



Enabling a political tipping point for rapid decarbonisation in the United Kingdom

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Abstract. Decarbonisation of the global economy is an ecological and humanitarian necessity. Much of the research on this defining task for humanity has focused on technological solutions, with less attention paid to the question of how to accelerate the political and policy changes needed. Like a growing number of countries, the United Kingdom (UK) has opted for a net zero by 2050 decarbonisation plan, based on least cost optimisation and designed to depoliticise the climate issue. The research presented here argues for a more radical, science and equity based rapid decarbonisation to net zero by 2035. Using the emerging concept of positive tipping points, it asks how advocates of rapid decarbonisation could transform UK climate politics and achieve decisive policy influence. Based on a thematic analysis of 47 expert interviews and 100 expert views in total, this multidisciplinary research examines the political, sociological, and psychosocial dimensions and proposes an adapted multilevel perspective to illustrate the enabling conditions for a political tipping point. It finds that the potential exists for an effective advocacy coalition for rapid decarbonisation, but the prospects for displacing the dominant coalition look very slim. It recommends combining top-down and bottom-up approaches to create a nationally coordinated movement that is also place-based and participatory, putting the public at the forefront of systemic change.

1 Introduction

According to the World Resources Institute's Net Zero Tracker, ninety-six countries representing almost 80% of global greenhouse gas (GHG) emissions have now communicated (in the form of a legal instrument, a policy document, or a political pledge) a net zero decarbonisation target (WRI, 2023). In common with many of these countries, the United Kingdom (UK) has chosen 2050 as its net zero target year and has developed a net zero plan based on technological innovation and least cost optimisation, while continuing with "the grain of existing behaviours and trends" of consumption (HMG, 2021, p. 274). UK political leaders maintain that the 2050 target is consistent with international commitments to limit global overheating to +1.5°C (UNFCCC, 2015). They assure us that we can all live sustainably, grow our economies, maintain current lifestyles and levels of consumption, and leave future generations with the same opportunities "without so much as a hair shirt in sight" (HMG, 2021, p. 9).

However, some researchers have argued that in the context of a "rapidly closing window of opportunity to secure a liveable and sustainable future for all" (IPCC, 2023, p. 24), a net zero target of 2050 is far too late, especially for wealthier countries



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like the UK, and that the UK should decarbonise much faster – by 2035 at the latest (Anderson et al., 2020, Jackson, 2021a, Stoddard et al., 2021, Gupta et al., 2023, Rockström et al., 2023, Sharpe, 2023). On current trends, the +1.5°C limit will already have been breached by the early 2030s. Deadly consequences of global overheating are already being felt in the form of extreme weather events, crop failures, species extinction, the spread of disease, conflict, and forced migration, especially in vulnerable countries least responsible for causing it (Rigaud et al., 2018, IPBES, 2019, Kirchmeier-Young et al., 2019, SEI et al., 2019, Vautard et al., 2020, Clement et al., 2021, IPCC, 2021, OECD, 2021, Quiggin et al., 2021). And heating beyond +1.5°C increases the risk of tipping Earth systems beyond critical thresholds, unleashing irreversible, self-reinforcing feedbacks and cascading effects that could pose an existential threat to human civilisation and ecosystems over timescales varying from decades to centuries (Armstrong McKay et al., 2022, IPCC, 2022, OECD, 2022, Wunderling et al., 2023).

In response, efforts are being made to understand how to accelerate the transition to net zero using a systems-thinking approach. This includes utilising the concept of positive tipping points to design and target interventions that can trigger disproportionately large and abrupt beneficial change, driven by internal feedbacks, to redirect human systems along more sustainable pathways as quickly as possible (Gladwell, 2000, Lenton et al., 2008, Meadows and Wright, 2008, Milkoreit et al., 2018, Lenton, 2020, Otto et al., 2020, Lenton et al., 2021, Lenton et al., 2022, Winkelmann et al., 2022, Mealy et al., 2023, Geels and Ayoub, 2023).

Some positive tipping points are already well underway and unstoppable, for example the uptake of solar and wind energy generation, which is increasing exponentially (IEA, 2022). Some promising ideas for triggering positive tipping – for example redirecting public procurement in food systems to promote the uptake of alternative proteins – need not involve significant cost, innovation, advocacy or diplomacy (Meldrum et al., 2023). However, other possible interventions – for example creating a global environmental court, ambitious mandates for renewable technologies, mass educational programs, or controversial urban planning concepts such as 15-minute cities (Otto et al., 2020, Moreno et al., 2021) – would likely require a political process and coalitions that advocate for them to help achieve decisive policy influence (Smith et al., 2020, Geels and Ayoub, 2023). This research argues that: a) many interventions for positive tipping therefore need to include a political dimension; b) political systems are themselves subject to positive tipping; and c) the need to 'tip' political systems into a qualitatively different state that prioritises safe and just Earth System Boundaries is as urgent as any technological innovation. The key research question investigated here is: What are the enabling conditions for building effective advocacy coalitions, and what are the supportive contexts, for triggering a political tipping point for rapid decarbonisation in the UK (Roberts et al., 2018, Köhler et al., 2019, Lenton et al., 2022).

The literature on sustainable transitions is full of recommendations about *what* to do. But the process of *how* to effect transformative positive change that first requires political advocacy is often left unexplained. Sociotechnical approaches have been shown to also apply to policy, knowledge and administrative innovations in explaining how, in certain conditions,



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'niche' innovations can emerge, accelerate (following a non-linear S-shaped curve, as in the diffusion of innovations model) and ultimately destabilise, assimilate with, or replace incumbent systems or regimes (Rogers, 2003, Marsh and Sharman, 2009, Stone, 2012, Sovacool and Geels, 2016, Berry and Berry, 2018, Geels et al., 2019, Köhler et al., 2019, Geels and Ayoub, 2023). Politics, power and agency have also become more central in terms of: a) the policy process (the incentives, rules and other mechanisms for accelerating policy change); and b) the micro-politics of transitions (the incentives and pressures for political actors to seek alliances to build the case for more radical change) (Smith et al., 2005, Smith and Stirling, 2010, Meadowcroft, 2011, Baker et al., 2014, Geels, 2014, Hess, 2014, Lockwood, 2015, Avelino et al., 2016, Lockwood et al., 2017, Köhler et al., 2019). The policy process has also been widened to incorporate the political contributions of civil society and social movements, which are also characterised by non-linear trajectories and trigger events (Moyer, 1990, Han, 2014, Tilly and Tarrow, 2015, Hess, 2018, Adams, 2019b, Laybourn-Langton et al., 2021).

