SCIENCE SET
OPEN ACCESS PUBLISHERS

ISSN: 3069-3209
Research Article

Current Research in Civil and Mechanical Engineering

Why Developing a Governance for Solar Radiation Modification (SRM) is a Matter of Urgency

Klaus Radunsky

Expert, Austria

***Corresponding author:** Klaus Radunsky, Expert, Austria.

Submitted: 17 June 2025 **Accepted:** 24 June 2025 **Published:** 01 July 2025

https://doi.org/10.63620/MKCRCME.2025.1008

***Citation:** Radunsky, K. (2025). Why Developing a Governance for Solar Radiation Modification (SRM) is a Matter of Urgency. Curre Res in Civil & Mech Eng, 1(3), 01-09.*

Abstract
The first part of this article explains why it seems appropriate to consider developing a governance for solar radiation management in order to avoid greater harm worldwide, in particular for the most vulnerable people, by providing seven reasons. The second part offers six steps how the current climate governance, established under the Paris Agreement and the UN Framework Convention on "Climate Change" (UNFCCC), should be improved in order to be better prepared for moving us away from a pathway that would result sooner or later in a so-called hothouse scenario.

Keywords: Climate Change, Risks, Governance.

Part 1 – Seven Reasons why there is the Risk to Move Along a Scenario Resulting in a Hothouse Scenario

Reason 1 Facts Related to Climate Change

The development of relevant indicators for climate change - the cut-off date for literature included in the IPCC's Sixth Assessment Report (AR6) was 11 October 2021 - has been investigated and published by a range of authors that contributed also to the 6th Assessment Report of the IPCC [1]. The authors gave an authoritative estimate of global warming to date (2024) and its causes. They found that in 2023, global warming – measured as an average over 15 years - reached 1.3 °C above the pre-industrial era and has been increasing at over 0.2 °C per decade. They also found that average decadal GHG emissions have increased steadily since the 1970s across all major groups of GHGs that the global surface mean concentrations of CO_2, CH_4 and N_2O have increased since 2019. Finally, the authors concluded that the 2020s are a critical decade: human-induced global warming rates are at their highest historical level, and 1.5 °C global warming might be expected to be reached or exceeded within the next 10 years in the absence of cooling from major volcanic eruptions.

WMO's State of the Global Climate report confirmed that 2024 was likely the first calendar year to be more than 1.5°C above the pre-industrial era, with a global mean near-surface temperature of 1.55 ± 0.13 °C above the 1850-1900 average. Among its additional key messages: key climate change indicators again reach record levels; sea-level rise and ocean warming is irreversible for hundreds of years; early warnings and climate services are vital to protect communities and economies [2].

According to the most recent global data on GHG emissions from Our World in Data [3] also from 2022 to 2023 the global GHG emissions have been increasing (from 53.33 to 53,82 billion t CO_2e), despite significant efforts to mitigate GHG emissions in many countries and regions.

According to an assessment by Berkeley Earth 2024 was the warmest year on Earth since 1850, exceeding the previous record just set in 2023 by a clear and definitive margin [4]. The warming spike observed in 2023 and 2024 has been extreme and represents a larger than expected deviation from the previous warming trend. The spike has multiple causes, including both natural variability and man-made global warming from the accumulation of greenhouses gases. Additional factors are needed to explain the full magnitude of this event. Reductions in low cloud cover and man-made sulphur aerosol pollution are likely to have played a significant additional role in recent warming.

The year 2024 with its above 1.5 °C signals, that Earth is most probably within the 20-year period that will reach the Paris Agreement limit [5].

According to satellite sea level observations sea level has increased globally by more than 100mm from 1993 to 2024 [6]. Sea level rise data from coastal tide gauge and satellite data show that sea level increased from about 1900 to 2018 by about 200mm and that that sea level rise is accelerating. Sea level rise has more than doubled from 1.4 millimetres per year throughout most of the twentieth century to 3.6 millimetres per year from 2006–2015. As global warming continues, the rate of sea level rise is expected to further accelerate, posing significant challenges for coastal regions around the world.

The impacts of climate change become visible for human societies in particular in the context of extreme weather events. The report "When Risks Become Reality: Extreme Weather In 2024" highlighted, that record-breaking temperatures fuelled unrelenting heatwaves, drought, wildfire, storms and floods that killed thousands of people and forced millions from their homes. Climate change contributed to the deaths of at least 3,700 people and the displacement of millions in 26 weather events that were studied in 2024 [7]. These were just a small fraction of the 219 events that met the trigger criteria, used to identify the most impactful weather events. It's likely that the total number of people killed in extreme weather events intensified by climate change in 2024, is in the tens, or hundreds of thousands.

