

## POLICY BRIEF

# 1.5°C to stay alive

## Why we need the 1.5°C limit

Anthropogenic climate change is causing the average global temperature to rise increasingly faster. In the Paris Agreement, countries agreed to limit average global warming to 1.5°C if possible. Ten years after the Paris Agreement, this paper discusses whether we can still manage to stay below this limit.

The first section explains the significance of the 1.5°C limit and the consequences of permanently exceeding it. The second section answers the question of whether we can still stay below the 1.5°C limit or return to it after exceeding the limit. The third section focuses on the reason why the 1.5°C limit is so important. Lastly, we look at the necessary next steps.

## 1 What does the 1.5°C limit actually mean?

2015 was a good year for international climate policy. A historic agreement was reached at the UN Climate Change Conference in Paris: the Paris Agreement. The signatory Parties (currently almost 200) agreed therein to hold “the increase in the global average temperature to well below 2°C” and pursue efforts “to limit global warming to 1.5°C”. Since then the 1.5°C limit has been a solid point of reference – not just in international politics but also in scientific studies, social discourse and Nationally Determined Contributions (NDCs).

A special report that the Intergovernmental Panel on Climate Change (IPCC) published in 2018 emphasised the relevance of the 1.5°C limit. It summarised all previous scientific findings on the impact of climate change and new possible emission pathways as well as specific measures to combat the climate crisis. The report also detailed the significant difference in risks compared to a 2°C limit. It made one thing very clear: even if we manage to limit global warming to 1.5°C, the effects of the climate crisis will be felt by many and be life-threatening.

Ten years after the Paris Agreement, reaching the 1.5°C limit is on shaky ground and in some cases has already been labelled a failure. Of particular concern is that 2024 was the “first year the 1.5°C limit was exceeded”. Does this therefore mean that the Parties’ efforts to fulfil the Paris Agreement failed? It is not that simple. In climate science, it is common to compare time periods. The Paris Agreement refers to a long-term goal and is only exceeded when not a single year but the annual average of a longer period of time (around 20 or 30 years) exceeds 1.5°C. The pre-industrial level is the starting point (1850–1900). For comparison, the average temperature from 2011–2020, the current reference period, was a warming of 1.09°C. The fact that the annual average global temperature for 2024 was above 1.5°C is nevertheless a red warning signal.

The consequences of the climate crisis are already clearly visible and pose immense challenges for practically all regions of the world, and in particular ecosystems, communities and entire countries. Every tenth of a degree of global warming significantly increases the risks to human safety and the environment. This can be attributed to an increase in the frequency and intensity of extreme weather events such as heat-waves, droughts and heavy rainfalls, as well as slow-onset changes such as rising sea levels. Vulnerable regions such as small island states, coastal areas and parts of Africa, where even small increases in temperature have serious consequences for water and food supplies, are particularly at risk. At the same time, the capacity of these regions and countries to deal with the consequences of climate change is limited.

This results in high economic costs and human harm, including loss of life. Global biodiversity is also under severe threat. Many species are already losing their habitats, and any further rise above 1.5° threatens ever more extreme waves of extinction.

By permanently exceeding the 1.5°C limit, we are putting the Earth in a state it has not been in [since the last ice age](#). The more global warming progresses, the less we know what to expect in the future. There is an increased risk to human civilisation and practically all ecosystems that are adapted to either the temperatures of the last 10,000 years or the colder years before that. A great deal of uncertainty surrounds the [climate tipping points](#). These are limits beyond which changes in a part of the climate system of at least one continent become self-perpetuating with unforeseeable consequences. Global warming above 1.5°C could trigger [six to potentially ten](#) tipping points. These include the collapse of the Greenland and West Antarctic ice sheets, the dying-off of coral reefs and widespread melting of permafrost. Some of these processes are irreversible and could lead to knock-on effects that accelerate global warming even more. Further global warming, among other things, could threaten the Amazon rainforest and severely weaken the Gulf Stream system, thus potentially resulting in the complete loss of important ecosystems. These changes have the potential to make parts of the planet uninhabitable and threaten the living and development conditions of our civilisation in the long term.

