2021

HAMBURG CLIMATE FUTURES OUTLOOK

Assessing the plausibility of deep decarbonization by 2050

Universität Hamburg
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CLUSTER OF EXCELLENCE
CLIMATE, CLIMATIC CHANGE, AND SOCIETY (CLICCS)

About CLICCS

Researchers from a wide range of disciplines have joined forces at the Cluster of Excellence CLICCS (Climate, Climatic Change, and Society) to investigate how climate and society will co-evolve. The CLICCS program is coordinated through Universität Hamburg's Center for Earth System Research and Sustainability (CEN) in close collaboration with multiple partner institutions and is funded by the Deutsche Forschungsgemeinschaft (DFG).

About the Outlook

In the annual *Hamburg Climate Futures Outlook*, CLICCS researchers make the first systematic attempt to assess which climate futures are plausible, by combining multidisciplinary assessments of plausibility.
The inaugural 2021 *Hamburg Climate Futures Outlook* addresses the question: Is it plausible that the world will reach deep decarbonization by 2050?

DOI: 10.25592/uhhfdm.9104
URL: www.cliccs.uni-hamburg.de/results/hamburg-climate-futures-outlook.html

Citation

Stammer, Detlef; Anita Engels; Jochem Marotzke; Eduardo Gresse; Christopher Hedemann; Jan Petzold (eds.); 2021. *Hamburg Climate Futures Outlook 2021. Assessing the plausibility of deep decarbonization by 2050*. Cluster of Excellence Climate, Climatic Change, and Society (CLICCS). Hamburg, Germany.

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Acknowledgements
Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy – EXC 2037 'CLICCS — Climate, Climatic Change, and Society' – Project Number: 390683824, contribution to the Center for Earth System Research and Sustainability (CEN) of Universität Hamburg.

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Implications for climate futures

The findings of this *Hamburg Climate Futures Outlook* present the currently available evidence for how physical and social dynamics influence climate futures. By combining physical and social plausibility assessments, we go beyond previous considerations of normative desirability or techno-economic feasibility (Box 1). The social plausibility assessment compels us to characterize the scenario of deep decarbonization by 2050 (Section 3.4) as currently not plausible (Section 5.3.1). Our assessment also shows the conditions under which the driver dynamics might change substantially and increase the plausibility of deep decarbonization by 2050 (Section 5.3.3). Our joint social and techno-economic plausibility assessments allow us to characterize both the highest and the lowest of the high-priority SSP scenarios as not plausible. Combining this finding with new assessments of climate sensitivity provides new upper and lower bounds for plausible global surface warming during the twenty-first century. We find that surface warming by 2100 of less than approximately 1.7°C relative to pre-industrial levels is not plausible, as is surface warming of more than approximately 4.9°C. In particular, we find that limiting global warming to below 1.5°C is currently not plausible (Section 6.1).

Our findings have several and in part opposing implications for climate action. First, societal actors who count on very low emissions scenarios and the lower end of the global surface warming range may feel greater urgency to increase the ambition and pace of climate mitigation and adaptation measures. By contrast, societal actors who orient themselves toward very high emissions scenarios and the higher end of the warming range might consider such futures to be less plausible, which could lead them toward reduced impetus for climate action. Finally, the uncertainty range for regional temperature change is shown to be larger than commonly appreciated (Section 6.3). Societal actors and decision-makers may therefore feel the need to re-evaluate what extremes in temperature they must prepare for.

Decision-makers must also consider future scenarios that include more than global and regional temperature changes. For developing appropriate adaptation strategies, changing precipitation patterns or sea-level changes may be more immediately relevant than temperature change. Possible trade-offs between different adaptation pathways, and between adaptation and mitigation strategies, must also be addressed in the policy process. Moreover, as important and urgent as climate change may be, it always competes for attention with other immediate problems that decision-makers must consider. Future versions of the *Hamburg Climate Futures Outlook* may examine some of the processes that are involved in such decision-making for climate futures.

What does our assessment mean for climate futures? Deep decarbonization by 2050, while currently not plausible, is not impossible. However, if deep decarbonization is to be achieved by 2050, it requires increased societal pressure and political momentum for climate action, the implementation and worldwide diffusion of climate-friendly laws, policies, and infrastructures, and the redirection of financial resources away from fossil fuel engagements toward climate mitigation. We conclude from our social plausibility assessment that long-term pledges in line with deep decarbonization are insufficient on their own. Effective, short-term actions that align with these long-term pledges must also be taken in the coming decade. Otherwise, deep decarbonization by 2050 will indeed become impossible.

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