Despite these advances, evidence for positive tipping points in the political/policy sphere is often difficult to substantiate and is based on either single technologies or pollutants (e.g., the phase-out of chlorofluorocarbons), rather than entire energy systems (Stadelmann-Steffen et al., 2021); or on small or centrally planned economies (Sovacool and Geels, 2016, Simms and Newell, 2017, Vinichenko et al., 2021). System-wide, rapid decarbonisation for climate stability is an unprecedented kind of societal transformation in at least three respects: it is problem-driven, rather than opportunity driven; it is unique in the scale and urgency of necessary changes; and it is intentional or 'normatively directional' (Lenton and Latour, 2018, Köhler et al., 2019, p. 4) and therefore contingent on significant state intervention (Schmitz, 2015, Kern and Rogge, 2016, O'Brien, 2018). The closest UK-related historical examples of normatively directional political and policy change, rapid shifts in social norms and values, and transformation at the societal scale over a single generation, are arguably:

- The abolition of slavery between the late 18th and early 19th Century (Appiah, 2010, Hochschild, 2010, Yerxa, 2012, Stoknes, 2015). Hayes (2014) stated that in terms of the economic and political interests involved in breaking up the multi trillion-dollar fossil-fuel industry, "it is impossible to point to any precedent other than abolition" (Hayes, 2014).
- The double movement of the UK political economy in the late 19th Century and mid-20th Century (Polanyi, 2001). This first involved the dis-embedding of markets from traditional norms to create a system of market exchange and the pre-eminence of monetary value (Göpel, 2016). It was followed by the rise of Keynesian economics and the welfare state following World War II (Newell, 2015).
- The neoliberal transformation. The crisis of Keynesianism in the late 1970s, the collapse of the Bretton Woods system, oil price shocks, and trade union disputes, all provided the political opportunity for the rapid ascent of neoliberalism, which used state power to expand the role of markets, competition, and individual responsibility in society (Newell, 2018, Davies and Gane, 2021).



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Thirty years of inadequate climate action means that some radical and disruptive change is now unavoidable. The more radical the proposal, the more necessary it becomes to describe a political process that can result in the desired policies, beginning with the existing political economy, institutions, public values, attitudes and beliefs, and other contexts. If a science and equity based rapid decarbonisation for countries like the UK demands a net zero carbon target of 2035, the question is how, in a democracy, do you persuade a pragmatic majority to support such radical action? How do you tip the political system into a qualitatively different state that prioritises the long-term collective interest? People are psychologically ill-equipped to perceive the climate issue as an emergency (Kahneman, 2011, Marshall, 2014, Stern, 2018). The British public report high levels of concern on climate issues, but at the same time are reluctant to give up their cars, meat, and cheap flights abroad (BritainThinks, 2022, Ipsos and CAST, 2022). In addition, there are shorter-term social and economic considerations, institutional inertia, and vested interests that all lean toward the adoption of more incremental pathways.

The challenge for an advocacy coalition for rapid decarbonisation is therefore to design a coherent political movement, a strategy for change, and a compelling narrative capable of persuading a pragmatic majority to support radical action in the absence of a perceived emergency. History shows that radical change in the collective interest is most likely to be initiated at the level of civil society and social movements (Smith et al., 2020). It is possible for a committed, well organised minority to mobilise around a common cause long enough to exceed a critical threshold or tipping point for change (Hunter, 2010, SCNARC, 2011, Chenoweth and Stephan, 2012, Skocpol, 2013, Han, 2014, Malik, 2014, Dunlap and Brulle, 2015, Leach and Scoones, 2015, Tilly and Tarrow, 2015, Engler and Engler, 2016, Green, 2016, Centola et al., 2018, Crutchfield, 2018, Sunstein, 2020, Leadbetter and Winhall, 2021, Meyer, 2021, Levine, 2022). However, it is not clear that the climate movement is capable of mobilising in a similar way to the civil rights movement, the suffragettes, or the Indian independence movement. In these historical social movements, the people driving the movement were the same ones suffering the injustices. They targeted a group of people who were clearly understood to be oppressing them. Their cause was highly emotionally salient by being personal, immediate, concrete, and local (PICL) (Kahneman, 2011). And they spent years building and embedding the movement through diverse community engagements (Adams, 2019a, Ahmed, 2019, Parekh and Rehman, 2019).

There are clearly gaps in knowledge and a need to investigate the enabling conditions, sensitive intervention points, and processes of non-linear change with the greatest potential to trigger positive tipping points for accelerating the political and policy aspects of the transition (Otto et al., 2020, Lenton et al., 2022, Mealy et al., 2023). The transdisciplinary research presented here, theoretically underpinned by positive tipping points theory, the advocacy coalition framework, a theory of fields, social movement theory, and discourse theory, lies at the intersection of political, sociological and psychosocial dimensions of sustainable transitions research. It examines the prospects for a political tipping point for rapid decarbonisation in the UK. Its findings are based on a thematic analysis of forty-seven face-to-face expert interviews and one





hundred expert views in total, from fieldwork conducted between November 2019 and June 2020. The fieldwork phase of this research addressed the following question: What are the key enabling conditions and prospects for tipping the UK political system into supporting a rapid decarbonisation policy agenda?

2 Methods

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In view of the complex and fast evolving nature of public concern about climate overheating, new modes of activism, and political discourses around net zero, semi-structured interviews and thematic analysis were considered the most appropriate research methods (Braun and Clarke, 2006). The use of purposive sampling also enabled the broadest possible representation from politics, business and civil society (Ritchie et al., 2003). Out of ninety-seven invitations, forty-seven experts ultimately participated in face-to-face interviews between November 2019 and June 2020. A semi-structured interview topic guide was created to support the interviews. Data was anonymised and coded by primary occupation: ACAD = academic; BUS = business/finance; NGO = non-governmental organisation; POL = politics; OTH = other. Other primary data comprising the views of fifty-three additional experts were collected from publicly available sources not subject to consent: conferences, televised debates, parliamentary select committee hearings, lectures, podcasts, and livestreamed sessions of the UK Climate Assembly (2020). In total, the views of one hundred experts were recorded, transcribed and subjected to an iterative and deductive process of thematic analysis (Gray, 2018, Jackson and Bazeley, 2019).

3 Results

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- Thematic analysis of the interview data and other primary sources revealed clear themes and interpretive insights that addressed the research question: What are the key enabling conditions and prospects for tipping the UK political system into support for a rapid decarbonisation policy agenda? Experts agreed that many of the enabling conditions and resistors to change related to rapid decarbonisation also apply to more incremental transitions and support the existing literature on effective coalition-building. Briefly, these include:
 - The need for a detailed, coherent, and system-wide decarbonisation plan. The UK High Court, the Committee on Climate Change, and many civil society organisations have repeatedly criticised the UK government for not having achieved this aim.
 - Coalitions should cooperate in broad, cross-party alliances using skilled brokers and mediators.
 - Diverse political methods and tactics are important to encourage broad participation and to sustain public and media interest.
 - A unified, consistent and above all optimistic narrative that invokes "a longing for a better world" (OTH34) is most effective: "simple messages, often repeated, by trusted voices" (OTH63), especially by unexpected voices, was a



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recurring theme. These messages should be targeted to the values and identities of specific audiences, with particular attention paid to less engaged population segments (Wang et al., 2020).