## 2 Is the 1.5°C limit still realistic?

The official long-term temperature limit of 1.5°C has not yet been exceeded. However, given recent record temperatures, we will exceed this limit sooner than expected (probably before 2035), unless effective countermeasures are taken promptly. Developments over the last two years and various [studies](#) have shown that we are probably already at the beginning of a multi-year period with an average temperature of more than 1.5°C.

This raises the question of whether the 1.5°C limit set forth in the Paris Agreement can still be adhered to. The following elements play a role in the response: the current greenhouse gas budget, the necessary measures to very quickly reduce global emissions to net zero, and additional measures to ensure that 1.5°C is only exceeded temporarily.

**The greenhouse gas budget:** The most recent [IPCC report](#) calculated various emission pathways to comply with the 1.5°C limit. Closely linked to this is the concept of the CO<sub>2</sub> budget, which details how much CO<sub>2</sub> can still be emitted without exceeding a certain temperature limit. According to the IPCC, there is a remaining global CO<sub>2</sub> budget of 500 gigatonnes from 2020 (with a 50% probability that the 1.5°C limit will be adhered to). Based on updated models, the German Advisory Council on the Environment has shown that of the 500 gigatonnes (Gt) originally available, around 380 Gt will be left from 2023 ([other estimates](#) even assume that only 231 Gt will still be available). Either way, it is clear that we are running out of time.

Due to its high contribution to [global greenhouse gas emissions](#), carbon dioxide (CO<sub>2</sub>) is the best-known greenhouse gas. It makes up around 75% of the emissions, while methane (CH<sub>4</sub>) accounts for around 20%. Nitrous oxide (N<sub>2</sub>O) and F-gases account for the remainder. Although the proportion of methane is significantly lower, the [greenhouse gas potential](#) of methane is many times higher: one tonne of methane is roughly equivalent to the climate impact of 25 tonnes of CO<sub>2</sub>. To become climate neutral by 2050, all greenhouse gases must be taken into account. While CO<sub>2</sub> is mainly produced by fossil fuel combustion, [most methane emissions](#) can be attributed to animal husbandry, the energy sector or landfill sites. Due to its high global warming potential, it makes sense to also focus on methane, especially because many [measures to prevent methane](#) are low-hanging fruits with comparatively low costs (e.g. by sealing leaks in oil or gas production).

Rather than decreasing, global greenhouse gas emissions have been approaching a plateau for several years. However, the necessary halving of emissions is not on the horizon. In addition, the situation is exacerbated by the fact that land, forests and oceans have recently absorbed a significantly lower proportion of greenhouse gases than in previous decades.

**Necessary measures to reduce emissions:** The most important and effective way to combat the climate crisis is to reduce emissions quickly. The latest [IPCC report](#) was clear: emissions must not increase any further beyond 2025, and compared to figures for 2019 must be reduced by around half by 2030. Above all, the switch from fossil fuels to renewable energy sources will play a key role in this. In the energy sector (i.e. electricity generation), CO<sub>2</sub> emissions can be completely avoided by using renewable energy in combination with green hydrogen and storage. In the industrial, construction and transport sectors, a large proportion of emissions can also be reduced through extensive electrification. Where this is not possible, hydrogen produced on the basis of renewable energies can be used. In industry, process changes and the replacement of fossil raw materials (oil and gas) with natural or recycled raw materials are also needed to reduce emissions. Emissions in agriculture can be reduced, for example, by using different fertilisers, reducing livestock numbers and rewetting soils. In addition to the reduction measures, natural carbon sinks (e.g. soil, forests, moors, salt marshes, and seagrass meadows) must be protected and promoted. These make an important, and currently rapidly decreasing contribution, to binding CO<sub>2</sub>, provide room for manoeuvre and can compensate for a few residual emissions that will remain even after the efforts described above (according to current knowledge in industry, aviation and animal husbandry). Natural carbon sinks are under pressure. Active cultivation or the expansion of settlement areas and the rise in temperature are limiting their carbon storage potential. In addition, the consequences of climate change already arising in the form of droughts, for example, are putting pressure on moors and forests. This reduces sink activity and, in the worst case, can lead to [original carbon sinks becoming carbon sources](#).

