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Assessing the plausibility of climate futures

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Assessing the plausibility of climate futures

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Anita Engels^{1,3,*}  and Jochem Marotzke^{2,3} RECEIVED
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13 January 2023¹ Center for Sustainable Society Research, Universität Hamburg, Hamburg, Germany² Max Planck Institute for Meteorology, Hamburg, Germany³ Center for Earth System Research and Sustainability, Universität Hamburg, Hamburg, Germany

* Author to whom any correspondence should be addressed.

E-mail: anita.engels@uni-hamburg.de**Keywords:** plausibility, climate futures, climate change, social plausibility assessment, decarbonization, deep uncertainty

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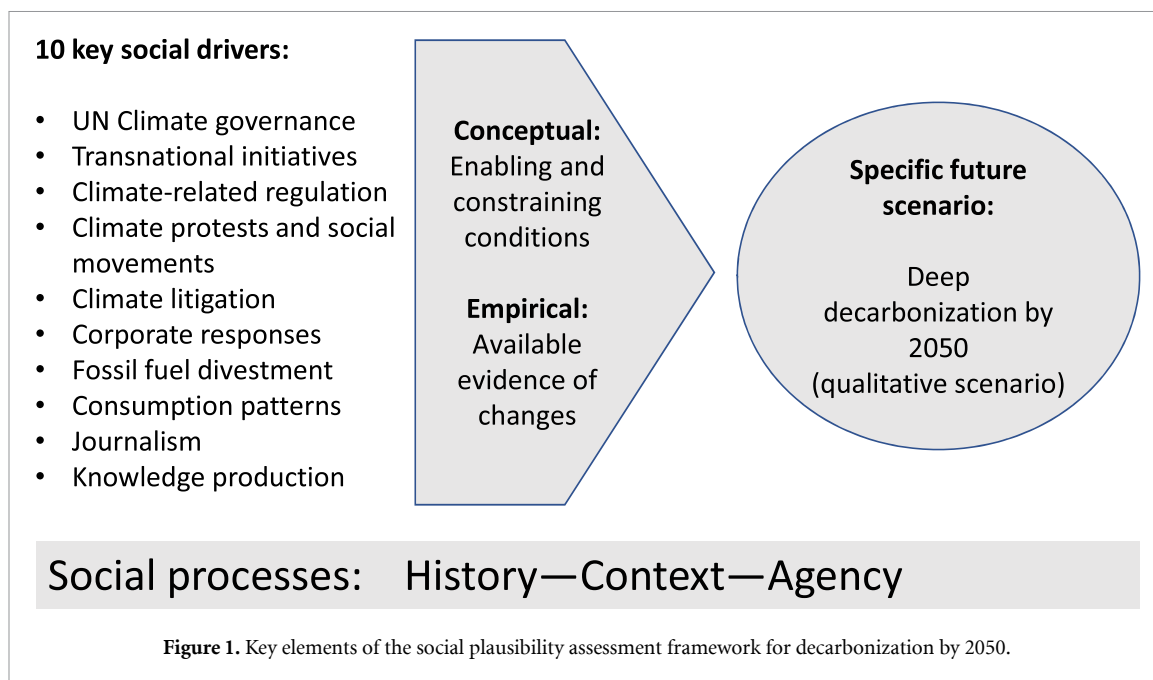
The gap between the science of climate change and global action to prevent climate change is breathtaking. While the temperature goals defined in the Paris Agreement of 2015 suggest that a complete decarbonization of human activities should be achieved by around 2050 and certainly no later than 2070, in the real world we still measure rising greenhouse gas emissions (IPCC 2021, 2022, SEI *et al* 2021, UNEP 2021).