The countries that experienced the highest number of dangerous heat days are overwhelmingly small island and developing states, who are highly vulnerable and considered to be on the frontlines of climate change. Many extreme events that took place in the beginning of 2024 were influenced by El Niño. However, most of the studies found that climate change played a bigger role than El Niño in fuelling these events, including the historic drought in the Amazon. This is consistent with the fact that, as the planet warms, the influence of climate change increasingly overrides other natural phenomena affecting the weather. Record-breaking global temperatures in 2024 translated to record-breaking downpours. From Kathmandu, to Dubai, to Rio Grande do Sul, to the Southern Appalachians, 2024 has been marked by a large number of devastating floods. Of the 16 floods studied, 15 were driven by climate change-amplified rainfall. The result reflects the basic physics of climate change — a warmer atmosphere tends to hold more moisture, leading to heavier downpours. Shortfalls in early warning and evacuation plans likely contributed to huge death tolls, while floods in Sudan and Brazil highlighted the importance of maintaining and upgrading flood defences. The Amazon rainforest and Pantanal Wetland were hit hard by climate change in 2024, with severe droughts and wildfires leading to huge biodiversity loss. Hot seas and warmer air fuelled more destructive storms, including Hurricane Helene and Typhoon Gaemi. Individual attribution studies have shown how these storms have stronger winds and are dropping more rain due to anthropogenic induced climate change. Research by Climate Central found that climate change also increased the intensity of most Atlantic hurricanes between 2019 and 2023 – of the 38 hurricanes analysed, 30 had wind speeds that were one category higher on the Saffir-Simpson scale than they would have been without human-caused warming [7].

Harmful tipping points in the natural world pose some of the gravest threats faced by humanity. Their triggering will severely damage our planet's life-support systems and threaten the stability of our societies. The Global Tipping Points Report 2023 assessed the current knowledge related to these tipping points [8]. This assessment concludes that climate change and nature loss could soon cause 'tipping points' in the natural world resulting in irreversible change. Environmental stresses could become so severe that large parts of the natural world are unable to maintain their current state, leading to abrupt and/or irreversible changes. These moments are called Earth system 'tipping points. Five major tipping systems are already at risk of crossing tipping points at the present level of global warming: the Greenland and West Antarctic ice sheets, warm-water coral reefs, North Atlantic Subpolar Gyre circulation, and permafrost regions [8].

The social cost of carbon which are an indicator for loss and damage resulting from climate change impacts have been studied. The latest update of such meta-analysis shows that the average social cost of carbon in 2024 is USD 538/tC [9]. For comparison: the price of EU Carbon Permits in the past four years has always been lower than 390 USD per tonne C [10].

Reason 2 What Scenarios Can Tell Us

The Network for Greening the Financial System (NGFS) published in November 2024 long-term scenarios for central banks and supervisors [11]. The fifth vintage of the NGFS Scenarios has been a collaborative effort of the members of the Workstream on Scenarios Design and Analysis and was prepared under the auspices of Livio Stracca (European Central Bank), Chair of the Workstream with support from the NGFS Secretariat. The NGFS Workstream on Scenarios Design and Analysis has been working in partnership with an academic consortium from the Potsdam Institute for Climate Impact Research (PIK), International Institute for Applied Systems Analysis (IIASA), University of Maryland (UMD), Climate Analytics (CA) and the National Institute of Economic and Social Research (NIESR).

The Main Results of the NGFS Scenarios have Been Described as Follows

• Limiting the temperature increase to 1.5 °C above pre-industrial levels by 2100 in an orderly fashion is within reach but it requires substantially more intensive efforts than delineated in previous vintages. While economic impacts differ significantly across countries, regions and economic sectors, almost all countries will benefit from keeping global warming levels close to the 1.5 °C threshold. Early and coordinated policy action will yield the highest long-run returns. The scale of the adjustment grows disproportionately, if action is delayed. However, it is not possible to achieve this goal without overshooting the temperature goal for about two decades.

• A substantial economic transformation affecting all sectors of the economy is required to achieve global net zero CO_2 emissions by 2050. Slow progress in implementing climate policies so far necessitates more ambitious approach going forward. It also means higher emissions in the near term and a more disruptive transition than previously anticipated fostered by a higher (shadow) carbon price.

• In all scenarios, the impact of physical risk rapidly outweighs the impact of transition efforts. The expected economic impact of unabated climate change has significantly increased. Due to the implementation of the new damage function, the projected physical risk impact has quadrupled by 2050 in some scenarios. These strong negative impacts on GDP could be mitigated by timely transition efforts.

The NGFS Scenarios Explored a Set of Seven Scenarios

• Three orderly scenarios (Net Zero 2050, Below 2 °C, Low Demand) which assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.

• One "Disorderly scenario" which explores higher transition risks due to policies being delayed or divergent across countries and sectors. For example, (shadow) carbon prices are typically higher for a given temperature outcome.

• Two so-called "Hot house" world scenarios which assume that some climate policies are implemented in some jurisdictions, but globally efforts are insufficient to halt significant global warming. The scenarios result in severe physical risk including irreversible impacts.

