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Editorial: Decision making for the net zero transformation: considerations and new methodological approaches

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Editorial on the Research Topic

Decision making for the net zero transformation: considerations and new methodological approaches

Members of the editorial team for this special edition have been engaging in an ongoing dialogue with the Clean Air Task Force (CATF) around the dominant decision support and decision-making orthodoxy for the net zero transformation since 2020. It was and has become increasingly evident that the realization of Net Zero by 2050 will require the ability for strategy developers, operational planners and decision makers to better manage uncertainty, complexity and emergence (Clean Air Task Force, unpublished)¹. It is also becoming ever apparent that the application of the conventional orthodox set of decision support tools and processes that have been used to explore deep decarbonisation options to 2050 have obscured decision makers from the enormity of the uncertainty, complexity and emergence which occupies the net zero decision space (Pye et al., 2021). Tools have often been used which are inappropriate (Gambhir et al., 2019; van Dorsser et al., 2020). This lack of competency has been glaringly revealed during the C-19 Pandemic which had uncertainty characteristics similar to climate change and net zero albeit more immediate impacts.

1 Clean Air Task Force (unpublished). "European decarbonization pathway de-risking workshops," in *Final Report March 2021*.

The editorial team and CATF therefore convened this special edition to:

- Challenge the present orthodoxy around decision support and decision making for net zero;
- Highlight the need for an interdisciplinary, end to end approach ranging from modeling best practice, decision science, psychology, anthropology, narratives amongst other ontologies to understand current best practice thinking for decision making for the net zero transformation; and
- Identify new research frontiers and practical approaches to adapt thinking in this fast-evolving space—most salient being how to better embed this new fit-for-purpose thinking into conventional policy making and corporate strategy design by making it more accessible.

In doing so it is intended to stimulate a recognition amongst policy makers, practitioners and academics—the target audience for this special edition—as to the importance of:

- Understanding the nature of uncertainty when applying the relevant decision support tool and processes including those associated with the net zero energy system transformation;
- The importance of deliberative processes to map different value sets beyond least cost; and
- Recognition that decision making under uncertainty likely requires competency-based training.

Encouragingly, the special edition has identified examples of novel thinking rapidly, with the articles being recruited in a very short period of time. The coverage, however, is far from that required to represent a mature systematic mindset shift in decision making. It represents a good start upon which further thinking can be built. To this end, individually the 10 articles in this Research Topic provide a range of lenses through which to explore this frontier agenda.

In their perspective, [Gambhir and Lempert](#) set out how least-cost modeling dominates the analysis field for the zero carbon transition. They set out how such plans can be thrown off course by shocks, such as financial crises, the coronavirus pandemic, and the energy supply crisis. They identify reasons for the dominance of the least cost perspective and make the case for a greater focus on identification of plans resilient to potential risks, illustrating what this might mean using electricity sector decarbonisation as an example.

Three articles focus on the different support tools that could be used. [Few et al.](#) review the Decision Making under Deep Uncertainty (DMDU) tools that have been used in relation to 42 case studies for infrastructure decisions. Around half of these studies entirely neglect issues around uncertainty in system relationships. Only a quarter consider deep leverage points for actions to transform system relationships, and even here are unable to represent the transformative change these interventions could affect. The authors argue that this could lead to neglect of some of the most effective routes to achieving transformative change.

[Joffe](#), Head of Net Zero at the Committee on Climate Change, articulates the way in which the UK manages uncertainty in its net zero advice to government by the use of exploratory scenarios in the 6th Carbon Budget. It is noteworthy that the legislative requirement for the carbon budget level does not allow explicitly for uncertainty which very much justifies the case being made of the need for decision making under uncertainty likely requiring competency-based training in order to hard-wire this culture in net zero policy design.