- A "grand narrative" (ACAD10), one that can be favourably re-interpreted by diverse audiences, would also be helpful. However, a "Take Back Control" for the climate a simple political slogan and mobilising message that has the evident effectiveness of the Vote Leave campaign has yet to be devised.
- Climate action delaying counter-narratives based on excessive cost and over-regulation are likely to become louder
 in the coming years but may be neutralised with arguments based on the far greater cost of inaction (Geels, 2014).
 Blaming net zero policies for the energy cost crisis should also be expected to continue, despite this argument being
 "more than a little upside down" (Evans, 2022).
- Climate, social and industrial policies should go together in a "just transition" (ACAD91), but a socialist manifesto for solving "all that plagues us" (Mann, 2019) risks alienating too many people and is likely to fail politically.
- Political strategies and policies need to be "prefigured" (OTH76) and ready to exploit windows of opportunity as they arise.

However, a policy agenda for rapid decarbonisation (net zero by 2035) requires more radical approaches and interventions than these and faces formidable obstacles to gaining politically viability. Expert responses combined with data from a mapping exercise of UK climate policy actors revealed the existence of an incumbent, broad, politically powerful and coherent coalition in support of the official net zero target of 2050. This coalition was labelled Green Growth, and consisted of all the main political parties, the business and finance sectors, the mainstream media, and most civil society NGOs (Smith and Christie, 2021). One expert captured the deep core belief (Sabatier et al., 1993) of the Green Growth coalition in stating that, "It's only within the context of a viable economy that you can save the environment" (Northcote, 2018).

By contrast, two smaller coalitions, who both advocate for rapid decarbonisation of the UK economy by 2035 or earlier, were fragmented and had marginal political influence, few resources, and no support from organisations in business, finance, health, trade unions or mainstream media (Smith and Christie, 2021). These two coalitions were labelled: 1) Limits, consisting of The Green Party, Transition Network, Greenpeace, Friends of the Earth, New Economics Foundation, Wellbeing Economy Alliance, and others; and 2) Revolution, consisting of Extinction Rebellion and associated groups. Experts who expressed support for a Limits advocacy coalition shared a deep core belief in the overriding importance of respecting safe and just Earth System Boundaries (Rockström et al., 2023) and tended to support "good growth" (ACAD10) where necessary to facilitate that outcome (e.g., in renewable technologies/infrastructure, energy-efficient buildings, care and wellbeing sectors) (Raworth, 2017, Trebeck and Williams, 2019, Jackson, 2021b, Likaj et al., 2022). A further coalition labelled Participation consisted of a handful of civil society organisations that prioritised participatory and collective decision-making and which therefore did not state a priori net zero targets or policy discourses.





Prospects for tipping the UK political system into supporting a rapid decarbonisation agenda are therefore very slim. Actors and coalitions advocating for this outcome are politically marginal players who would need to displace a vastly more powerful and better organised socio-political regime. Experts tended to endorse the idea that radical change in the collective interest is most likely to be initiated at the level of civil society and social movements. However, they also agreed that until such a movement achieves the legitimacy of a democratic mandate for change, policymakers are highly unlikely to engage with such a radical proposal (Willis, 2020, DNZ, 2021, Newell et al., 2021). "A prerequisite to getting the right policies is getting the right politics" (Meadowcroft, 2011, p. 73).

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The analysis found that "getting the right politics" to improve the prospects for rapid decarbonisation begins with an experimentation phase – involving place-based clusters of innovation, spaces for genuine deliberation, prefigurative communities and projects, and social movements. The following political phase coordinates these local clusters into a national framework which – enabled with the "right" communications, organisation and network-building, policy preparation, coordination and funding, and supportive contexts – grows exponentially. This in turn emboldens politicians and others involved in the policy phase to build their own policy coalitions, with self-reinforcing policy feedbacks (Lockwood, 2015). The process is illustrated in Figure 1 as an adapted multi-level perspective (Geels and Turnheim, 2022). Thematic analysis of experts' views generated the following enabling conditions for a positive tipping point as themes:

215 3.1 Communications

Communications should focus on non-polarising, values-inclusive messages that invoke outrage and optimism. One expert offered a definition of outrage as "the reaction to a scandal" (OTH69). The two most prominent climate movements of recent years, Extinction Rebellion and the school strikes, have (according to this expert) made serious communications errors by sounding the alarm about the climate threat and treating it as a tragedy. Instead, these movements should be "driving real change by focusing on what can be done, and yet isn't being done – the elements of a scandal, not a tragedy" (OTH69). Suggestions for outrage messages (n=30) generated by 16 experts were categorised into three subthemes: 1) The corrupting influence of power – why are we letting them get away with it? 2) The science demands a wartime response – why aren't we getting one? And 3) International examples – why isn't it happening here?

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A unifying climate narrative, and a rapid reappraisal of values and norms, could emerge from a citizen-led national conversation about the kind of society we wish to live in. But first we need to break the "silent stand-off" (ACAD96) or "Mexican stand-off" (ACAD10) between politicians and the public in which each looks to the other for guidance and permission to lead. This, combined with "socially organised denial" (Norgaard, 2011) of the necessary urgency, results in a "subtle but nonetheless unproductive dance of partial commitment" (Jordan et al., 2022, p. 9). To help the nation break away



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from this unconscious conspiracy of silence, several experts called for a national network of impartially designed, deliberative mini publics (DMPs). These could examine the risks and difficult trade-offs as a whole, linked to a "set of policy choices which, if applied together, would achieve net zero" (ACAD1). The recommendations of DMPs could then be fed into the policy process (OTH83, ACAD10, OTH34, ACAD1, ACAD96, OTH17). Another expert agreed that it was vital for people to understand the real risks and to decide what levels of risk are acceptable to them:

"We don't really know what the risk is... [Are we] facing a truly existential crisis to humanity? ... Or is it really not that much of a problem? ... How dangerous do you think climate change is going to be?... And what's your attitude to risk? If I knew for a fact the worst-case scenarios were actually true..., what would I do to protect my sons? ... be on the front line with Extinction Rebellion?... I don't know... but it's just in my head all the time... I just keep coming back to that question: what kind of risk is it that we face?" (NGO73).

Communications also include the spreading of new social norms. Several experts referred to recent scholarship showing that new norms can spread rapidly, particularly when facilitated by social influencers sharing new paradigms and new ways of defining prosperity and the "good life" (Appiah, 2010, Hunter, 2010, Baker, 2019, Lenton, 2020, Otto et al., 2020, Laybourn-Langton et al., 2021, Lenton et al., 2022).