• The "Too-little-too-late scenario" which assumes that a late and uncoordinated transition fails to limit physical risks.

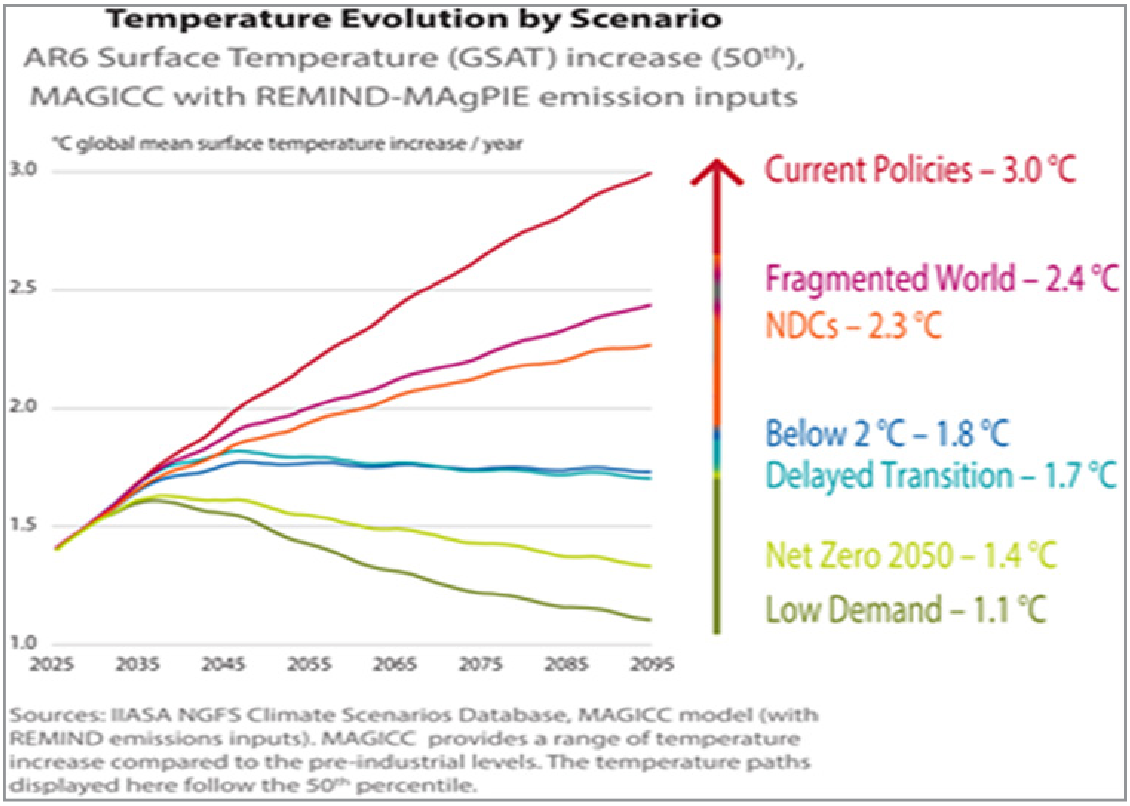

Figure 1: The temperature evolution by scenario

The three Orderly Scenarios have Been Characterized as Follows

- Net Zero 2050 limits global warming to 1.5° C through stringent climate policies and innovation, reaching global net zero CO_2 emissions around 2050.
- Below 2 °C gradually increases the stringency of climate policies, giving a 67% chance of limiting global warming to below 2 °C.
- Low Demand assumes that significant behavioural changes – reducing energy demand – in addition to (shadow) carbon price and technology induced efforts, would mitigate pressure on the economy to reach global net zero CO_2 emissions around 2050.