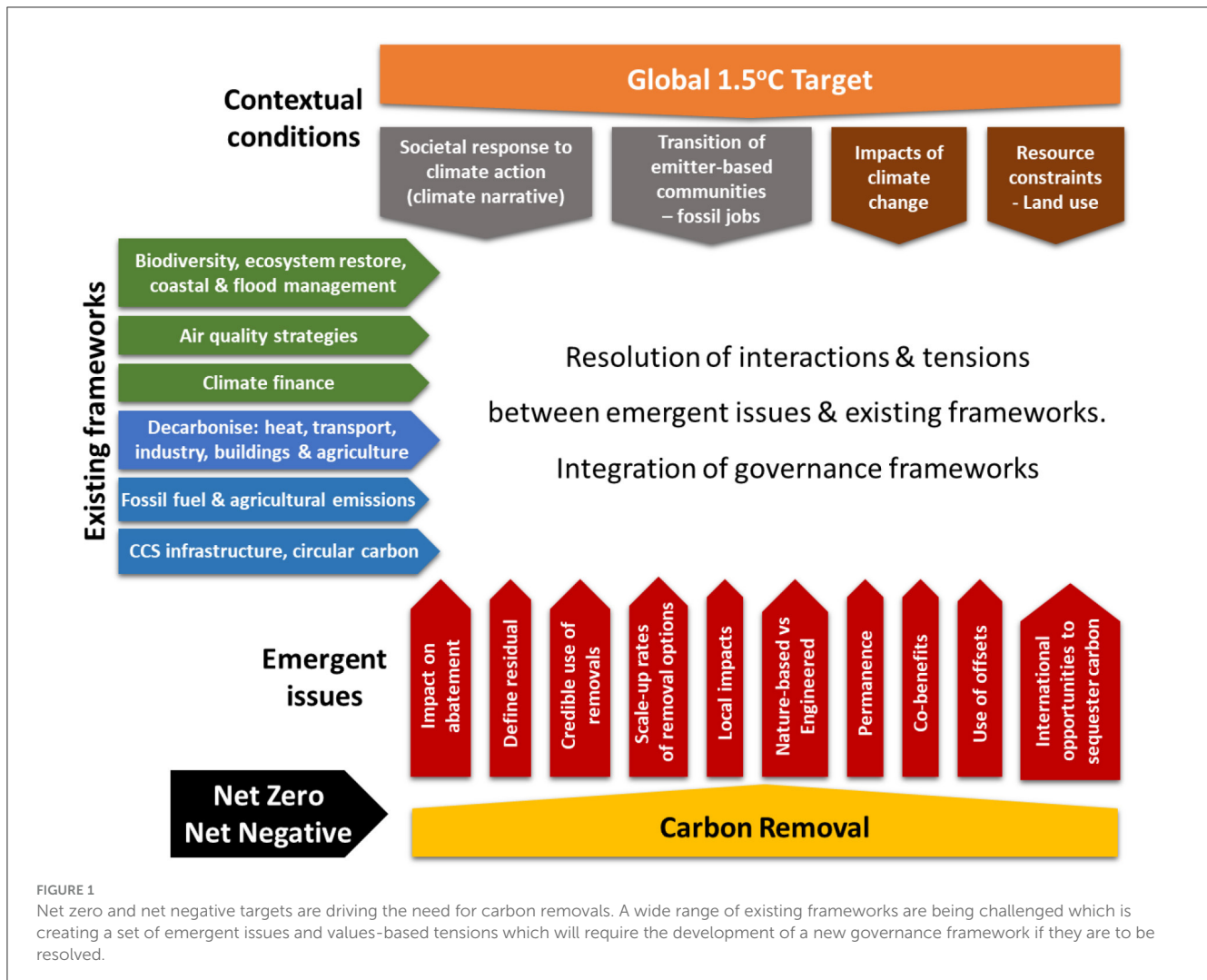
[Basu and Bale](#) argue that urban energy systems, where decisions today may lock in energy consumption patterns for the future, need to transition in line with net zero. They consider key characteristics of such urban systems, which bear on the methodologies required to support decision-making. They find that futures and foresight approaches have not been applied to anything near their full potential, and propose a preliminary methodology for policy makers to move toward approaches which deal with complexity and uncertainty.