3.2 Organisation and Network-building

Organisation and network-building need to improve at all levels: a) internationally – situating domestic policy within the context of fair, reciprocated global action (BritainThinks, 2022); b) nationally – drawing in new members from currently disengaged groups, particularly those from the centre-right (Wang et al., 2020, Outreach, 2022). One expert spoke of the need for campaigners and organisers to "break out of their bubble" and to feel "that sense of discomfort" when engaging with people with different worldviews (NGO6); and c) locally – building community-based hubs of prefigurative power and experimentation (Centola, 2018, Han et al., 2021, Laybourn-Langton et al., 2021, Stone et al., 2021). Successful coalitions broadly and strategically target "the changeable people... 30% of the middle 50%" (Kasser, as cited in Newell, Daley and Twena, 2021, p. 43). They also value knowledge brokers and translators with the skills to talk to diverse people "in their language" (POL41), to bring them together, and to "make their worlds touch" (OTH63).

3.3 Policy Preparedness





Policy preparedness means engaging in "prefigurative politics" (OTH76), having policies ready for when political windows of opportunity arise following, for example, a natural disaster that triggers a tipping point in public attitudes. One expert expressed concern that he had seen "very little, if any... policy development work on ... a rapid transition framework" (OTH76). Another expert suggested attention-grabbing "symbolic policies" (ACAD96), such as the right to generate and sell your own renewable energy and free public transport funded by a levy on frequent flying.

3.4 Coordination and Funding

Coordination and funding are needed to design a coherent movement, a strategy for change, and a compelling narrative. Funders have a crucial role to play, incubating, connecting and mobilising change-makers into a coherent, well-coordinated whole (Newell et al., 2021). However, as one expert (OTH83) commented, this long-term challenge requires "a new mindset and a higher level of trust". The scale of funding remains "very small relative to the urgency and scale of climate change" (Ravenscroft and Kane, 2021, p. 2). Only 2% of European philanthropic funding is directed towards climate change mitigation and only 22 of 127 European foundations focused on transformative change (Cracknell et al., 2021). Funding could also transform prefigurative community projects into an integrated movement and help to make the "longing for a better world" (OTH34) more tangible. As one expert commented:

'If we had the funding in place... you could make Transition Towns a different movement... There's probably much to learn from the Transition Towns movement that is not being translated into this wider movement...because it's seen as slightly on the side, not very impactful, small-scale" (OTH83).

3.5 Supportive Contexts

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Supportive contexts were categorised as either positive or negative. Positive supportive contexts included prefigurative communities, creative spaces that help people to imagine and experience living sustainably. As one expert described them, prefigurative spaces could be anything from small gardens to entire neighbourhoods, places "in which you are apt to say the future you want has already arrived" (ACAD10). Another expert described how such projects can serve as a bridge between individuals and systems:

"It's where you can feel the tangible impact of change in a way that you don't with individual behaviour change. You can feel pointless in the face of a huge scale of change. And equally, if you're always just pushing for systemic change, that can feel disempowering too, because... pushing against a... system... can feel slow and frustrating.



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Whereas, at a community level, you can see tangible change, tangible results... And it has all these other social benefits, of meeting people, of getting over loneliness, of feelings of collective agency... generating an income for the community... a sense of ownership" (OTH83).

Negative supportive contexts included extreme weather events and other climate-related impacts that act as "teachable moments, suitably contained disasters which keep reminding everyone how bad things could get." (ACAD10). Negative supportive contexts can galvanise public support for bolder climate policy. However, as one expert warned, "there's a narrow window there, because if they get bad enough, they're no longer teachable, they're just disasters" (ACAD10). Moreover, there is extensive evidence to suggest that, depending on many variables including the kind and degree of trauma, in-group influences, and individual differences, some people can become less supportive of climate action or can use denial as a defence mechanism (Marshall, 2014). Increased stress and insecurity can reduce cooperation and support for social goals (Friedman, 2005). Climate-related impacts might therefore have the opposite effect of triggering and accelerating "damaging cascades" (Lenton et al., 2022, p. 8) of social unrest, political polarisation (Levin et al., 2021, Macy et al., 2021), conflict and "barbarisation" (Raskin, 2016), leading to the "fractured world" (Laybourn-Langton, 2022, p. 10) of a "Climate Behemoth" scenario (Wainwright and Mann, 2018).

4 Conclusions

Some scholars regard rapid decarbonisation (net zero by 2035) for wealthy countries like the UK to be an ethical and ecological necessity. However, in the UK this plan has marginal political influence and is opposed by a well-resourced, incumbent coalition of actors. It also needs to persuade the UK public who, despite record levels of concern, remain reluctant to face the difficult trade-offs and, as one expert put it, can't trust the government to manage the rubbish, never mind a full-scale societal transformation. Its slim chances of success rely not only on enabling conditions (communications, organisation, network-building, policies, favourable contexts, coordination and funding) designed to tip the political system into a qualitatively different state that prioritises safe and just Earth system boundaries – but on all of them happening at once, as illustrated in Figure 1. Philanthropy would have a crucial role to play in this regard to incubate, connect and mobilise a range of change-makers into a coherent and well-coordinated whole that is greater than the sum of its parts.

An advocacy coalition for rapid decarbonisation would need to combine top-down and bottom-up strategies to create a nationally coordinated movement that is also place-based and participatory, putting people at the forefront of radical societal transformation. While diverse community and grassroots movements can initiate the drive towards a critical tipping point for change, eventual success and decisive policy influence also depends on a network that includes firms, faith groups, trade





unions, academics, influencers, artists, political insiders and disaffected elites and which "gets us all heading in the same direction" (ACAD66).

The climate and ecological crisis is the most complex and daunting political challenge the world has ever faced, one that draws out fundamental tensions of collective action, democracy and political organising, and which spans generations, sectoral interests, core human values and attitudes towards economic growth and consumption. After decades of campaigning and organising, the elements of civil society and the UK polity who advocate accelerating action for rapid decarbonisation are still much clearer about the diagnosis of problems than about the effective mobilisation of their coalitions and of citizens in general. This is not a surprising conclusion, but it underlines the urgency for the 2020s of civic engagement, innovation in political narratives and imaginaries, and rapid coalition-building among NGOs and other pro-net zero institutions across sectors.

References

- 340 Adams, N.: Ecologies of UK Social Movements, https://thinkingdoingchanging.files.wordpress.com/2019/05/the-ecologies-of-uk-social-movements-.pdf, 2019.
 - Ahmed, N.: The flawed social science behind Extinction Rebellion's change strategy, Insurge Intelligence, https://medium.com/insurge-intelligence/the-flawed-science-behind-extinction-rebellions-change-strategy-af077b9abb4d, 2019.
- Anderson, K., Broderick, J. F., and Stoddard, I.: A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways, Climate Policy, 20, 1290-1304, https://doi.org/10.1080/14693062.2020.1728209, 2020.
 - Appiah, K. A.: The Honor Code: How Moral Revolutions Happen, W. W. Norton & Company, London, 264 pp., ISBN 9780393080711, 2010.
- Armstrong McKay, D. I., Staal, A., Abrams, J. F., Winkelmann, R., Sakschewski, B., Loriani, S., Fetzer, I., Cornell, S. E., Rockström, J., and Lenton, T. M.: Exceeding 1.5°C global warming could trigger multiple climate tipping points., Science, 377, eabn7950, https://www.science.org/doi/10.1126/science.abn7950, 2022.
 - Avelino, F., Grin, J., Pel, B., and Jhagroe, S.: The politics of sustainability transitions, Journal of Environmental Policy & Planning, 18, 557-567, https://doi.org/10.1080/1523908X.2016.1216782, 2016.
- Baker, L., Newell, P., and Phillips, J.: The political economy of energy transitions: the case of South Africa, New Political Economy, 19, 791-818, http://dx.doi.org/10.1080/13563467.2013.849674, 2014.
 - Baker, R.: The Structure of Moral Revolutions, MIT Press, Cambridge, MA, 336 pp., ISBN 9780262043083, 2019.