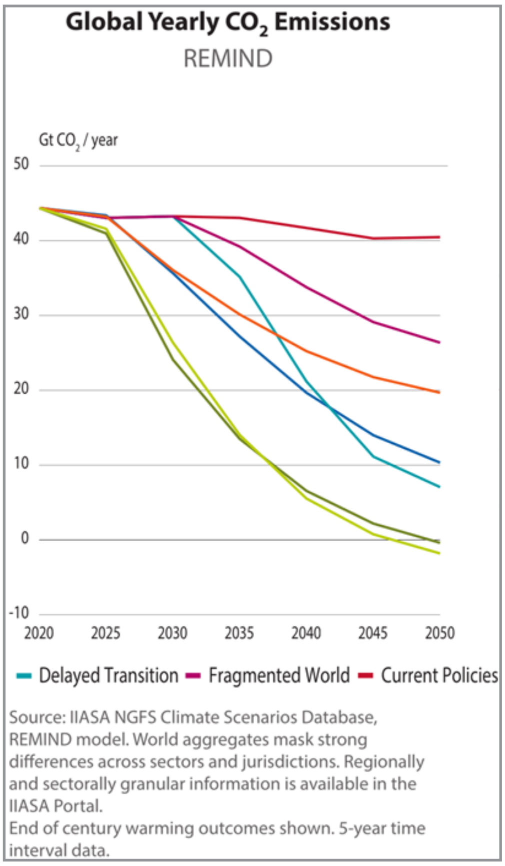

Figure 2: The development of CO2 emissions under the assumed scenarios

What is Obvious

There is significant uncertainty with respect to the speed of future emission reduction. Current policies would result in a very slow decarbonization rate which leads to a hothouse scenario and results in global warming of 3.0°C above preindustrial level by 2100. The scenario assuming implementation of the NDCs (including the US) would also result in significant warming by 2100 of 2.3°C, a warming level that also would trigger a development towards a hothouse world. The scenarios with the highest rate of decarbonization would result in net zero emissions by 2050 and would limit overshooting of the 1.5°C warming to about two decades – and would avoid the risk of moving into a hothouse scenario. Only significant policy shifts now would mitigate high losses of GDP in the future.

Note: In a Hothouse Earth scenario, human greenhouse gas emissions activate mechanisms in Earth's climate that eventually push the global climate over a threshold into continued, self-perpetuating warming, independent of human emissions [12, 13].

The reality of 2025 is, that the Trump administration has pulled the plug on the UN climate process and its financial contributions, while at the same time backing fossil fuels and obstructing renewables. "It is the policy of my Administration to put the interests of the United States and the American people first in the development and negotiation of any international agreements with the potential to damage or stifle the American economy" has been Trump's justification. However, analysts warned that the implications could be far-reaching and weaken the US geopolitically [14].

It should also be noted that even the scenario which includes all pledged targets as described in the Nationally Determined Contributions (NDCs) would overshoot by 0.3°C the 2°C target and thus would require global net negative emissions to reduce global warming to the 2°C target.

Compensating high GHG emissions by removals, e.g. by Direct Air Capture and Storage (DACS), is a technical option – but it would require to up-scale the current capacity (~ 10 k t CO2 per annum) very fast. If we manage to reduce current CO2 emissions of 40 bio t CO2/a to 10 bio t CO2/a or by 75% it is still very challenging to compensate the remaining 10 bio t CO2/a. According to an interview with Climeworks co-founder and co-CEO Jan Wurzbacher 1000 large DAC plants, each with the capacity to capture one million tons of CO2 per year, are needed to capture 1 bio t CO2 per year. Each plant requires investments of about 1 to 2 bio USD. Such development would require a strong regulatory framework, e.g. in the form of tax credits, carbon taxes, and net-zero emissions obligations but seems possible and has massive energy requirements [15].

A signal that more and more realize what is finally required to control the risks of climate change, is the fact that a growing coalition of countries, cities, businesses and other institutions are pledging to get to net-zero emissions. As of June 2024, 107 countries, responsible for approximately 82 per cent of global greenhouse gas emissions, had adopted net-zero pledges either in law, in a policy document such as a national climate action plan or a long-term strategy, or in an announcement by a high-level government official. More than 9,000 companies, over 1000 cities, more than 1000 educational institutions, and over 600 financial institutions have joined the Race to Zero, pledging to take rigorous, immediate action to halve global emissions by 2030 [16]. It remains to be seen if such announcements and plans are finally resulting in real action on the ground that is also reflected in slowing down the increase of CO2 concentrations in the atmosphere. For the time being the CO2 concentrations in the atmosphere are still rising [17]. See also figure 3 (Daily Global CO2). A decline in CO2 concentrations in the atmosphere can only be expected after the point in time by when we have achieved globally net-zero CO2 emissions.