Even with the ambitious implementation of all possible reduction options in individual sectors, unavoidable residual (fossil) emissions will remain, making technical measures to reduce greenhouse gas emissions necessary, for example in the form of [Carbon Capture and Storage](#) (CCS). Simply put, CCS is technology that captures CO<sub>2</sub> emissions as they are emitted (e.g. at industrial plants) and stores them geologically. This prevents the climate-damaging greenhouse gas emissions from being released into the atmosphere. In practice, however, the technology faces considerable hurdles. On the one hand, it is very energy-intensive and would mean high energy consumption if used on a large scale. On the other hand, safe storage locations, such as former oil and gas reservoirs, are limited. Furthermore, CCS carries the great political risk of the technology being used as an excuse to scale back the already inadequate measures to reduce emissions. CCS should only be used where there is no alternative to high CO<sub>2</sub> emissions in the foreseeable future (e.g. in the production of cement or in waste incineration plants) and must be kept to a minimum, as the rapid availability of geological CO<sub>2</sub> storage sites and the annual feed-in volume are very limited. This must be specified by clear regulations that ensure that the necessary phase-out of fossil fuels is not delayed by the use of CCS. One example where CCS does not make sense is the [use of fossil-fuelled power plants](#) (e.g. gas-fired power plants). Introducing the technology requires high initial investment and a huge amount of additional energy. Financially, this is only worthwhile if the power plant can then also generate electricity from natural gas for a long time, which in turn would block the timely phase-out of gas. Instead of investing in the local economy, further investments would be made in gas, with methane being released even before it is used in the power plant. The business model of the often-authoritarian supplier states would continue to be financed. That is why the following must prevail: as little CCS as possible, as much CCS as necessary.

**Additional measures if 1.5°C is temporarily exceeded:** The concept of climate overshoot is also being discussed in the context of the 1.5°C limit. In this regard, overshoot means temporarily exceeding the temperature limit in order to reduce the atmospheric CO<sub>2</sub> concentration again at a later date by taking appropriate measures. This is where [Carbon Dioxide Removal](#) (CDR) comes into play, in other words the removal

of CO<sub>2</sub> from the atmosphere.<sup>1</sup> A rough distinction can be made between the use of natural and technological CDR. Natural CDR measures include afforestation, reforestation and the rewetting of moors, while technological approaches include DACCS (Direct Air Carbon Capture and Sequestration) or BECCS (Bioenergy with Carbon Capture and Storage). As with CCS, the key sticking points in the use of technological CDR relate to the question of suitable storage sites and the high energy consumption. Natural CDR cannot be increased indefinitely and forests are coming under increasing pressure due to advancing climate change. [Researchers](#) already showed in 2021 that the Amazon rainforest, for example, is no longer a sink for carbon, and is increasingly becoming a carbon source. This is also becoming more and more true for German forests. The development of technological CDR approaches is not yet at a stage where they can be implemented on a large scale. According to some [experts](#), they could probably be used by the end of the century, although it is questionable whether warming can be reduced to 1.5°C again in 2100 after an overshoot.

Even if CDR measures succeed in reducing the average temperature in the long term over the course of the 21<sup>st</sup> century, this cannot be equated with a scenario in which certain average temperatures are not exceeded in the first place. Every tenth of a degree of overshoot is associated with major risks, as the risk of tipping points and knock-on effects in the Earth system increases massively above 1.5°C. A number of climate change effects can then no longer be reversed, such as the [loss of biodiversity, alterations in marine biogeochemistry and irreversible thawing processes in the large glacier masses](#).

