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# Policymakers' FAQ: Climate Interventions

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Answers to the top questions raised by EU policymakers during initial consultations with ICFG in early 2024.



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## Why study this issue? Why now?

**The climate crisis is rapidly worsening and the world is on course for a 3°C rise, significantly exceeding the Paris temperature goals. Civilization as we know it would be fundamentally transformed. There is thus growing interest in powerful new technological interventions in the climate system 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 uncontrolled 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 are 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.

## 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 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 solar radiation modification (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 also address carbon dioxide removal besides SRM. Co-CREATE focusses on the governance of SRM research. The total amount of EU funding that has

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explicitly gone into SAI research is thus significantly less than €7m. These numbers, however, do not count basic research of relevance to SAI.

Meanwhile, SRM research funding in the US may have surpassed €50m though there are currently no reliable estimates. A growing number of researchers in other countries including the UK (€5m), China (€3m), and a growing number in the Global South study 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 need to 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.

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## What are the main obstacles to SAI research?

**Researchers, funders and civil society have been reluctant to study SAI for multiple reasons, including concerns 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 causes a lack also 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 both to researchers and research funders struggling with making sense of these issues.

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## What do you think about outdoor tests?

**The decision to do outdoor testing is both scientific and political and requires input from scientists and broader publics. 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 with the intention of studying SAI has particular resonance. This has in practice led to opposition - centering on concerns that testing might be a step toward deployment; regarding a lack of sufficient consultation, and environmental and climate impacts 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 may be required to fill critical gaps in knowledge.

Responsible research, including greater transparency and international monitoring - can help mitigate risks from outdoor testing. ICFG 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.

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

**One of the greatest 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, ICFG 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 done in an internationally collaborative, publicly-funded, transparent fashion. 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.**

The guiding ethos of researchers should be a deep-rooted desire to decrease human suffering and ensure sustainable development, while also breaking humanity's addiction to harmful fossil fuels. Intellectual property rights should be in the hands of the public and 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?

**ICFG 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 the governance the better.**

Among the conditions that would 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 needed to be halted.

More broadly, society is not sufficiently aware and informed 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.

Do you think that adverse impacts of SAI could be minimised? How?

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 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 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 would likely aim to gradually phase-in 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, ICFG 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.



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