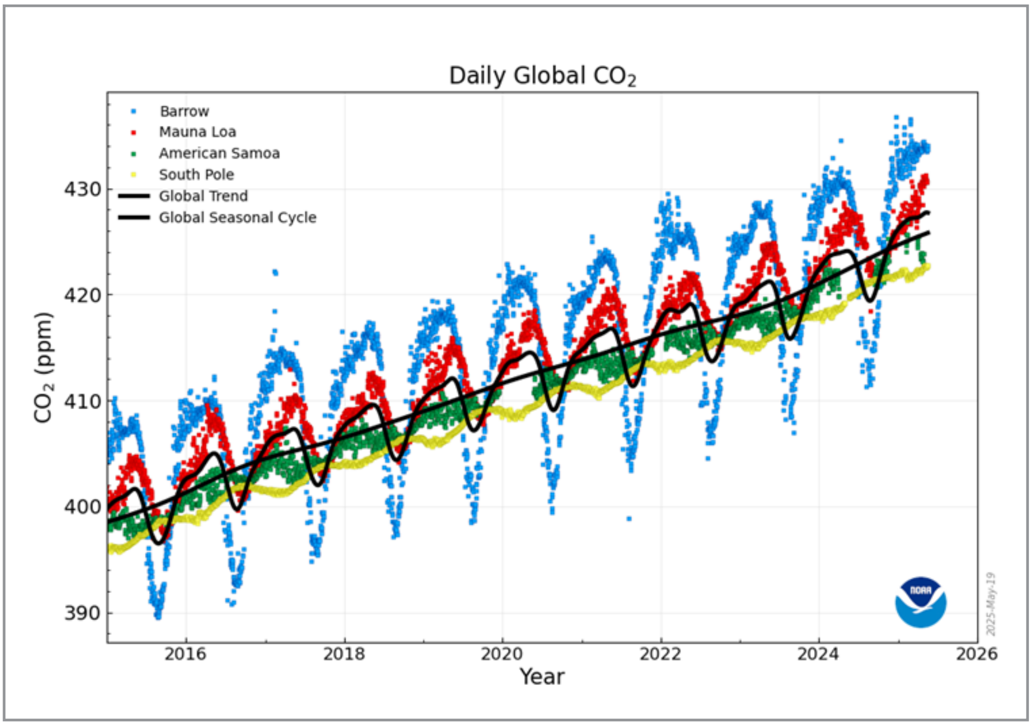

Figure 3: Global CO_2 Concentration in ppm in the Atmosphere from 2015 to 2024

The WGII Report of the AR6 of the IPCC defines limits of adaptation [18]. All should be aware that the availability of adaptation options is constrained by limitations faced by the natural world and people, especially at higher degrees of warming. Biophysical, institutional, financial, social and cultural barriers can lead to soft and hard adaptation limits, particularly when combined. Hard limits occur when adaptive actions become infeasible to avoid risks. One prominent example is when small islands become uninhabitable due to sea level rise and lack of sufficient freshwater. In that case, inhabitants may have no other option than to abandon their homes. Soft limits, in contrast, can be overcome if additional financial, institutional or technological support becomes available. With sufficient funding, for instance, cities can invest in new parks and lakes, creating new spaces for citizens to find shade and cool down during heatwaves.

WGII report of the AR6 of the IPCC finds that many species and ecosystems are currently near or beyond their hard adaptation limits, and people that rely on them to survive, are currently near or beyond their soft adaptation limits.

Reason 3 The Carbon Removal Catch [19]

Here's something that doesn't get enough attention – warming itself threatens our carbon drawdown tools. As regions experience shifting weather patterns, droughts, and temperature increases, the very land-based solutions we're counting on – like forests and agricultural soil carbon – become increasingly vulnerable. Regions once suitable for carbon-sequestering agriculture might become too dry or hot, and forests might die off from novel pests or wildfires. While some new regions might become more suitable for carbon sequestration, the uncertainty and transition costs create enormous risks. In worst-case scenarios, we could actually lose critical tools in our carbon removal toolkit – creating a vicious cycle where warming makes carbon removal harder, which leads to more warming. Furthermore, the warmer the ocean becomes the smaller the fraction of the absorbed CO_2 becomes and the more CO_2 remains in the atmosphere.

Reason 4 The Cooling Bridge We Need to Build [19]

Expanding our climate solution portfolio beyond carbon-centric approaches to include cooling interventions is both inevitable and obvious.

Considered options are:

Marine Cloud Brightening (MCB)

Enhancing the reflectivity of low-lying marine clouds by introducing sea salt particles. This could be targeted to protect specific vulnerable systems like coral reefs or ice sheets.

Surface Albedo Modifications

From ice preservation techniques to ocean surface films, these approaches increase reflectivity of Earth's surfaces.

Cirrus Cloud Thinning (CCT):

Releasing fine, harmless dust into the thin, wispy clouds high in the sky so their ice crystals grow larger, fall out faster, and the clouds thin out. That lets more of Earth's heat escape to space, complementing albedo-based methods.

Stratospheric Aerosol Injection (SAI)
Introducing reflective particles into the stratosphere to mimic the cooling effect of volcanic eruptions. This could reduce globaltemperatures by 0.5-1.0°C within years, not decades. Note, that one of the main risks of deployment of SAI is the termination shock. If solar geoengineering were to be deployed so as to mask a high level of global warming, and then stopped suddenly, there would be a rapid and damaging rise in temperatures. This effect is often referred to as termination shock, and it is an influential concept. Based on studies of its potential impacts, commentators often cite termination shock as one of the greatest risks of solar geoengineering. Thus, it is strongly recommended not to start implementation of SAI before DACS is available at Gt scale.

Reason 5 The New Complexity We Must Navigate [19]
Here's where things get vastly more complicated than carbon removal, in particular when it comes to SAI. With the founding of the carbon removal industry, we were mostly dealing with voluntary markets, project developers, and corporations making offset claims. The complexity was significant but containable.

Cooling Interventions at Global Scale (MCB or SAI) Introduce Entirely new Dimensions of Complexity

Governance Challenges: Unlike current and near term (next 20 years) carbon removal, cooling interventions may have transboundary and in the case of large-scale MCB or SAI global effects. Who decides whether or not to deploy, and if yes when to deploy? Under what conditions? With what oversight? Based on what and whose information? We need governance frameworks that don't yet exist.