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- Berry, F. S. and Berry, W. D.: Innovation and Diffusion Models in Policy Research, in: Theories of the Policy Process, edited by: Weible, C. M. and Sabatier, P. A., Routledge, Abingdon, Oxon. 252-297, 360 https://doi.org/10.4324/9780429494284, 2018.
 - Bond, B. and Exley, Z.: Rules for Revolutionaries: how big organising can change everything, Chelsea Green Publishing, White River Junction, VT, ISBN 9781603587273, 2016.
 - Braun, V. and Clarke, V.: Using thematic analysis in psychology, Qualitative Research in Psychology, 3, 77-101, https://www.tandfonline.com/doi/abs/10.1191/1478088706QP063OA, 2006.
- BritainThinks: The Net Zero Diaries: A citizen perspective on tackling the climate emergency, https://britainthinks.com/the-net-zero-diaries-a-citizen-perspective-on-tackling-the-climate-emergency/, 2022.
 - Centola, D., Becker, J., Brackbill, D., and Baronchelli, A.: Experimental evidence for tipping points in social convention, Science, 360, 1116-1119, https://openaccess.city.ac.uk/id/eprint/20031/1, 2018.
- Centola, D.: How Behavior Spreads: the science of complex contagions, Princeton University Press, Woodstock, Oxon, 312 pp., ISBN 9780691202426, 2018.
 - Chenoweth, E. and Stephan, M. J.: Why Civil Resistance Works: The Strategic Logic of Nonviolent Conflict, Columbia University Press, New York, NY, 296 pp., ISBN 9780231156837, 2012.
 - Clement, V., Rigaud, K. K., de Sherbinin, A., Jones, B., Adamo, S., Schewe, J., Sadiq, N., and Shabahat, E.: Groundswell Part 2, https://openknowledge.worldbank.org/bitstream/handle/10986/36248/Groundswell Part II.pdf?sequence=8, 2021.
 - Climate Assembly UK: The Path to Net Zero: Climate Assembly UK Full Report, https://www.climateassembly.uk/detail/advisorypanel/, 2020.
- Climate Outreach: Net Zero, Fairness and Climate Politics, https://climateoutreach.org/britain-talks-climate/seven-segments-big-picture/net-zero-fairness-politics/, 2022.
 - Cracknell, J., Flon, D., Balmas, S., and Patuzzi, L.: Environmental Funding by European Foundations, 5, https://www.efc.be/uploads/2021/04/Environmental-Funding-by-European-Foundations-vol.5.pdf, 2021.
 - Crutchfield, L. R.: How Change Happens, John Wiley & Sons, London, 240 pp., ISBN 9781119413783, 2018.
- Davies, W. and Gane, N.: Post-Neoliberalism? An Introduction, Theory, Culture & Society, 38, 3-28, http://dx.doi.org/10.1177/02632764211036722, 2021.
 - DNZ: DNZ: Delivering Net Zero. Key Themes from the Academic Community, https://www.deliveringnetzero.org/publications, 2021.
 - Dunlap, R. E. and McCright, A. M.: Challenging Climate Change: The Denial Countermovement, in: Climate Change and Society: Sociological Perspectives, edited by: Dunlap, R. E. and Brulle, R. J., Oxford University Press, New York, N.Y., 393-442, 2015.
 - Engler, M. and Engler, P.: This Is an Uprising, Bold Type Books, New York, NY, 368 pp., ISBN 9781568585147, 2016.





- Friedlingstein, P., O'Sullivan, M., Jones, M. W., Andrew, R. M., Hauck, J., Olsen, A., Peters, G. P., Peters, W., Pongratz, J., Sitch, S., Le Quéré, C., Canadell, J. G., Ciais, P., Jackson, R. B., Alin, S., Aragão, L. E. O. C., Arneth, A., Arora, V., Bates, N. R., Becker, M., Benoit-Cattin, A., Bittig, H. C., Bopp, L., Bultan, S., Chandra, N., Chevallier, F., Chini, L. P., Evans, W., Florentie, L., Forster, P. M., Gasser, T., Gehlen, M., Gilfillan, D., Gkritzalis, T., Gregor, L., Gruber, N., Harris, I., Hartung, K., Haverd, V., Houghton, R. A., Ilyina, T., Jain, A. K., Joetzjer, E., Kadono, K., Kato, E., Kitidis, V., Korsbakken, J. I., Landschützer, P., Lefèvre, N., Lenton, A., Lienert, S., Liu, Z., Lombardozzi, D., Marland, G., Metzl, N., Munro, D. R., Nabel, J. E. M. S., Nakaoka, S.-I., Niwa, Y., O'Brien, K., Ono, T., Palmer, P. I., Pierrot, D., Poulter, B., Resplandy, L., Robertson, E., Rödenbeck, C., Schwinger, J., Séférian, R., Skjelvan, I., Smith, A. J. P., Sutton, A. J., Tanhua, T., Tans, P. P., Tian, H., Tilbrook, B., van der Werf, G., Vuichard, N., Walker, A. P., Wanninkhof, R., Watson, A. J., Willis, D., Wiltshire, A. J., Yuan, W., Yue, X., and Zaehle, S.: Global Carbon Budget 2020, Earth System Science Data, 12, 3269-3340, http://dx.doi.org/10.5194/essd-12-3269-2020, 2020.
 - Friedman, B. M.: The Moral Consequences of Economic Growth, Vintage Books, New York, NY, 570 pp., ISBN 9781400095711, 2005.
- 405 Geels, F. W., Turnheim, B., Asquith, M., Kern, F., and Kivimaa, P.: Sustainability transitions: policy and practice, https://www.eea.europa.eu/publications/sustainability-transitions-policy-and-practice, 2019.
 - Geels, F. W.: Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective, Theory, Culture & Society, 31, 21-40, http://dx.doi.org/10.1177/0263276414531627, 2014.
- Geels, F. W. and Ayoub, M.: A socio-technical transition perspective on positive tipping points in climate change mitigation:

 Analysing seven interacting feedback loops in offshore wind and electric vehicles acceleration, Technological Forecasting and Social Change, 193, 122639, http://dx.doi.org/10.1016/j.techfore.2023.122639, 2023.
- Geels, F. W. and Turnheim, B.: The Great Reconfiguration: A Socio-Technical Analysis of LOw-Carbon Transitions in UK Electricity, Heat and Mobility Systems, Cambridge University Press, Cambridge, 400 pp., ISBN 9781009198240, 2022.
 - Gladwell, M.: The Tipping Point, Little, Brown and Company, Boston, MA, 279 pp., ISBN 9780349113463, 2000.
 - Göpel, M.: The Great Mindshift: how a new economic paradigm and sustainability transformations go hand in hand, Wuppertal Institute, Springer Nature, Wuppertal, 2016.
 - Gray, D. E.: Doing Research in the Real World, SAGE Publications Limited, London, 824 pp., ISBN 9781473947269, 2018.
- Gupta, J., Liverman, D., Prodani, K., Aldunce, P., Bai, X., Broadgate, W., Ciobanu, D., Gifford, L., Gordon, C., and Hurlbert, M.: Earth system justice needed to identify and live within Earth system boundaries, Nature Sustainability, 1-9, https://doi.org/10.1038/s41893-023-01064-1, 2023.
 - Han, H.: How Organizations Develop Activists, Oxford University Press, Oxford, 250 pp., ISBN 9780190463595, 2014.
- Han, H., McKenna, E., and Oyakawa, M.: Prisms of the People, University of Chicago Press, Chicago, 216 pp., ISBN 9780226744063, 2021.



435



- Hayes, C.: The New Abolitionism, https://www.thenation.com/article/new-abolitionism/, 2014.
- Hess, D. J.: Sustainability transitions: A political coalition perspective, Research Policy, 43, 278-283, https://doi.org/10.1016/j.respol.2013.10.008, 2014.
- Hess, D. J.: Energy democracy and social movements: A multi-coalition perspective on the politics of sustainability transitions, Energy Research & Social Science, 40, 177-189, http://dx.doi.org/10.1016/j.erss.2018.01.003, 2018.
 - HMG: Net Zero Strategy: Build Back Greener, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028157/net-zero-strategy.pdf, 2021.
 - Hochschild, A.: Bury the Chains: The British Struggle to Abolish Slavery, Pan Macmillan, London, 480 pp., ISBN 9780330469906, 2010.
 - Hunter, J. D.: To Change the World: The Irony, Tragedy, and Possibility of Christianity in the Late Modern World, Oxford University Press, New York, NY, 368 pp., ISBN 9780199779529, 2010.
 - IEA: Renewable Energy Market Update: Outlook for 2022 and 2023, International Energy Agency, Paris, 0 pp., ISBN 9789264412040, 2022.
- 440 IPBES: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.), 56, https://doi.org/10.5281/zenodo.3553579, 2019.
 - IPCC: IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, doi:10.1017/9781009157896.001, 2021.
- IPCC: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth

 450 Assessment Report of the Intergovernmental Panel on Climate Change,

 https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_FullReport.pdf, 2022.
 - IPCC: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 36 pages. (In press)., 2023.
 - Ipsos and CAST: Net Zero Living, https://www.ipsos.com/sites/default/files/ct/publication/documents/2022-06/net-zero-living-ipsos-cast-2022.pdf, 2022.
 - Jackson, K. and Bazeley, P.: Qualitative Data Analysis with NVivo, Sage Publications, London, 376 pp., ISBN 9781526478474, 2019.



475



- Jackson, T.: Zero Carbon Sooner: revised case for an early zero carbon target for the UK. CUSP Working Paper No.29, https://cusp.ac.uk/wp-content/uploads/WP-29-Zero-Carbon-Sooner-update.pdf, 2021.
 - Jepperson, R. L. and Meyer, J. W.: Institutional Theory, Cambridge University Press, Cambridge, 280 pp., ISBN 9781107078376, 2021.
- Jordan, A., Lorenzoni, I., Tosun, J., i Saus, J. E., Geese, L., Kenny, J., Saad, E. L., Moore, B., and Schaub, S. G.: The political challenges of deep decarbonisation: towards a more integrated agenda, Climate Action, 1, 1-12, http://dx.doi.org/10.1007/s44168-022-00004-7, 2022.
 - Kahneman, D.: Thinking, Fast and Slow, Penguin Books, London, 499 pp., ISBN 9780141033570, 2011.
 - Kern, F. and Rogge, K. S.: The pace of governed energy transitions: agency, international dynamics and the global Paris agreement accelerating decarbonisation processes, Energy Research and Social Science, 22, 13-17, 2016.
- 470 Kirchmeier-Young, M. C., Gillett, N. P., Zwiers, F. W., Cannon, A. J., and Anslow, F. S.: Attribution of the influence of human-induced climate change on an extreme fire season, Earth's Future, 7, 2-10, https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2018EF001050, 2019.
 - Köhler, J., Geels, F. W., Kern, F., Markard, J., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A. B., F. Fünfschilling, L., Hess, D., Holtz, G. H., S. Jenkins, K. Kivimaa, P. Martiskainen, M., McMeekin, A., Mühlemeier, M. S., Nykvist, B. O., E., Pel, B., Raven, R. R., H. Sandén, B. Schot, J. Sovacool, B. Turnheim, B. Welch, D., and Wells, P.: An agenda for sustainability transitions research: State of the art and future directions, Environmental Innovation and Societal Transitions, 31, 1-32, https://doi.org/10.1016/j.eist.2019.01.004, 2019.
 - Laybourn-Langton, L.: The Cohort 2040 Challenge: How Can Future Leaders be Better Prepared for a Future of Worsening Environmental Crisis and Destabilisation of Societies, https://www.ippr.org/files/2022-01/cohort-2040-jan-22.pdf, 2022.
 - Laybourn-Langton, L., Quilter-Pinner, H., and Trelouar, N.: Making Change: What Works?, https://www.ippr.org/files/2021-11/making-change-what-works-october21.pdf, 2021.
 - Leach, M. and Scoones, I.: Mobilising for Green Transformations, in: The Politics of Green Transformations, edited by: Scoones, I., Leach, M., and Newell, P., Routledge, Abigndon, Oxon, 119-133, 2015.
- Leadbetter, C. and Winhall, J.: The Power to Shift a System, https://rockwoolfonden.s3.eu-central-1.amazonaws.com/wp-content/uploads/2021/11/SII_ThePowerToShiftASystem_2021-1.pdf?download=true, 2021.
 - Lenton, T. M. and Latour, B.: Gaia 2.0., Science, 361, 1066-1068, https://www.science.org/doi/10.1126/science.aau0427, 2018.
- Lenton, T. M., Benson, S., Smith, T., Ewer, T., Lanel, V., Petykowski, E., Powell, T. W. R., Abrams, J. F., Blomsma, F., and Sharpe, S.: Operationalising Positive Tipping Points towards Global Sustainability, Global Sustainability, 5, e1, 1-16, https://doi.org/10.1017/sus.2021.30, 2022.



