The feasibility of transformation pathways for achieving the Paris Climate Agreement

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What drives the feasibility of climate scenarios commonly reviewed by organizations like the Intergovernmental Panel on Climate Change (IPCC)? And can they actually be achieved in practice? A new

systematic framework can help understand what to improve in the next generation of scenarios and explore how to make ambitious emission reductions possible by strengthening enabling conditions.

While the IPCC is in the midst of the drafting cycle of the Sixth Assessment Report, whose publication will start in the second half of 2021, there is an ongoing debate on how to assess the feasibility of ambitious climate mitigation scenarios developed through integrated assessment models and to what extent they are actually achievable in the real world. In their new study published in *Environmental Research Letters*, researchers from IIASA and the RFF-CMCC European Institute on Economics and the Environment (EIEE) developed a systematic framework that allows identifying the type, timing, and location of feasibility concerns raised by climate mitigation scenarios.

"Feasibility—in other words, how plausible it is that a scenario materializes in the real world—is a complex concept that is currently getting significant academic attention. In our research, we built on past advancements in theoretical discussions and propose to operationalize feasibility in terms of the timing, disruptiveness, and scale of transformation across geophysical, technological, economic, institutional, and sociocultural feasibility dimensions," explains the paper's first author, Elina Brutschin, researcher in the IIASA Transformative Institutional and Social Solutions Research Group.

"Another major insight concerns the necessity to improve the assessment of socio-cultural feasibility concerns by including more indicators and incorporating insights on attitudes and behavioral changes from the social sciences," says Silvia Pianta, a postdoctoral researcher at EIEE and Ph.D. fellow at Bocconi University.

"We found that the current generation of scenarios does not explore demand-side mitigation to its full potential and that more research is

necessary in this area," adds coauthor Bas van Ruijven, IIASA Sustainable Service Systems Research Group leader.

To address these issues, the researchers developed a feasibility evaluation of indicators in each decade, with a flexible aggregation procedure that allows assessing feasibility concerns across dimensions and time. This flexible approach enabled them to look at the "big picture" to, for instance, assess which dimension raises major feasibility concerns, but also to analyze more detailed questions such as trade-offs over time, both within and across different dimensions. The resulting systematic framework is extremely useful, not only to understand what to improve in the next generation of scenarios, but also to analyze more systematically what type of enabling factors might bring us closer to more ambitious mitigation paths in the future.

The authors specifically applied the framework to the publicly available scenario set from the IPCC Special Report on Global Warming of 1.5°C and found that many scenarios currently assume a relatively fast overall decarbonization rate in regions that have a relatively low mitigation capacity. According to Brutschin, this suggests that many feasibility concerns are related to institutional constraints such as government effectiveness. While improving the quality of governance in many regions might be complicated, targeted capacity building and investments can significantly contribute to overcoming this challenge.

The authors highlight that the framework allows tracing important trade-offs over time, noting that while past studies focused on mitigation costs, the new research clearly shows that delayed climate action might generally be much more risky than an early disruptive transformation as delayed action requires an overall larger system to be transformed much faster and by relying on new technologies. In this regard, a better understanding of inter-temporal and inter-dimensional trade-offs incorporating insights from experts and policymakers is essential to take

the overall understanding of the feasibility concepts to the next level.

"The new versatile framework that emerged from this collaborative project can be applied to any set of scenarios and can be constantly improved by incorporating new insights from the empirical literature on what is feasible in the real world. Although it was originally developed to evaluate global scenarios, it can be adjusted to have a more systematic evaluation of regional or national feasibility concerns in the future," notes IIASA Energy, Climate, and Environment Program Director, Keywan Riahi, who is also a coordinating lead author in Working Group III of the IPCC Sixth Assessment Report.

In addition to the new framework, the researchers also developed an interactive visual tool with key contributions by Giacomo Marangoni, a researcher at EIEE and Assistant Professor at Politecnico di Milano.

"A new data visualization method is extremely valuable when looking at multidimensional concepts such as feasibility. The tool we developed allows us to visualize our feasibility evaluations for different scenarios and to assess the sensitivity of our results to the definition of different feasibility concern thresholds," he says.

More information: Brutschin, E. et al. (2021) A multidimensional feasibility evaluation of low-carbon scenarios. *Environmental Research Letters* DOI: 10.1088/1748-9326/abf0ce

The data visualization tool can be accessed here: data.ece.iiasa.ac.at/climate-a … asibility-dashboard/

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