Mitigation Versus Solar Geoengineering: The Role of Time Preference

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What happens when solar radiation management (also called solar geoengineering) is added to the toolbox for tackling climate change? Mariia Belaia, a post-doctoral fellow at Harvard SEAS, presented work in progress on this topic in Monday's energy policy seminar.

Belaia began with a brief explanation of what solar radiation management (SRM) is. In contrast to traditional methods of climate mitigation, which focus on decreasing global climate change by reducing the greenhouse gas emissions that trap heat from the sun, solar radition management would attempt to partially counterbalance the warming impact of greenhouse gas emissions by blocking some of the sun's rays through the release of particulates (of some not yet determined kind) into the stratosphere.

Belaia explained how she and her co-authors, David Keith and Gernot Wagner (both of Harvard) have been using economic modeling to examine the potential economic impacts of SRM, including in the model damages caused by potential SRM side-effects (these are still being studied, but might include things like reduction in agricultural output in response to less penetration of sunlight throught the atmosphere) as well as damages prevented by its reductions in global warming, and assessments of how these costs and benefits interact with the costs and benefits of climate mitigation (reducing greenhouse gas emissions) and with the inherent uncertainty involved in predicting damages from climate change.

In order to examine these questions, Belaia and her co-authors are extending the DICE model (the Dynamic Integrated Climate-Economy model developed by William Nordhaus) to include the potential use of SRM and also to better model uncertainty about climate damages. The extended model (DICE-SRM) incorporates variables that can refect negative radiative forcing (cooling) resulting from SRM, as well as the cost of damages related to SRM, which are assumed to grow proportionally along with greater use of SRM.

Belaia presented some prelimary findings from the DICE-SRM model. Overall, Belaia found, solar radiation management is far from a "magic wand" capable of undoing all the effects of greenhouse gas emissions; however, including SRM in the model does change the "optimal" path for carbon emissions reductions, offering a little more than twenty extra years before the target deadline for zero emissions (a path which may better reflect limited speed of success to date in emissions reductions, Belaia noted), along with a slight reduction in estimated mean temperature increases resulting from this combination of emissions reductions and SRM. As a result, the use of SRM somewhat reduces the social cost of carbon, since some of the negative impacts of carbon emission warming can be prevented through SRM—however, in all the scenarios Belaia examined, warming still occurs and SRM carries its own costs, so the reduction in the social cost of carbon is relatively small (ranging from approximately 2% to 25%, depending on what assumptions are made about the discount rate and the level of climate sensitivity).

Belaia and her co-authors plan to extend their analysis to include technologies for direct removal of carbon dioxide from the atmosphere. Belaia spoke as part of the Kennedy School's Energy Policy Seminar Series, which is sponsored by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government.