500



- Lenton, T. M., Held, H., Kriegler, E., Hall, J. W., Lucht, W., Rahmstorf, S., and Schellnhuber, H. J.: Tipping elements in the Earth's climate system, Proceedings of the national Academy of Sciences, 105, 1786-1793, https://www.pnas.org/doi/full/10.1073/pnas.0705414105, 2008.
- Levin, S. A., Milner, H. V., and Perrings, C.: The dynamics of political polarization., Proceedings of the National Academy of Sciences USA, 118, e2116950118, https://www.pnas.org/doi/10.1073/pnas.2116950118, 2021.
 - Levine, P.: What Should We Do? A Theory of Civic Life, Oxford University Press, New York, NY, 248 pp., ISBN 9780197570494, 2022.
 - Likaj, X., Jacobs, M., and Fricke, T.: Growth, Degrowth or Post-growth? Towards a synthetic understanding of the growth debate, https://newforum.org/wp-content/uploads/2022/05/FNE-BP02-2022.pdf, 2022.
 - Lockwood, M.: The political dynamics of green transformations: feedback effects and institutional context, in: The Politics of Green Transformations, edited by: Scoones, I., Leach, M., and Newell, P., Routledge, Abingdon, Oxon, 86-101, 2015.
- Lockwood, M., Kuzemko, C., Mitchell, C., and Hoggett, R.: Historical institutionalism and the politics of sustainable energy transitions: A research agenda, Environment and Planning C: Politics and Space, 35, 312-333, https://doi.org/10.1177/0263774X16660561, 2017.
 - Macy, M. W., Ma, M., Tabin, D. R., Gao, J., and Szymanski, B. K.: Polarization and tipping points., Proceedings of the National Academy of Sciences USA, 118, e2102144118, https://doi.org/10.1073/pnas.2102144118, 2021.
- Malik, K.: The Quest for a Moral Compass: A Global History of Ethics, Melville House, London, 400 pp., ISBN 9781612194042, 2014.
 - Mann, M. E.: Radical Reform and the Green New Deal, Nature, 573, 340-342, https://www.nature.com/articles/d41586-019-02738-7, 2019.
 - Marsh, D. and Sharman, J. C.: Policy diffusion and policy transfer, Policy Studies, 30, 269-288, https://doi.org/10.1080/01442870902863851, 2009.
- Marshall, G.: Don't Even Think About It: Why Our Brains Are Wired to Ignore Climate Change, Bloomsbury Publishing USA, New York, NY, 272 pp., ISBN 9781620401347, 2014.
 - Meadowcroft, J.: Engaging with the politics of sustainability transitions, Environmental Innovation and Societal Transitions, 1, 70-75, https://doi.org/10.1016/j.eist.2011.02.003, 2011.
- Meadows, D. H. and Wright, D.: Thinking in Systems, Chelsea Green Publishing, White River Junction, VT, 218 pp., ISBN 9781603580557, 2008.
 - Mealy, P., Barbrook-Johnson, P., Ives, M. C., Srivastav, S., and Hepburn, C.: Sensitive Intervention Points: a strategic approach to climate action, Oxford Review of Economic Policy, (in press), 2023.
 - Meldrum, M., Pinnell, L., Brennan, K., Romani, M., Sharpe, S., and Lenton, T., M: The Breakthrough Effect: How to Trigger a Cascade of Tipping Points to Accelerate the Net Zero Transition, SystemIQ, University of Exeter, Bezos Earth Fund., 2023.





- Milkoreit, M., Hodbod, J., Baggio, J., Benessaiah, K., Calderón-Contreras, R., Donges, J. F., Mathias, J.-D., Rocha, J. C., Schoon, M., and Werners, S. E.: Defining tipping points for social-ecological systems scholarship—an interdisciplinary literature review, Environmental Research Letters, 13, 033005, https://doi.org/10.1088/1748-9326/aaaa75, 2018.
- Moreno, C., Allam, Z., Chabaud, D., Gall, C., and Pratlong, F.: Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities, Smart Cities, 4, 93-111, http://dx.doi.org/10.3390/smartcities4010006, 2021.
 - Moyer, B.: The practical strategist: Movement action plan (MAP) strategic theories for evaluating, planning, and conducting social movements, Social Movement Empowerment Project, San Francisco, CA, 1990.
- Newell, P.: Trasformismo or transformation? The Global Political Economy of Energy Transitions, Review of International Political Economy, 26, 25-48, https://doi.org/10.1080/09692290.2018.1511448, 2018.
 - Newell, P., Twena, M., and Daley, F.: Scaling behaviour change for a 1.5-degree world: challenges and opportunities, Global Sustainability, 4, e22, https://doi.org/10.1017/sus.2021.23, 2021.
- Norgaard, K. M.: Living in Denial: Climate change, emotions, and everyday life, MIT Press, Cambridge. MA, 279 pp., ISBN 9780262015448, 2011.
 - O'Brien, K.: Is the 1.5 C target possible? Exploring the three spheres of transformation, Current Opinion in Environmental Sustainability, 31, 153-160, https://www.sciencedirect.com/science/article/pii/S1877343517301768, 2018.
 - OECD: Climate change impacts and their cascading effects: implications for losses and damages, in: Managing Climate Risks, Facing up to Losses and Damages, OECD Publishing, Paris, 2021.
- 545 OECD: Climate Tipping Points: Insights for Effective Policy Action, OECD Publishing, Paris, ISBN 9789264858763, 2022.
 - Otto, I. M., Donges, J. F., Lucht, W., and Schellnhuber, H. J.: Reply to Smith et al.: Social tipping dynamics in a world constrained by conflicting interests., Proceedings of the National Academy of Sciences USA, 117, 10631-10632, https://pubmed.ncbi.nlm.nih.gov/32327604, 2020.
- Parekh, P. and Rehman, A.: Intersectional Strategies for Rebellion, The Ecologist, 550 https://theecologist.org/2019/nov/07/intersectional-strategies-rebellion, 2019.
 - Polanyi, K.: The Great Transformation, Beacon Press, Boston, MA, 360 pp., ISBN 9780807056431, 2001.
 - Quiggin, D., De Meyer, K., Hubble-Rose, L., and Froggatt, A.: Climate Change Risk Assessment 2021, https://www.chathamhouse.org/2021/09/climate-change-risk-assessment-2021, 2021.
- Raskin, P.: Journey to Earthland: The Great Transition to Planetary Civlisation, 138, http://www.greattransition.org/publication/journey-to-earthland, 2016.
 - Ravenscroft, C. and Kane, D.: Grant funding versus the climate crisis. Blog, https://www.greenfunders.org/2021/03/29/grant-funding-versus-the-climate-crisis/, 2021.
 - Raworth, K.: Doughnut Economics, Chelsea Green Publishing, White River Junction, VT, 320 pp., ISBN 9781603586740, 2017.