So where is society heading? Can we tell as scientists which climate future lies ahead of us if we try to get a realistic understanding? The continuously rising global CO₂ emissions imply that achieving the Paris Agreement goals requires ever steeper CO₂ emissions reduction curves if reduction starts later rather than sooner. We know that theoretically these reductions are still possible (e.g. IPCC 2018), but can the steep curves realistically be expected? Will available technologies be adopted to the necessary degree? Under what conditions do they become more realistic? In a large interdisciplinary climate research cluster we have developed a new assessment framework (Aykut *et al* 2021, Stammer *et al* 2021) that helps us understand the plausibility of certain climate futures. We briefly introduce the method, explain the basic outcomes, and discuss the implications for climate action.

Many different climate futures are *possible*, both in terms of physical and social parameters. To focus on the social parameters for a moment: extremely different climate futures are all *possible*. The world *might* see a phase of enhanced global collaboration, motivated by the biggest global food crisis that it has seen in modern times, a possible consequence of Russia's war against Ukraine (Jagtap *et al* 2022). This new level of cooperation might help in actually achieving decarbonization (Lombardo and Sambetta 2020, Tollefson 2022). However, it is *just as possible* that the war extends to a global scale, becomes an atomic war, and destroys the basis for industrial production on the

planet (Sethi 2022). This would replace the current problem of climate change by much bigger ones. And third, it is *equally possible* that the world will see rising emissions over the next decade, because war is essentially a carbon-intensive practice (Perreira *et al* 2022), and a long war leading to global economic turmoil might be used to shift priorities away from decarbonization to much more directly pressing social issues.

Many would have a gut feeling about the likelihood of these three possible climate futures. But is it possible to determine scientifically just how likely these different paths are? A number of authors have suggested ways to improve our capability of predicting social processes, the likelihood of collective action, and the outcomes of such action (Tetlock and Gardner 2016, Bak-Coleman *et al* 2021, Moore *et al* 2022). For a number of reasons we depart from this approach. We start from the assumption of deep or fundamental uncertainty in which the basis is lacking that would allow the calculation of probabilities (Beckert 1996, Dequech 2000, Constantino and Weber 2021). The reasons for this uncertainty are at least threefold: complexity, the possibility of systemic changes, and reflexivity. First, even though social scientists can say a lot about future trends of isolated social dynamics, these trend extrapolations rely on *ceteris paribus* conditions and the absence of disruptive events (Pielke Jr *et al* 2022). In reality, the complexities of interconnected dynamics and disruptive events render a probability calculation futile. Second, unlike the laws of nature that inform climate physics, the laws of the social world can change fundamentally within a few years only. For example, a world in which multilateralism is strong differs along many key dimensions from a world in which multilateral institutions are weak or non-existing (Viola 2020). And third, even if scientists were able to calculate the probability of a certain climate future, this information would inevitably become part of the social world



