Balancing technology and governance are key to achieving climate goals, study highlights

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Despite advancements in clean energy, global CO_2 emissions continue to rise. IIASA researchers contributed to a new international study that underscores the importance of integrating technological advancements

with robust institutional capacities to formulate effective climate policies.

The Paris Agreement's goal to limit global warming to 1.5°C demands rapid reductions in CO_2 emissions and heightened attention to non-CO_2 greenhouse gases. Despite advancements in clean energy, global CO_2 emissions have risen steadily over the past three years following the initial decline during the COVID-19 pandemic in 2020.

The study, published in *Nature Climate Change*, was led by the Center for Global Sustainability (CGS) at the University of Maryland, in partnership with the IIASA-led, Exploring National and Global Actions to reduce Greenhouse gas Emissions (ENGAGE) project—a global consortium of international and multidisciplinary leading research groups.

"These new insights highlight the critical challenges in meeting the Paris Agreement's long-term goals given recent global climate-damaging emissions trends," notes Bas van Ruijven, study co-author and coordinator of the ENGAGE project.

The authors set out to co-produce knowledge for designing cost-effective, technologically sound, socially and politically feasible pathways that can meet the objectives of the Paris Agreement.

Using eight state-of-the-art multi-regional and process-based global integrated assessment models (IAMs), along with a set of 20 different feasibility scenarios in their analysis, the team found that the institutional dimension (i.e., accounting for limits of countries to enable effective climate regulation) has the largest influence on feasible peak temperature.

"Through rigorous analysis of climate scenarios across eight different

models, our research underscores the importance of accounting for the varying capacities of countries as well as regional differences," explains Christoph Bertram, CGS Associate Research Professor and study lead author.

"By combining institutional constraints with technological and socio-cultural factors, we show that the most feasible pathways to achieve the Paris climate goals differ from the most widely used cost-effective benchmarks."

"From an international fairness perspective, this also means that today's affluent countries like the US and the EU not only need to reach their net-zero targets, but they need to think about multilateral collaborations to enhance the governance and institutional capacity in vulnerable regions," adds study co-author and IIASA Energy, Climate, and Environment Program Director, Keywan Riahi.

The study integrates region-specific governance indicators to showcase the capacity for implementing climate mitigation policies effectively.

This innovative approach builds on earlier work done in the ENGAGE project to assess the feasibility of transformation pathways for achieving the Paris Climate Agreement, which served as a basis for the new scenario development.

The tools and approaches developed as part of the ENGAGE project to explore the multidimensional feasibility of these decarbonization pathways, have been made available to decision makers in a Summary for Policymakers. The new study provides an additional nuanced framework that can be used in future studies for representing institutional capacity across different regions and over time.

"These new scenarios explore the implications of having many countries

that potentially lack the institutional capacity to implement ambitious climate policies," said co-author Elina Brutschin, a researcher in the IIASA Transformative Institutional and Social Solutions Research Group.

"With additional strategies such as rapid demand-side transformation—especially in affluent countries—combined with fast electrification, it could still be possible to limit peak temperature to below 1.7°C."

"Thanks to the latest advances in low carbon technology deployment such as solar, wind or electric vehicles, the technological feasibility of climate-neutrality is no longer the most crucial issue," noted co-author Gunnar Luderer, lead of the Energy Systems Group at the Potsdam Institute for Climate Impact Research (PIK) and Professor of Global Energy Systems Analysis at the Technical University of Berlin.

"It is much more about how fast climate policy ambition can be ramped up by governments."

The research underscores the importance of balancing technological advancements with institutional capabilities in formulating effective climate policies and demonstrates that inadequate institutional capacity could hinder reaching even 2°C, whereas improved global institutional support could enhance the likelihood of achieving 1.6°C targets by 25–45%.

As efforts intensify towards the 1.5°C goal, it is imperative for global stakeholders to identify pathways that enhance the feasibility of climate actions and reduce carbon costs.

The study's findings provide valuable insights for guiding ongoing climate policy discussions and future scenario assessments, thereby

supporting informed global climate ambitions decision-making.

More information: Bertram, C., et al, Feasibility of peak temperature targets in light of institutional constraints. *Nature Climate Change*. (2024) DOI: 10.1038/s41558-024-02073-4