Geopolitical Implications: MCB or SAI could affect regional precipitation patterns. Rogue actors or one nation's deployment could negatively impact another's agriculture or water resources – and what may actually count is the perception and not necessarily the science-based attribution. Countries have gone to war over less.

Monitoring Requirements: We need vastly improved monitoring capabilities to track effects, detect unintended consequences, and make evidence-based adjustments.

Ethical Questions: How do we weigh climate risks against intervention risks, considering known risks and uncertain impacts? Who bears those risks? How do we ensure just outcomes across regions?

Funding Models: Unlike carbon removal with its clear "tonne of CO_2" unit (which of course has many challenges), cooling interventions have no obvious market mechanism. Who pays for this? How much? Through what structures? However, the overall costs of SRM techniques would be 2 orders of magnitude lower compared to CDR. We are talking about a few 10s of billons per annum. What increases the risk of moral hazard to further delay mitigation action.

For CDR it is required i.e. to create new markets, methodologies, and verification approaches. But cooling interventions require all that plus international diplomatic frameworks, real-time monitoring systems, and emergency response protocols that don't yet exist.

Reason 6: What Needs to Happen Now [19]
The preparation window for cooling interventions is open now and closing rapidly. Based on current warming trajectories, we'll likely need deployment readiness within 5-15 years in order to avoid increasing climate impacts as described under Reason 1 above in the coming decades. Unlike carbon removal circa 2015, there are a lot of researchers and policy folks who have been looking into these topics for a very long time. So, there is a robust body of work. But when it comes to practical deployment of theories, our current state of readiness is woefully inadequate.

Research Acceleration: We need to dramatically scale up research into efficacy, impacts, and monitoring systems. Current funding is minimal and scattered.

Governance Development: We need to begin creating international frameworks for deployment decisions, monitoring, and response protocols. We need honest, evidence-based conversations about risks, benefits, and trade-offs that move beyond both techno-optimism and knee-jerk rejection.

Coordination Systems: We need mechanisms to align research, policy, deployment, and monitoring across institutions and nations.

Paul Gambill (author of (19)) is absolutely not suggesting we deploy cooling interventions tomorrow. But that we need to start building the systems that would allow for responsible deployment when needed. If we wait until cooling is desperately needed, it will be too late to deploy it responsibly.

Reason 7 Moving Forward: A Portfolio for Climate Stability [19]
According to Paul Gambill we Need a Comprehensive Portfolio Approach.

Emissions Reductions: Continuing to aggressively reduce the total carbon burden, including Short Lived Climate Forcers

Carbon Removal: The long-term solution that must reach gigatonne scale by mid-century.

Cooling Interventions: Buying critical time by preventing the worst tipping points (e.g. melting down of ice shields) while another solutions scale.

These aren't competing alternatives – they're complementary components working on different timescales for different purposes. The portfolio must work together, with each element playing its essential role. Further explanation of the described rationale and the specific function of these three fields of activities are described in Part 2.

Part 2 – Six Steps to Enhance Current Governance as a Basis for Action to Move Us into a Scenario that Offers a Basis for

These steps are social tipping points to move us towards a world exposed to less climate change risks. A social tipping point is

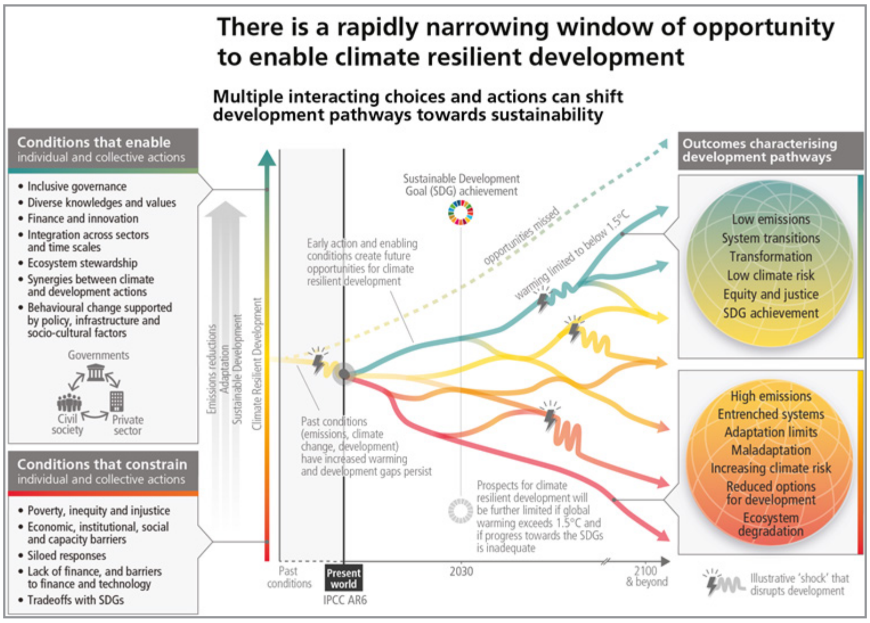

Figure 4: Possible development pathways

We are currently not in the location of the present world as indicated in figure 4 but moved five years onwards on the red curve. We definitely should end in the world characterized by low emissions, system transitions, transformation, low climate risk, equity and justice and achievement of SDGs.

