halve by 2030 to limit warming to 1.5°C**

To limit warming to 1.5°C, global GHG emissions must peak as soon as possible before 2025, and roughly halve by 2030 compared to 2019, so that the world achieves net zero $CO_2$ emissions around 2050 and net zero GHG emissions around 2070.

These latest IPCC findings are consistent with earlier findings from the 2018 Special Report on Global Warming of 1.5°C, which concluded that global $CO_2$ emissions must decline by 45 % by 2030 from 2010 levels and reach net zero by mid-century to limit warming to 1.5°C[17].

Immediate emissions cuts "lead within years to discernible effects on greenhouse gas and aerosol concentrations, and air quality", while "discernible differences in trends of global surface temperature would begin to emerge from natural variability within around 20 years"[15].

[16] UNFCCC, 2022: Nationally determined contributions under the Paris Agreement. Synthesis report by the secretariat.

[17] IPCC, 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte et al. (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.

In fact, warming could slow down already in the 2030s and halt or even begin to reverse by mid-century, with noticeably lower adverse climate impacts[18].

**Current policies, NDCs, net zero targets insufficient to limit warming to 1.5°C**

This years' World Meteorological Organization (WMO) Greenhouse Gas Assessment showed that carbon dioxide ($CO_2$), nitrous oxide ($N_2O$), and especially methane ($CH_4$) are at record levels[19].

The UNFCCC's latest NDC Synthesis Report[16] found that the current set of NDCs would reduce emissions in 2030 only slightly compared to the set of NDCs available in 2021, despite the Glasgow Climate Pact stating that governments would revise their NDCs before COP27 to bring them in line with 1.5°C. Total GHG emissions in 2030 under current NDCs are on track to be 10.6% higher than in 2010, or 0.3% lower than in 2019. This would lead to 2.5°C of warming by 2100.

The latest Emissions Gap Report by the United Nations Environment Programme (UNEP) also concludes that pledges since COP26 have a negligible impact on 2030 emissions, leading to 2.4-2.6°C of warming[8]. This is consistent with the Climate Action Tracker's assessment of warming under current 2030 pledges of 2.4°C[20].

Governments are not on track to meet their targets, with projected emissions under current policies leading to an estimated warming level in 2100 of 2.7°C, and still rising[20].

The remaining emissions gap is significant and governments must close it by delivering more ambitious targets and implementing them.

[18] CONSTRAIN, 2022: ZERO IN ON The Critical Decade: Insights from the latest IPCC reports on the Paris Agreement, 1.5°C, and climate impacts. The CONSTRAIN Project Annual Report 2022.
[19] WMO, 2022: Greenhouse Gas Bulletin (GHG Bulletin) - No.18: The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2021.
[20] https://climateactiontracker.org/global/cat-thermometer/.