The fact remains that reducing emissions is the most effective and cost-efficient method of limiting climate change. Technology such as CCS should only be used where no other solution to emissions can be found. CDR measures are probably essential but are associated with a high degree of uncertainty.

The global CO<sub>2</sub> budget continues to shrink. It would still be technically possible to implement the necessary emission reduction measures by 2030 in order to keep the 1.5°C limit within reach. However, political developments around the world make this seem extremely unlikely. Given [current climate policies in different countries](#), we are heading more towards 2.7°C of warming. The further we exceed the 1.5°C limit, the more we will have to rely on CCS technologies that have not yet been sufficiently tested, with potentially devastating consequences for human safety and the ecological foundations of life.

### 3 Why we must stick to the 1.5°C limit

Ten years after the adoption of the Paris Agreement, it is clear that the 1.5°C limit can barely be adhered to without overshoot measures. The climate crisis is not at the top of many governments' agendas, and a series of other crises are taking the political and media limelight. At this critical moment, strong climate mitigation efforts are required at all levels to avoid a further escalation of the crisis. The implementation of ambitious and effective measures is important because:

- the 1.5°C limit is more than just a physical target, it is an important political, social and economic guardrail,
- Germany and all other parties to the Paris agreement have undertaken, under international law, to comply with the 1.5°C limit.<sup>2</sup> The 1.5°C limit is also of central importance in legal terms to measure the responsibility of individual states for the climate crisis,
- a focus on the 1.5°C limit also means a focus on human rights and human security, as well as the preservation of global livelihoods.

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<sup>1</sup> CDR can be used not only to correct a temporary overshoot of emissions, but also to compensate for unavoidable residual emissions and fulfil the legal requirements for net negative emissions in Germany and the EU. This arises in the context that other countries will probably need longer than 2050 to reduce their emissions to zero.

<sup>2</sup> In the [Paris Agreement](#), the signatory Parties undertook to limit global warming to well below 2°C, but preferably to 1.5°C compared to pre-industrial levels. We are focussing on 1.5°C because this target safeguards the basis of life of many people and ecological systems.

The 1.5°C limit is therefore much more than a technical climate target. Rather, it is a scientifically well-founded threshold that cannot be negotiated, as exceeding it will come at a high price. It is a guardrail for a sustainable future and crucial for global stability, social justice and economic resilience. The 1.5°C limit serves as a benchmark and compass for political goals, decisions and social consensus. Ambitious measures to reduce emissions promote the expansion of renewable energies, strengthen energy security and reduce the long-term costs of climate damage and the risks to food security.

## 1.5°C as a political, social and economic guardrail

**Political goals and decisions:** Since 2015, the 1.5°C limit has been a central reference point for global climate policy. It provides a clear and scientifically sound framework for national and international climate mitigation measures. In the international process, for example at the annual UN climate change conferences, the G20/G7 meetings or the Petersberg Climate Dialogue, it is a central yardstick for decision-making. Results from these meetings must always be measured by whether they contribute to compliance with the 1.5°C limit. On the basis of the 1.5°C limit, ambitious reduction paths can be drawn up and evaluated for each country and adaptation strategies discussed.

**Orientation for economic players:** Economic players demand planning security from politicians. Long-term targets are therefore particularly important. Orientation towards the 1.5°C limit helps economic actors find a guideline for the ambition of their transition plans and thus their planned investments and innovations. At the same time, economic activities send signals to politicians.

**Social consensus:** The 1.5°C limit makes climate mitigation efforts measurable. Instruments such as the [Climate Action Tracker](#) or the [Climate Change Performance Index](#) make it clear that current efforts are insufficient to comply with the 1.5°C limit, and demonstrate the extent to which they are so. It creates a common basis for climate mitigation movements, companies and political actors who are committed to sustainable transformation. The 1.5°C limit has a [high level of social acceptance](#), partly because it was adopted by the global community in the Paris Agreement.

