Policymakers' FAQ

We continually ask EU policymakers and stakeholders what they need to know about climate interventions. This document answers questions we have frequently encountered as of March 2025.

Questions & Answers

Research

Why study this issue? Why now?

The climate crisis is rapidly worsening, and the world is on course for a 3°C rise[1], significantly exceeding the Paris temperature goals. Civilisation as we know it would be fundamentally transformed. There is thus growing interest in powerful new technological interventions in the climate system[2] aimed at limiting some of its worst effects. With the prospect of warming well above 2°C, these technologies reflect a growing sense of desperation and urgency.

One increasingly discussed and researched technology is Stratospheric Aerosol Injection (SAI). It entails spraying aerosols into the upper atmosphere continually to reflect a small portion of sunlight back into space. Theoretically, this could be deployed using today's technology within a handful of years with near-immediate though initially limited effects on the climate system. This poses a significant risk of geopolitically problematic ungoverned deployment in the short term, which is not well understood.

There is no other policy or technological option that would lower the temperature so quickly. But SAI has numerous unknowns and brings its own risks - environmental, societal, geopolitical security - as well as ethical concerns, including over justice and intergenerational equity. Political risks, such as SAI being used as an excuse to delay mitigation efforts, are relevant independent of its scientific risks and uncertainties.

Policymakers need to weigh the potential harms and risks of SAI with those of a world on course to nearly double the 1.5°C temperature rise this century. The recent emergence of commercial actors and private money for research is changing the climate interventions field and adding impetus to the need for public governance.

If deployed at a global scale, SAI would affect every country in the world, though not necessarily equally, and would likely be used for decades if not longer. Cautious, responsible research - transparent and publicly accountable - is essential to answer uncertainties and weigh whether the risks from SAI would be more or less (and for whom) than those of a rapidly overheating planet.

[1] UNEP's 2024 Emissions Gap Report "No more hot air … please!" finds that "a failure to increase ambition (…) and start delivering immediately would put the world on course for a temperature increase of 2.6–3.1°C over the course of this century."
[2] Climate interventions are powerful climate-altering measures, which include Carbon Dioxide Removal (CDR), and Solar Radiation Modification (SRM) technologies. Among the different SRM techniques researched, there are: injection of aerosols in the stratosphere (SAI), marine cloud brightening (MCB), preventing polar ice melting, or space mirrors.

Research

What's the current state of play of the research on SAI?

Currently, not enough is known about SAI to make well-informed decisions about its potential deployment. There are many uncertainties and unknowns related to the potential impacts of SAI deployed at scale, including on the ozone hole, precipitation and monsoon cycles and agriculture, to name a few.

Cumulative Solar Radiation Modification (SRM) research funding to date is estimated at less than €100m (i.e. less than 0.7% of climate science research funding). There are no updated published figures on global SAI research funding.
Since 2012, the EU has funded the following research projects on SRM, of which SAI is the most prominent type:

- ➔ GENIE (ca. €5m),
- ➔ EUTRACE (ca €1.5m),
- ➔ IMPLICC (ca €1m) and
- ➔ Co-CREATE (ca €3m)

Both GENIE and EUTRACE address carbon dioxide removal in addition to SRM. Co-CREATE focuses on the governance of SRM research. Thus, the total amount of EU funding that has explicitly gone into SAI research is significantly less than €7m. These numbers, however, do not count basic research relevant to SAI.

Meanwhile, SRM research funding in the US may have surpassed €50m, although there are currently no reliable estimates. A growing number of researchers in other countries, including the UK (€5m), China (€3m), and the Global South, are studying SAI. The Degrees Initiative has supported more than 150 researchers working across 28 projects hosted in 22 developing countries. It has awarded over €1.7m in research grants in the Global South.

Ethical concerns, public perceptions, and governance options have been discussed, but more efforts must be devoted to these issues. No serious SAI field experiments, even at a small scale, have taken place in the EU or elsewhere due to high levels of controversy and opposition by civil society.

Research

What are the main obstacles to responsible SAI research?

Researchers, funders, and civil society have been reluctant to study SAI for multiple reasons, including concerns that it might undermine or delay the need for urgent emission reductions and adaptation or that it may be inherently ungovernable. Some fear a 'slippery slope' from research to testing to deployment. This has resulted in sparse and ill-coordinated publicly funded research. This also causes a lack of critical inter- and transdisciplinary research connecting the dots of SAI's broader environmental, societal, and (geo-)political implications.

The lack of clear guidance on desirable and undesirable research also remains a significant obstacle for researchers and research funders who struggle to make sense of these issues.

What do you think about outdoor tests?

The decision to do outdoor testing is both scientific and political and requires input from scientists and the broader public. Moving from computer-based simulations to outdoor testing would be significant politically and psychologically. While environmental field experiments are done regularly with little public reaction, framing an experiment as dedicated to studying SAI has particular resonance. This has, in practice, led to opposition, centring on concerns that testing might be a step toward deployment. Concerns also focus on a lack of public discussion on SRM and environmental and climate threats in general. The advisory committee to the controversial Harvard SCoPEx proposed experiment, which was later cancelled, has published a number of recommendations on better engagement.

