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HAMBURG CLIMATE FUTURES OUTLOOK

Assessing the plausibility of deep decarbonization by 2050



Key Findings (1/2)

There are many possible futures of climate, but not all possible futures are also plausible. Because climate futures arise from a complex combination of social and physical dynamics, estimating their plausibility requires insights from multiple disciplines. The inaugural *Hamburg Climate Futures Outlook* makes the first systematic attempt to assess the plausibility of various climate futures. We deem climate futures to be plausible if we expect them to unfold with appreciable probability, given the existing evidence from the physical and social worlds.

In this *Outlook*, we combine complementary assessments of physical and social dynamics, starting with a review of the techno-economic plausibility of very high and very low CO₂ emissions scenarios. We find evidence from the scenario literature which suggests that very high emissions scenarios are internally inconsistent, due to the extent of economic damages from climate change, the falling cost of clean energy, and limits to recoverable coal reserves. The literature also provides some degree of evidence against the plausibility of large-scale deployment of carbon dioxide removal technologies, which is a common requirement of very low emissions scenarios.

Very low emissions scenarios, if they are designed to achieve the Paris Agreement's 1.5°C target, additionally require decarbonization of the global economy by around the year 2050. Many known technical or economic options would in principle achieve this decarbonization goal in time. Yet existing assessments have only begun to evaluate the plausibility of the societal transformations necessary for deep decarbonization. Such a plausibility assessment requires the definition of the political, economic, and cultural conditions under which the necessary transformations become plausible. The existing empirical evidence can then be weighed against this theoretical model of transformation.

We therefore propose the Social Plausibility Assessment Framework, a framework that enables the analysis of the social drivers of decarbonization, their enabling and constraining conditions, and emerging resources and structures that could influence plausible future developments of these drivers. None of the ten social drivers studied show sufficient movement toward deep decarbonization. Some of these drivers — namely United Nations climate governance, transnational initiatives, climate-related regulation, climate litigation, fossil fuel divestment, and knowledge production-support decarbonization, but without sufficient momentum to drive deep decarbonization by 2050. For two drivers-climate protests and social movements, and journalism—the momentum toward or away from deep decarbonization by 2050 could not be assessed. Two further drivers - consumption patterns and corporate responses-currently oppose decarbonization.

Therefore, we find that unless the enabling conditions of social drivers deliver a radical boost to these drivers in the coming years, reaching worldwide deep decarbonization by 2050 is not plausible (see Figure 1). This result implies that, even if

Key Findings (2/2)

techno-economic options for decarbonization are theoretically available, reaching deep decarbonization by 2050 constitutes a societal challenge that may well be much larger than assumed by many.

However, six of the evaluated social drivers show movement toward decarbonization, and many drivers offer resources that could be utilized by societal actors to strengthen the enabling conditions and therefore increase the plausibility of decarbonization in the future. Therefore, partial decarbonization by 2050 remains plausible under our current social assessment.

The finding that deep decarbonization by 2050 is currently not plausible adds to the evidence speaking against the overall plausibility of very low emissions scenarios for the entire twenty-first century. Combined with the recently identified, narrower range of climate sensitivity, this indicates that limiting global surface warming below about 1.7°C by 2100 is currently not plausible. The new climate sensitivity range, combined with our techno-economic plausibility assessment, also constrains the upper bound of plausible warming, so that global surface warming above about 4.9°C by 2100 is likewise currently not plausible.

This assessment of plausible climate futures represents a judgement that synthesizes currently available evidence. However, social agency can always produce departures from expected trajectories. For deep decarbonization by 2050 to become plausible, much will depend on public pressure via protests, organized action, and climate litigation, so that governments around the globe are increasingly driven towards policies that support change, not only via goals and pledges, but by consistent action. Furthermore, the complex interrelations within social dynamics can produce unforeseen disruptions, and events like the COVID-19 pandemic can happen at any time. Should additional evidence, including that from unexpected events, necessitate modifications of our assessment, this will be reflected in future editions of the *Hamburg Climate Futures Outlook*.