**Courts:** The number of climate lawsuits has risen steadily worldwide in recent years. The 1.5°C limit is also playing an increasingly important role in the reasoning behind them. A case study from Switzerland clearly illustrates this. In the lawsuit, the KlimaSeniorinnen association took Switzerland to the European Court of Human Rights because its climate policy was not doing enough to comply with the 1.5°C limit. In 2024, the European Court ruled in favour of the plaintiffs, obliging the Swiss government to do more to protect the climate and paving the way for further lawsuits.

**Obligations under international law:** By ratifying the Paris Agreement, Germany has undertaken to make its contribution to limit global warming to well below 2°C, ideally to 1.5°C. The Paris Agreement is a treaty under international law that provides for binding obligations to reduce emissions, report, and promote climate mitigation measures. Compliance with the 1.5°C limit from the Paris Agreement is therefore not just a climate policy goal for Germany, but an obligation under international law. In line with this, the Federal Constitutional Court has sufficiently enshrined climate mitigation as a human rights obligation. Violating this would mean disregarding human rights and international law standards, in particular the right to life and to a healthy environment and the civil liberties of young people and future generations, which many people are already being denied as a result of the climate crisis. As a signatory Party, Germany has a duty to do its part to limit global warming in order to protect precisely these rights. In addition, the risk of climate lawsuits against states and companies increases if commitments under the Paris Agreement are not met - with potentially far-reaching financial and political consequences. In the current geopolitical situation, compliance with international agreements is particularly important in order to ensure the credibility and stability of the value-based multilateral system. Anyone who undermines the Paris Agreement is not only weakening climate mitigation, but also international trust in cooperation and the rule of law.

**Human rights, human security and global livelihoods:** The consequences of climate change pose a key threat to livelihoods. In the past 30 years, extreme weather events alone have led to more than 765,000 deaths worldwide and economic losses totalling almost USD 4.2 trillion. Exceeding the 1.5°C limit increases social inequalities (within countries, but also between countries) and increases the risk of conflict. From a human rights perspective, global warming must be limited to a level that protects people and the environment. The burden of the climate crisis must be shared fairly and not carried out at the expense of the most vulnerable groups. Even with global warming below 1.5°C, we have already significantly changed the Earth system, with far-reaching consequences around the world. We therefore cannot assume that we will have a safe world at 1.5°C. Even a warming of 1.1°C is already in a range that could trigger climate tipping points.

The most affected countries and communities in particular regard the 1.5°C limit as the basis for their survival. They played a decisive role in securing its inclusion in the Paris Agreement. A significant breach of the target could undermine the faith that such countries have in the international process. However, maintaining these multilateral processes is particularly important in times of national isolation, growing authoritarianism and increased marginalisation. The 1.5°C limit, which might otherwise seem abstract, is becoming a reality in the Pacific Island Countries, for example. The rise in sea levels associated with climate change means that many islands will be flooded and exceeding the 1.5°C limit will destroy coral reefs - and thus the very basis of life.

Climate change is directly linked to other crises. Countries that are under political or social pressure, for example, due to war, increasing inequality or fragile state structures, are considered to be particularly vulnerable. When the effects of the climate crisis are added to this, their situation is further exacerbated. Climate change acts as a catalyst for crises.

## 4 What do we need to do now?

As complex as the issues are, the realisation is simple: the 1.5°C limit is still politically achievable if we act now! This requires decisive and ambitious measures:

**Global greenhouse gas emissions must be reduced as quickly as possible:** To achieve this, the phase-out of fossil fuels must be implemented quickly. The phase-out of coal, oil and gas must not be delayed any longer. Instead, we need a major and equitable expansion of renewable energies and significant progress in energy efficiency worldwide. The Paris Agreement stipulates that a Global Stocktake (GST) must take place every five years. The GST shows how far the global community of Parties has come in fulfilling the Paris Agreement, what gaps still exist and what measures need to be taken. The first GST was concluded at the end of 2023 at the UN climate change conference in Dubai. It emphasised that current climate protection efforts are insufficient to limit global warming to 1.5°C. Specifically, it was stated that the signatory Parties should triple their global renewable energy capacity and double their energy efficiency by 2030. Reducing the use of fossil fuels was also agreed.