At the same time, some scientists suggest outdoor testing - within clearly defined boundaries - is needed to more robustly study effectiveness, risks, and uncertainties around SAI. More systematic SAI modelling can answer some questions, but on its own is not sufficient. There may come a point where outdoor tests are required to fill critical gaps in knowledge.

Responsible research, including greater transparency and international monitoring, can help mitigate risks from outdoor testing. CFG sees a need for carefully selected field experiments, which include public input at all stages, from research design to monitoring, to answer questions that computer models cannot.

Research

Are you thinking about setting up a code of conduct for SAI research?

One of the most significant risks of SAI – a risk that EU policymakers can help mitigate – is the current lack of comprehensive governance for research, testing and any potential deployment of SAI. Governance to strengthen the transparency and monitoring of research and testing is urgently needed.

Beyond transparency, CFG seeks to move from principles to practice, including cooperative, transdisciplinary research. It is currently exploring – together with relevant institutions – what types of policy options it might help advance, including building on the EU-funded Co- CREATE project, which examines the conditions for an SRM research governance framework, and existing frameworks such as the Oxford Principles and the 2017 Code of Conduct for Responsible Geoengineering Research.

What would you consider the best way forward on SAI research?

(e.g. data supply, public funding, governance of research, field tests)

SAI research should ideally be internationally collaborative, publicly funded, and transparent. Data and research protocols should be shared and coordinated. Research should invite the scrutiny of other disciplines and inputs from wider society through accessible communication of each project's research goals and findings, e.g., in a repository.

Researchers' guiding ethos should be a deep-rooted desire to decrease human suffering, ensure sustainable development, and break humanity's addiction to harmful fossil fuels. Intellectual property rights should be in the hands of the public, not individual researchers or companies.
Research should be done in a way that answers pressing knowledge needs among decision-makers at the local, national, regional and global levels so that they can do their job.

Deployment

What kind of conditions are needed for SAI deployment?

CFG is not advocating for deployment. The world is simply not ready for a global, science-based and well-governed SAI deployment. Those conditions are at least a decade away. International policymaking takes time. The sooner policymakers start strengthening governance, the better.

Among the conditions that need to be met, technological readiness (of aircraft and related hardware) might be the least challenging to achieve. More challenging might be to reach the conditions of sufficient agreement within the international community to make well-informed decisions. These include how to phase in, monitor and provide options for phasing out again if deployment needs to be halted.

More broadly, society is largely unaware of the stakes involved, including potential risks and benefits. Far more public discussion is needed around not only the physical consequences of SAI but also its societal and political impacts and whether humanity is willing to take the profound and ethically fraught step towards deliberate large-scale manipulation of the climate system.

Some researchers, however, say that SAI may be doable – haphazardly and at a sub-scale level – by 2030. This means it might be deployed irresponsibly, for commercial gain, or as a provocation or political bargaining chip in the absence of responsible multilateral governance. The result could be geopolitically destabilising.

This raises vexing questions with no simple answers. How might policymakers decide whether SAI is less risky than overshooting particular temperature levels? What metrics should they employ, against what ethical standards, and how should they deal with scientific and political uncertainty?

Responsible and inclusive research, deliberation, and governance are prerequisites to answering these questions. Efforts in these areas can help increase public input and accountability, connect the dots between issues and actors, and facilitate information flows. Dedicated efforts will need to foster a society-wide debate on this issue, empowering in particular youth and those most vulnerable to climate impacts.

Since SAI would have global impacts, governance also needs to be global. Broad international alignment between governments and their populaces on the form, scale and intended timeline and objectives will be critical. Since SAI might need to be continued for decades to centuries, continuity will need to be ensured. This is not easy to ensure at a time of rising geopolitical tensions and eroding confidence in multilateral processes.

Deployment

Could the adverse impacts of SAI be minimised?

SAI does not simply "turn back the clock" on climate change. This means that there are potentially adverse impacts that need to be researched and debated openly. But SAI risks and uncertainties are to be seen in the context of the risks of a heating planet. Some countries might benefit, others less so. Idealised deployment scenarios might leave most better off compared with the impacts of 2–3°C warming in 2100 and even more thereafter. Less ideal and perhaps more likely scenarios may cause harm, for instance, by altering precipitation patterns if the cooling is uneven.

Whether and how such an ideal case deployment might be achieved is an open question. Much more research is needed on the potential impacts, for good or for ill, of SAI on the Sustainable Development Goals to minimise adverse impacts.

Science can give some indications of how adverse impacts might perhaps be minimised: The impacts of SAI strongly depend on the amounts of aerosols used and for how long, where they are injected in both hemispheres, and the international community's ability to detect, attribute, and adapt to rapidly changing conditions. An ideal-case deployment might involve a gradual phase-in of deployment. It would be accompanied by monitoring for climate responses, efforts to identify potential corrective measures and deliver support to aid vulnerable populations adapt to residual changes. It would also anticipate possible off-ramps to phase out deployment in case needed.

