

Employing a Broader Policy Toolkit to Mitigate Climate Change Risks

For three decades, advocates for climate change policy have simultaneously emphasized the urgent need to take ambitious actions to mitigate greenhouse gas emissions while providing false reassurances of the feasibility of doing so. This policy prescription has relied almost exclusively on a single tool: reducing the emissions of carbon dioxide and other GHGs. We are discovering, however, that this exclusive approach is not sufficient to combat climate change's deadly effects.

Furthermore, mitigation of GHG emissions has a poor track record. Atmospheric concentrations are up by more than 40 percent above baseline, and since mitigation efforts began around 1990 global CO₂ emissions have increased 60 percent and temperatures have increased at an accelerating rate. The coordinated efforts among nations of the world have fallen way short.

Looking to the future, our prospects are no better. The 2015 Paris Agreement called for a limit to global warming of "well below" 2 degrees Celsius relative to pre-industrial levels. Pursuing such a goal through emissions mitigation alone would likely require global CO₂ emissions from the energy system to be net negative over the second half of this century. Given the technological challenges, the economic costs, and the lack of political will, the odds of achieving the necessary transformation are bleak. In short, the one-prong strategy of emissions mitigation has not worked to control climate change risks.

In our recent paper "Three Prongs for a Prudent Climate Policy," Richard Zeckhauser and I evaluate a broader policy portfolio to combat climate change. In particular, we explore adding amelioration — through solar radiation management, or SRM — and adaptation to the emissions mitigation

approach to climate change policy.

Each of the three prongs targets a different dimension of climate change risks. Mitigation reduces the flow of emissions to the atmosphere, SRM offsets some of the warming associated with the accumulation of CO₂ in the atmosphere, and adaptation reduces damages for a given amount of warming. Expanding policy toolkits in this way would strengthen global efforts to reduce climate change risks, and do so at far lower cost than the one-prong, approach that is the status quo.

The risk of foregoing solar radiation management is larger than pursuing it

The potential of SRM interventions, such as through the injection of small particles into the upper atmosphere to offset some human-caused global warming, is evident from natural experiments. For example, past volcanic eruptions sent substantial quantities of particles into the atmosphere and temporarily cooled the Earth by a significant amount.

The financial costs of SRM would be modest, too. Indeed, the direct costs of implementing SRM are orders of magnitude lower than those of emissions mitigation and adaptation. They are dramatically lower than the harms the world will bear over generations to come as the planet continues to warm. The prospect of indirect costs, such as unintended adverse consequences from SRM, need to be weighed fully and merit serious research. However, the risks of foregoing SRM appear greater than the risks of pursuing it.

Some environmental advocates are deeply concerned that employing SRM — or even considering it — would create a form of moral hazard by potentially reducing incentives to cut CO₂ emissions. Several economic analyses have shown that implementing SRM could reduce the magnitude of emission abatement necessary to limit glob-



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al warming. And SRM is an imperfect substitute, since it does not address the adverse effects of ocean acidification resulting from higher atmospheric concentrations.

This potential moral hazard concern, however, pales in comparison to the free-riding incentive that has plagued emission mitigation efforts since the 1992 Earth Summit. As the costs of reducing emissions are local but the benefits are global, individuals, businesses, and governments have an incentive to defer to others to undertake cuts.

Moreover, in contrast to the moral hazard reservation, we observe that SRM deployment might serve as an "awful action alert" that galvanizes more ambitious emissions mitigation. The prospect that governments would begin daily injections of particles into the upper atmosphere to combat climate change could make the need to cut emissions and change the way the world produces and consumes energy all the more salient to the public.

Pursuing each of these prongs would increase the likelihood of avoiding catastrophic climate change impacts and doing so would impose lower costs than a mitigation-only approach. We should also stress that massive uncertainties accompany each of the three policy prongs, their interplay, and the consequences of a warming planet. An effective policy will require us to optimize decisionmaking under uncertainty. We will learn as we go, and now is the time to go.