A number of articles directly consider decision support requirements for policy makers and Ministers. [Workman et al.](#) use the development of Carbon Dioxide Removal policy design for UK net zero as a specific case study, as well as assessing how decision support around climate change is more broadly integrated into policy. This suggests inadequacies in the present research-policy interface and system for importing evidence for policy that accommodates deep uncertainty. The contribution suggests the need for much greater co-development between policy design stakeholders, a need for greater focus on understanding translation mechanisms rather than generating more evidence and most significantly that many of the barriers to realizing effective net zero policy design is predicated on non-technical, values driven issues (see [Figure 1](#)). This indicates the need for participatory dialogues which are largely absent in UK policy design ([Mendez et al., 2023](#)).

In a perspective article for an international audience, [Elliott et al.](#) emphasize the urgency of action, and need to strengthen our understanding of how actions drive change—to provide greater confidence in these actions. They propose a logical framework model as a tool to support net zero implementation planning and tracking. Further research and case studies on conducting such evaluation in real time may be a practical next step.

In a more specific policy area, [Aczel and Peffer](#) considers the potential of community-based and -managed microgrids to contribute to improved energy resilience and justice. To facilitate this, in relation to the California energy system, she identifies the benefits of anticipatory regulation and resilience thinking, moving away from regulation of decentralized systems under rules derived from the needs of a system designed for centralized generation and distribution.

Use of participatory approaches to inform policy development and help secure buy-in, has developed substantially in recent years. [Peisker and Schinko](#) examine how one such process—a Climate Modernity workshop in Styria, Austria—impacted on participants in terms of their belief in the ease of taking action (“*self efficacy*”) and their belief in the effectiveness of action



(“response efficacy”). Interestingly, they found that in this instance the former was reduced (possibly by greater awareness of the complexity and range of views on some actions), but the latter increased (the process instilled greater trust in collective action). The authors recognize the need for more research to understand context and variation in views across participants, but there are also suggested lessons for the design and evaluation planning of further participatory approaches.

Two articles look at uncertainty in the financial sector. Baer et al. identify limitations in climate scenario analysis for use by the financial sector. They find that currently available scenarios inadequately reflect the short-term volatility and disruption likely to occur through the transition. This may lead to down-playing of climate-related risk, hindering required changes in capital allocation and the building of resilient business models. The authors propose a practical framework aimed at improving understanding, both of scenarios and between the financial sector and the academic community.

Increased focus on future credit risks stemming from climate change has been motivated by stability objectives for the banking system. Aguais and Forest identify that

early modeling approaches utilizing smooth top-down scenarios have tended to show climate change as slowing economic growth rates, but not increasing the amplitude of economic cycles. They have failed to reflect the potential for a broader range of more extreme climate impacts. The authors apply three different empirical approaches to provide an alternative foundation or climate credit risk assessment highlighting systematic volatility, not just trends in economic variables.

In summary, the special edition shows that there is a proliferation of approaches which both challenge and complement the decision support orthodoxy in better working with the extent of uncertainty in the net zero future option space. Much of this activity, however, is taking place in niches within diverse, disparate domains which don’t naturally cross-pollinate to generate systemic learning, cross-domain capacity building and spillovers. As a community two questions need to be addressed to allow the translation of these approaches into net zero policy design. Firstly, how to generate network effects and critical mass across domains linking up the niches of heterodox thinking. Secondly, how the community of practice can co-evolve their approaches in lockstep with policy makers and

decision makers within the present institutional architectures and policy cultures. Until these substantive unanswered questions are addressed the mindset shift required to challenge the present orthodoxy will not be catalyzed. Policy makers and strategy designers will continue to generate mal-adaptive and unfit net zero policy in an increasingly uncertain, emergent and complex future option space.

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MW: Writing – original draft, Writing – review & editing. AG: Writing – original draft, Writing – review & editing. KR: Writing – review & editing. GD: Writing – review & editing. GS: Supervision, Writing – review & editing.

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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