Are you afraid of a rogue deployment or the involvement of private companies in SAI research?

Yes, CFG is concerned about these possibilities, especially if they are not transparent or lead to SRM research for profit rather than the good of humanity.

On the one hand, fears of one or more wealthy individuals deploying SAI and changing the global climate may be exaggerated, as deployment without the knowledge and tacit acceptance of governments seems highly challenging. They would need access to numerous air bases in both hemispheres and a significant global aircraft infrastructure.

At the same time, there is currently a lack of governance frameworks to prevent this. Entry barriers to serious deployment are high, but there may be numerous actors with both the means and motivation to do so. Commercial actors have already entered the field, raising questions about intellectual property rights and corporate profits taking precedence over concerns for society. The potential consequences of a rogue or private deployment are sufficiently grave that they must be taken seriously, however unlikely.

Science-Policy

What is the EU scientific advice, and what is your view on their recommendations?

In December 2024, the EU Scientific Advisors and Group on Ethics, at the Commission's request, released an independent expert review on Solar Radiation Modification (SRM). They explore the risks, opportunities, and governance of SRM research and potential deployment, building on the EU's 2023 climate-security nexus communication and a scoping paper.

We fully agree with the Advisors' call to prioritise emissions cuts (Recommendation 1) and keep SRM deployment off the table for now (Recommendation 2). However, we caution that responsible publicly funded research is needed (in line with recommendation 4 below). Without public research funding, Europe falls behind in expertise and information while others advance. Indeed, the EU should lead in global governance (3), fostering transparency, including at the international level via UNEP and WCRP, to build trusted scientific and diplomatic relationships and prevent uncoordinated deployment. Public consultations (3.2) and citizen assemblies (5.2) are vital to shaping fair governance, with early data showing stronger support for SRM research in the Global South.

Large-scale testing indeed needs international oversight (3.3), but thresholds must be clear to avoid deterring small-scale experiments. We agree with the necessity of preventing militarisation (3.4) and the use of misleading cooling credits (3.6), though collaborative monitoring might need to come before any international treaties seeking to curb rogue use. Satellite-based detection (3.5) and robust research guidelines (4) are essential, and SRM studies should be publicly funded (4.3) to comprehensively strengthen understanding of risks, side-effects and uncertain potentials.

Finally, regular evidence reassessment (5) should, in our view, happen more often than every five years, since climate breakdowns and international developments can happen quickly.

Does research automatically lead to deployment?

No, we believe that research and deployment can and should be distinguished in order to have a clear policy discussion. Researching climate interventions and deploying those uncertain planet-cooling technologies are not the same.

There are large differences in the environmental issues as well as the political implications between desk-based research, small-scale field experiments, larger tests, technology development and ultimately the use of SRM. Research can also clarify why and how we could prevent reckless deployments by powerful actors, including by considering geopolitical dimensions and diverse viewpoints and expertise. We unpack these differences and views of different communities on the matter in a dedicated brief.

Science-Policy

How is the Intergovernmental Panel on Climate Change addressing SRM?

The Intergovernmental Panel on Climate Change (IPCC) is set to address SRM from two primary angles in its Working Group I and II reports that will be published in 2028. So far, it has addressed SRM tangentially, with the sixth assessment report (AR6) featuring a cross-chapter box spanning several pages. The box explored SRM's potential to reduce climate threats, alongside its associated risks and governance challenges, setting the stage for further analysis in the future.

In late February, the IPCC convened to finalise the chapter outlines for its seventh assessment report (AR7), anticipated to be released in 2028. This report will address SRM in two parts: Working Group I (which assesses the physical science of climate change) will summarize the Earth system's responses to SRM, while Working Group II (which assesses the impacts, adaptation and vulnerabilities related to climate change) will delve into its risks, risk management strategies, and ethical dimensions.

What is the World Climate Research Program, and how is it addressing SRM?

The World Climate Research Programme (WCRP) is an international effort dedicated to advancing climate science to support informed decision-making. The programme builds on its work on climate models to coordinate and communicate on SRM research. It is sponsored by the World Meteorological Organization (WMO), the International Science Council (ISC), and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

Via a dedicated lighthouse initiative, it seeks to address SRM as one of three types of climate intervention. It seeks to foster inclusive international scientific collaboration to build a robust, equitable scientific foundation and inform international discussions on policy and governance.[3]

[3] This article outlines options for WCRP's contributions: Climate intervention research in the World Climate Research Programme: a perspective

CFG

What resources does CFG offer on this issue?

The CFG team working on climate interventions seeks to listen and learn from stakeholders to identify and put forward opportunities for no-regret governance options. This includes briefs and longer reports on key science and governance aspects of climate interventions. We also provide a quarterly information update, which you can subscribe to on our website (at the very bottom).

We continually look for suggestions on how our work can be most useful to policymakers in Europe and abroad. Get in touch with us if you have knowledge requests or any other questions.

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