We should do everything we can to avoid landing in a world with high emissions, entrenched systems, adaptation limits, maladaptation, increasing climate risk, reduced options for development and ecosystem degradation.

The social tipping points identified in this paper above would help to lift our society upwards, towards the nicer and better world.

The above described seven reasons described how the risks of climate change are growing and that the efforts to avoid dangerous anthropogenic interference with the climate system until now sadly failed. Despite the dire warnings of scientists and although the IPCC stated that "Every increment of global warming will intensify multiple and concurrent hazards in all regions of the world" [21].

The second part describes five by six steps to strengthen governance such that we could successfully reduce the growing climate change risks and thus move us on a pathway towards a better world. These steps would also help to reduce the termination risk (see above) as well as address the challenge of moral hazard which is inherent to all approaches with the exception of mitigation of greenhouse gas emissions. (Note: In the context of climate change a moral hazard is a situation where an actor has an incentive to reduce its mitigation action because DACS or SRM or other action might be cheaper compared to mitigation of GHG emissions).

Step 1 Modification of the Rules of Procedure Under the UNFCCC/the Paris Agreement

The processes under the UNFCCC and the Paris Agreement delivered many helpful decisions – but overall, these decisions fell short of what would have been required. A main obstacle to produce decisions that would be more adequate to address the climate challenge is the fact that decisions under those bodies have to be taken by consensus. Parties have recognized from the beginning that this is a problem of the Rules of Procedure (RoP). Over the years various alternatives have been discussed, including an alternative that would allow to take decisions by a two-third majority vote of the Parties present.

But for 30 years (respectively 30 COPs) the paragraphs related to voting in the RoP have remained without agreement, and remain in "square brackets". In order to deliver meaningful outcomes on the issues described below the first step should be to agree on this important procedural issue. Only such decision could pave the way for other difficult decisions described below. If Parties fail to agree on such greater flexibility the alternative might be unilateral actions to curb global warming as also discussed in the literature [22] and also mentioned in a side event "Solar Radiation Modification: A Conversation on Governance and Research" of COP29 (Baku, 2024) [23].

Step 2 Transformation of the Voluntary Mitigation Commitments Under the Paris Agreement Into Legal Binding Obligations, Including Enforcement Regulations

In order to limit the potential deployment of geoengineering options, such as large scale DACS (direct air capture and storage as well as SRM) as much as possible, it would be rather important to add to the current voluntary pledges under the Paris Agreement legally binding commitments of countries to achieve carbon neutrality at a reasonable point in time, e.g. by 2050. Missing those targets should be coupled to payments in order to finance the additional investments in DAC, including DACS, adaptation, loss and damage, capacity building.

Step 3 Address Climate Forcers Beyond the Kyoto Basket Under the Paris Agreement
The current Kyoto basket of greenhouse gases addressed under the Paris Agreement should be enlarged by short lived climate forcers once the IPCC has finalised its Methodology Report on Short-lived Climate Forcers (SLCFs), which is to be expected by 2027. These mitigation actions would help to reduce additional warming quicker than mitigation actions focused on long lived climate forcers.

Step 4 Legal Obligation to Upscale DACS
Given that organizations that are planning to achieve carbon neutrality in the coming decades realize that there might be finally residual emissions due to lack of feasible technologies to reduce those emissions countries will have to start preparing to compensate those residual emissions by DACS. Companies, who are working in this field have already developed management plans how these residual emissions might be compensated – a challenging but manageable issue given the expected scale in the range of about 5 Gt CO2 per year. The governance should address legal obligations for countries to develop and create the required new markets, methodologies, and verification approaches but also to specify the legally binding contributions in order to trigger the necessary investments.

Step 5 Basis for the Governance of SRM
As already indicated above we need international agreement on the following issues on SRM: research acceleration; international frameworks for deployment decisions, monitoring, and response protocols; transparent and regular communication to the broader public; coordination systems.

It is important to realize that the broad spectrum of response options to address the growing climate change risks is comprised of complementary components working on different timescales for different purposes. The portfolio must work together, with each element playing its essential role. E.g., It seems not possible to start deploying of SRM at scale without being in a position to address the termination shock by DACS at scale so that the period of overshooting a specific level of warming can by reliable be controlled from the very beginning, if finally required. This means, that the governance of SRM has to be linked with the governance of mitigation and adaptation.