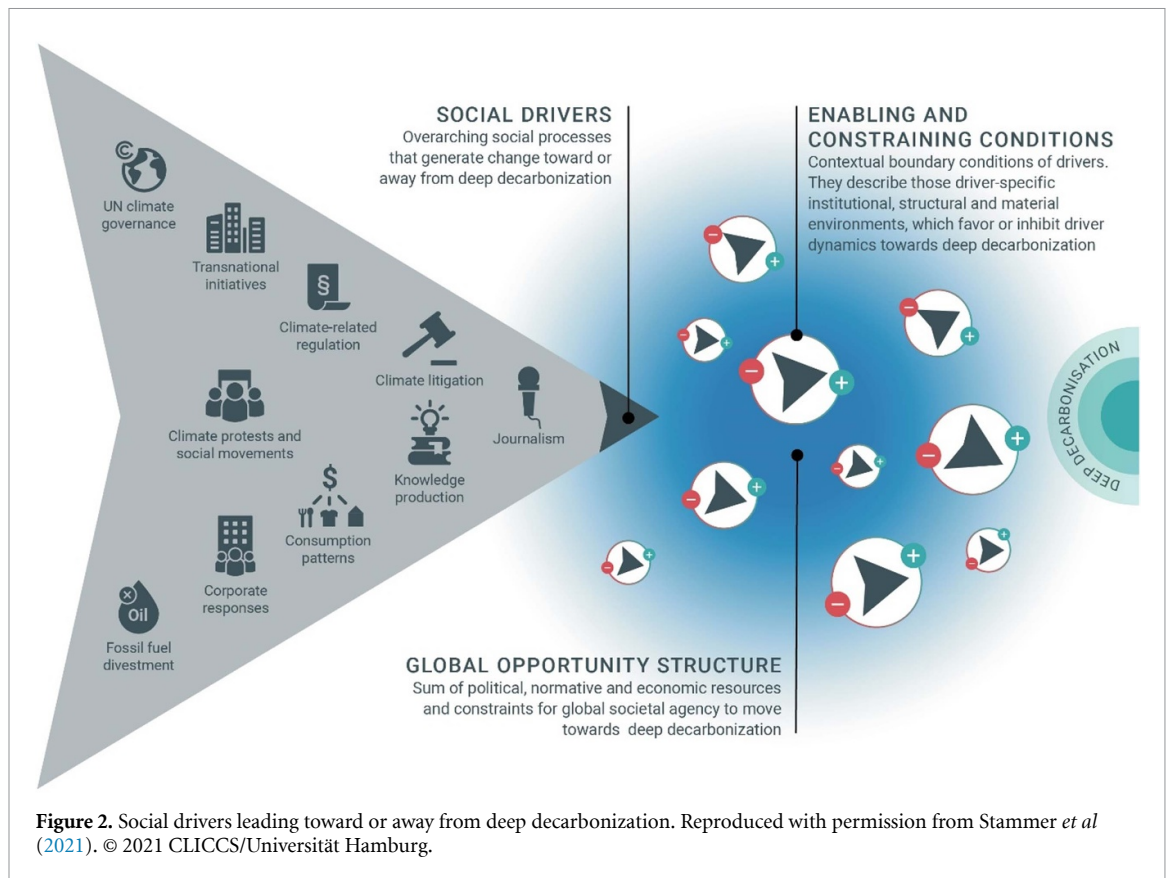
and might completely change the probability (Sabetta 2019).

Given the deep uncertainty underlying the determination of how likely a particular climate future is, it is perhaps not surprising that even the Intergovernmental Panel on Climate Change (IPCC) in the most recent Assessment Report 6 (AR6) of its Working Group III (WGIII), published in April 2022 (IPCC 2022; see especially its chapter 3, Riahi *et al* 2022), has shied away from explicitly declaring certain climate futures either plausible or implausible. It is this gap that our large Hamburg-based research cluster is filling with a new assessment framework, albeit in the first instance for only one, particularly pronounced, scenario—by assessing the plausibility of global decarbonization already by 2050. A proper definition of plausibility is a major element of our innovation and will be given below.

Our focus on plausibility (see Stammer *et al* 2021, p 19) stands in marked contrast to the IPCC focus on *feasibility*, which ‘refers to the potential for a mitigation or adaptation option to be implemented’ (IPCC 2022, Footnote 71). We think it appropriate to equate *feasible* in the AR6 WGIII with *possible* as used by us for climate futures. The AR6 WGIII comprehensively assesses potential enabling conditions for and barriers to the feasibility of mitigation measures, especially in its chapter 3 (Riahi *et al* 2022). However, the AR6 WGIII does not assess from empirical evidence the extent to which the societal dynamics will plausibly activate these enabling conditions or barriers, and hence it does not assess the plausibility of these mitigation measures being implemented in the future. By contrast, user practices, actor constellations, and regulatory environments are central to our assessment (Aykut *et al* 2021).