The results of the first global stocktake in Dubai showed that it is still technically possible to limit global warming to 1.5°C in the long term, at least after a phase of overshooting. The good news is that we know the next steps we need to take to solve this problem as part of a joint global effort. Above all, however, an honest and transparent discussion on how the measures agreed in Dubai can be implemented is crucial.

**Countries must submit NDCs that are compatible with the Paris Agreement:** The new round of NDCs to be submitted in 2025 must not only include increased 2030 targets, but also provide ambitious 2035 targets and clear implementation plans. However, concrete policy measures and clear pathways for all sectors are urgently needed to ensure that this does not remain a mere target.

The NDCs must incorporate the results of the GST and outline how they will contribute to a global tripling of renewable energies and doubling of energy efficiency. The corresponding momentum is already astounding. According to IRENA, 92% of all new investments in the electricity system in 2024 were in renewable energies.

But there is still a gap in achieving the targets. Above all a clear signal is needed to phase out fossil fuels. Transformations are needed in almost all sectors to achieve the Paris targets. Merely incremental changes will not suffice.

**Adapt climate finance to actual needs:** Countries with high emissions and high levels of income must fulfil their responsibilities. International climate finance must be adapted to the needs of developing countries - to reduce emissions, adapt and deal with loss and damage. At the international level, multilateral processes such as the UN climate change conferences must deliver ambitious results. After three COPs in a row in authoritarian fossil-fuelled states, COP30 in Belém (Brazil) offers a possible ray of hope. Progress on the [Baku to Belém Roadmap to 1.3T](#) is an important milestone. This process aims to answer the question of how annual public and private climate finance can be increased from the pledged 300 billion to 1.3 trillion per year by 2035. Sufficient climate finance is the basis for enabling [low-income countries to embark on a climate-friendly development path](#).

**Multilateralism must remain a viable option:** Global climate policy must create concrete incentives and support programmes for national implementation, and consistently enforce compliance with the Paris Agreement. In the current tense geopolitical climate, it is essential to get the issue of the climate crisis back at the top of the political agenda. An interesting proposal in this regard came from Brazil, which has called for a Climate Change Council under the UN to support the implementation of the Paris Agreement. It should support the UNFCCC in coordinating various actors and processes in climate policy, enable faster decision-making, bring together fragmented processes and mechanisms and increase climate finance. International cooperation and diplomacy are an important cornerstone of an ambitious climate agenda that needs to be implemented at national level. Following the announcement that the US government under President Donald Trump is withdrawing from the Paris Agreement, the USA is no longer a reliable partner in the fight against climate change for the moment. Instead, new partnerships will have to be found. The rapid expansion of renewable energies in China in recent years gives reason to hope that the current largest emitter has started a process of reducing emissions. A centrepiece of international climate policy is the [ambition mechanism of the Paris Agreement](#). This consists of the GST, which takes place every five years and in turn provides important input for increasing the NDCs.

We have a lot to lose if we permanently exceed the 1.5°C limit. More importantly, however, we have a lot to gain if we as a global community of countries succeed in limiting climate change. Not only would we contribute to the preservation of ecosystems and biodiversity. It would also be an important signal of global cooperation in a period characterised by tension. Additionally, we would have more time and resources to adapt to the ongoing effects of climate change and could avoid triggering at least most of the tipping points, the consequences of which would often not be possible to adequately adapt to. Conflicts that jeopardise human security and social systems could also be avoided. Meeting the 1.5°C target through international cooperation would strengthen global solidarity.

Although the long-term temperature target of the Paris Agreement has not yet been exceeded, the temperature record of 2024 is both a warning and a call to action: anthropogenic climate change will not be stopped on its own. It must be tackled ambitiously with effective, fair and affordable measures. Drastically reducing greenhouse gas emissions is the top priority.

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