Step 6 Exchange of Experiences About Barriers to Mitigation Including Transformation, e.g. of Energy Systems Based Upon Fossil Fuels and How they Have Been Addressed in Order to Speed up Reduction of Climate Change by Mitigation and how an Enabling Environment for Meaningful Activities has Been Created
Steps one to five addressed "what" needs to be done. Step six should help to exchange experiences among countries on speeding up transformation – thus having a focus on the "how". Step 6 is intended to have a function for mitigation similar to the function of the Nairobi Work Programme for adaptation. Step six thus strives to assist all Parties, in particular developing countries, including the least developed countries and small island developing states, to improve their understanding and assessment of mitigation needs and opportunities, in order to make informed decisions on practical mitigation actions and measures to respond to climate change on a sound, scientific, technical and socioeconomic basis, in the broader context of meeting the sustainable development goals. Relevant information might be collected at all levels of governance by a national focal point (or ombudsman?).

Conclusion
Unfortunately, time is not any more on our side as has been in 1992 when the Climate Convention was adopted in Rio. And we also cannot negotiate with nature – the increase of climate risks is driven by natural processes that are/have been/will be triggered by anthropogenic GHG emissions. We have to adopt speedy the current rules of procedure under the UNFCCC and the Paris Agreement in a manner that allows a much faster response to those further increasing risks of global warming in order to save our planet as we know it now. In order to be finally successful and avoid being overwhelmed by nature in moving into a hothouse scenario, we might have to make use of all the options identified above.

The more time it takes to agree on the steps identified above, the later we will reach net zero carbon emissions globally, the higher will become the temperature increase compared to the preindustrial level, the greater will become the associated losses and damages, the greater will become the demand for DACS, the longer and the more future generations will have to work to re-establish a healthy atmosphere and the greater will be the need to address overshooting by SRM and the larger will become the risk of unintended side effects of SRM.

References

1. Forster, P. M., Smith, C., Walsh, T., Lamb, W. F., Lamboll, R., Hall, B., ... & Zhai, P. (2024). Indicators of Global Climate Change 2023: annual update of key indicators of the state of the climate system and human influence. Earth System Science Data, 16(6), 2625-2658.
2. State of the Global Climate 2024; WMO-No. 1368; ISBN 978-92-63-11368-5; © World Meteorological Organization, 2025;https://library.wmo.int/viewer/69455/download?file=WMO-1368-2024_en.pdf&type=pdf&navigator=1
3. https://ourworldindata.org/grapher/total-ghg-emissions
4. https://berkeleyearth.org/global-temperature-re-port-for-2024/
5. https://www.nature.com/articles/
6. s41558-025-02246-9?fromPaywallRec=false
7. https://climate.nasa.gov/vital-signs/sea-level/?intent=121
8. https://www.worldweatherattribution.org/when-risks-become-reality-extreme-weather-in-2024/
9. https://report-2023.global-tipping-points.org/summary-report/key-messages/
10. Richard S.J. Tol, Database for the meta-analysis of the social cost of carbon (v2025.1); Department of Economics, University of Sussex, Falmer, United Kingdom Institute for Environmental Studies, Vrije Universiteit, Amsterdam, The Netherlands Department of Spatial Economics, Vrije Universiteit, Amsterdam, The Netherlands Tinbergen Institute, Amsterdam, The Netherlands CESifo, Munich, Germany Payne Institute for Public Policy, Colorado School of Mines, Golden, CO, USA

11. https://arxiv.org/html/2402.09125v3#S4.F3
12. https://tradingeconomics.com/commodity/carbon
13. https://www.ngfs.net/system/files/import/ngfs/medias/documents/ngfs_scenarios_main_presentation.pdf
14. https://www.pnas.org/doi/10.1073/pnas.1810141115
15. https://probablefutures.org/perspective/what-is-the-hothouse-earth-trajectory/
16. https://www.climatechangenews.com/2025/04/29/trumps-first-100-days-us-walks-away-from-global-climate-action/
17. https://www.swissinfo.ch/eng/science/to-meet-our-carbon-removal-target-by-2050-we-need-1000-large-plants/89009076
18. https://www.un.org/en/climatechange/net-zero-coalition
19. https://www.co2.earth/daily-co2
20. https://www.ipcc.ch/report/ar6/wg2/about/frequently-asked-questions/keyfaq4/#:~:text=Hard%20limits%20occur%20when%20adaptive,than%20to%20abandon%20their%20homes.
21. https://www.inevitableandobvious.com/p/break-glass-cool-planet?utm_campaign=post&utm_medium=web
22. IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001; Figure SPM.6
23. IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 184 pp., doi: 10.59327/IPCC/AR6-9789291691647.
24. Geoengineering Wars and Atmospheric Governance (Craig Martin & Scott Moore) https://journals.law.harvard.edu/ilj/2025/03/geoengineering-wars-and-atmospheric-governance/
25. https://enb.iisd.org/events/solar-radiation-modification-cop29