As a large multidisciplinary research group based in Hamburg, Germany, we seek to narrow down the range of possible climate futures by asking which climate futures are not only possible but also plausible. In the first Hamburg Climate Futures Outlook (Stammer *et al* 2021), we have suggested a new Social Plausibility Assessment Framework that allows us to address this plausibility question (Aykut *et al* 2021). The approach is rooted in theories about social change, social inertia and path dependency, disruptive change, and transformation. This theoretical basis allows us to identify a set of key drivers that can be assumed to have a high impact on a given future scenario (see figure 1). The selection is grounded in the vast literature on transformative social change and deep decarbonization, and in expert elicitation in the form of intense workshops. While the general framework acknowledges history, context, and agency, each of these drivers is conceptualized on the basis of a specific subset of theories of change, drawn, for example, from social movement theories or organizational theories. A climate future is socially plausible if the empirical evidence about the key drivers point toward the chosen scenario, or at least strongly indicates that enabling conditions are building up that support this direction. This allows us to distinguish plausible from implausible scenarios, even if we are not able to assess degrees of plausibility on a continuum.

To test the framework, we chose the scenario of deep decarbonization by 2050, which is our understanding of the necessary social change that would be needed for limiting the global temperature rise to 1.5 °C, with reasonable likelihood of only a limited overshoot. We selected ten key social drivers that influence whether we achieve deep decarbonization by 2050 (see figure 2), among them drivers that are



discussed in the literature as possible social tipping points (Otto *et al* 2020), such as climate protests and social movements (Perino *et al* 2021) and fossil fuel divestment (Engels *et al* 2021). We go beyond the literature on social tipping points by defining enabling and constraining conditions for each of these drivers, so that we are able to assess whether these drivers are moving toward or away from deep decarbonization, and doing so fast enough. We used extensive literature reviews, existing data bases, and our own research to establish the empirical evidence for the assessment. The framework also goes beyond assessments centered on technological developments, because it allows us to analyze the social conditions that would allow or hinder a rapid and effective deployment of technologies.

According to our analysis, six drivers point toward decarbonization, but not strongly enough for deep decarbonization to take place by 2050. For two drivers—climate protests and social movements, and journalism—we are not able to establish a direction. And two drivers—corporate responses, and consumption patterns—even point away from deep decarbonization. If we take these driver assessments together, we conclude that unless the enabling conditions of social drivers change dramatically over the next few years, reaching worldwide deep decarbonization by 2050 is not plausible. The assessment also discusses briefly how some of the drivers

provide a growing repertoire of symbolic and material resources for a global opportunity structure in which climate action can become more powerful (Aykut *et al* 2021). The coming Outlook (Engels *et al* forthcoming) will have an even stronger focus on these dynamics (Wiener and Aykut 2023).

This result has three important implications. First, this is a serious warning. The Hamburg Climate Futures Outlook sends a strong message to those who naïvely think that the current plethora of climate activities will automatically bring the world closer to achieving the Paris Agreement goals. No one should fool oneself. Second, through the new Social Plausibility Assessment Framework we also identify the societal drivers that need to become stronger or even change direction so that achieving the Paris Agreement goals becomes plausible. This offers many entry points for climate action that aims at structural change, whether in the fields of climate litigation, fossil fuel divestment, or transnational initiatives. This is not easy to do, but a better understanding of the underlying social dynamics might capacitate those who currently feel desperate and helpless; they might better be able to develop a more strategic approach to climate action and start improving the enabling conditions that will eventually change the strength or direction of these drivers. And third, our assessment also calls for an increased level of attention to adaptation to climate change—since deep

decarbonization by 2050 is currently not plausible, it is imperative to prepare for the climate change that is plausibly impending.

Data availability statement

The data that support the findings of this study are openly available at the following URL/DOI: <https://www.cliccs.uni-hamburg.de/results/hamburg-climate-futures-outlook/download.html>.

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ORCID iDs

Anita Engels  <https://orcid.org/0000-0003-4974-6607>

Jochem Marotzke  <https://orcid.org/0000-0001-9857-9900>

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