565



- Rigaud, K. K., de Sherbinin, A., Jones, B., Bergmann, J., Clement, V., Ober, K., Schewe, J., Adamo, S., McCusker, B., Heuser, S., and Midgley, A.: Groundswell: Preparing for Internal Climate Migration, The World Bank, Washington, D.C., 2018.
 - Ritchie, J., Spencer, L., and O'Connor, W.: Carrying Out Qualitative Analysis, in: Qualitative Research Practice: A Guide for Social Science Students and Researchers, edited by: Ritchie, J. and Lewis, J., Sage Publications, London, 219-262, 2003.
 - Roberts, C., Geels, F. W., Lockwood, M., Newell, P., Schmitz, H., Turnheim, B., and Jordan, A.: The politics of accelerating low-carbon transitions: Towards a new research agenda, Energy research & social science, 44, 304-311, https://doi.org/10.1016/j.erss.2018.06.001, 2018.
- Rockström, J., Gupta, J., Qin, D., Lade, S. J., Abrams, J. F., Andersen, L. S., Armstrong McKay, D. I., Bai, X., Bala, G.,
 Bunn, S. E., Ciobanu, D., DeClerck, F., Ebi, K., Gifford, L., Gordon, C., Hasan, S., Kanie, N., Lenton, T. M., Loriani, S., Liverman, D. M., Mohamed, A., Nakicenovic, N., Obura, D., Ospina, D., Prodani, K., Rammelt, C., Sakschewski, B., Scholtens, J., Stewart-Koster, B., Tharammal, T., van Vuuren, D., Verburg, P. H., Winkelmann, R., Zimm, C., Bennett, E. M., Bringezu, S., Broadgate, W., Green, P. A., Huang, L., Jacobson, L., Ndehedehe, C., Pedde, S., Rocha, J., Scheffer, M., Schulte-Uebbing, L., de Vries, W., Xiao, C., Xu, C., Xu, X., Zafra-Calvo, N., and Zhang, X.: Safe and just Earth system boundaries., Nature, 619, 102-111, https://doi.org/10.1038/s41586-023-06083-8, 2023.
 - Rogers, E. M.: Diffusion of Innovations, 5th Edition, Simon and Schuster, New York, NY, 576 pp., ISBN 9780743258234, 2003.
 - Schmitz, H.: Green transformation: Is There a Fast Track?, in: The Politics of Green Transformations, edited by: Scoones, I., Leach, M., and Newell, P., Routledge, Abingdon, Oxon, 170-184, 2015.
- SCNARC: Minority Rules: Scientists Discover Tipping Point for the Spread of Ideas, http://scnarc.rpi.edu/content/minority-rules-scientists-discover-tipping-point-spread-ideas, 2011.
 - SEI, IISD, ODI, E3G, and UNEP: The Production Gap: Governments' planned fossil fuel production remains dangerously out of sync with Paris Agreement limits (2021 Report), https://productiongap.org/2021report/, 2021.
- Sharpe, S.: Five Times Faster: Rethinking the science, economics, and diplomacy of climate change, Cambridge University
 Press, ISBN 100932649X, 2023.
 - Simms, A. S. and Newell, P.: How Did We Do That? The Possibility of Rapid Transition, STEPS Centre and New Weather Institute, Brighton, 2017.
 - Skocpol, T.: Naming the problem: What it will take to counter extremism and engage Americans in the fight against global warming, Harvard University. Prepared for the symposium on the politics of America's fight against global warming, https://bpb-us-w2.wpmucdn.com/voices.uchicago.edu/dist/7/112/files/2014/03/SkocpolAmericanPolitics.pdf, 2013.
 - Smith, A., Stirling, A., and Berkhout, F.: The governance of sustainable socio-technical transitions, Research policy, 34, 1491-1510, https://doi.org/10.1016/j.respol.2005.07.005, 2005.



600

605



- Smith, A. and Stirling, A.: The politics of social-ecological resilience and sustainable socio-technical transitions, Ecology and Society, 15, 11, https://www.jstor.org/stable/26268112, 2010.
- 595 Smith, S. R., Christie, I., and Willis, R.: Social tipping intervention strategies for rapid decarbonization need to consider how change happens., Proceedings of the National Academy of Sciences, 117, 10629-10630, https://doi.org/10.1073/pnas.2002331117, 2020.
 - Smith, S. R. and Christie, I.: Knowledge Integration in the Politics and Policy of Rapid Transitions to Net Zero Carbon: A Typology and Mapping Method for Climate Actors in the UK, Sustainability, 13, 662, http://dx.doi.org/10.3390/su13020662, 2021.
 - Sovacool, B. K. and Geels, F. W.: Further reflections on the temporality of energy transitions: A response to critics, Energy Research & Social Science, 22, 232-237, http://dx.doi.org/10.1016/j.erss.2016.08.013, 2016.
 - Stadelmann-Steffen, I., Eder, C., Harring, N., Spilker, G., and Katsanidou, A.: A framework for social tipping in climate change mitigation: What we can learn about social tipping dynamics from the chlorofluorocarbons phase-out, Energy Research & Social Science, 82, 102307, https://doi.org/10.1016/j.erss.2021.102307, 2021.
 - Stern, D. I.: The Environmental Kuznets Curve, in: Reference Module in Earth Systems and Environmental Sciences, Elsevier, London, 10.1016/b978-0-12-409548-9.09278-2, 2018.
 - Stoddard, I., Anderson, K., Capstick, S., Carton, W., Depledge, J., Facer, K., Gough, C., Hache, F., Hoolohan, C., and Hultman, M.: Three Decades of Climate Mitigation: Why Haven't We Bent the Global Emissions Curve, Annual Review of Environment and Resources, 46, 653-689, https://www.annualreviews.org/doi/10.1146/annurev-environ-012220-011104, 2021.
 - Stoknes, P. E.: What We Think About When We Try Not to Think About Global Warming: Toward a New Psychology of Climate Action, Chelsea Green Publishing, White River Junction, VT, 320 pp., ISBN 9781603585842, 2015.
 - Stone, D.: Transfer and translation of policy, Policy Studies, 33, 1-17, https://doi.org/10.1080/01442872.2012.695933, 2012.
- Stone, L., Montes de Oca, G., and Christie, I.: A Commoner's Climate Movement, in: Addressing the Climate Crisis: Local action in theory and practice, edited by: Howarth, C., Lane, M., and Slevin, A., Palgrave Macmillan, London, 27-37, 2021.
 - Sunstein, C. R.: How Change Happens, MIT Press, Cambridge, MA, 344 pp., ISBN 9780262538985, 2020.
- Tilly, C. and Tarrow, S.: Contentious Politics, Oxford University Press, New York, NY, 272 pp., ISBN 9780190255060, 2015.
 - Trebeck, K. and Williams, J.: The Economics of Arrival: Ideas for a Grown-Up Economy, Policy Press, Bristol, 224 pp., ISBN 9781447337850, 2019.
 - UNFCCC: Adoption of the Paris Agreement, https://unfccc.int/documents/9064, 2015.
- Vautard, R., van Aalst, M., Boucher, O., Drouin, A., Haustein, K., Kreienkamp, F., Van Oldenborgh, G. J., Otto, F. E. L.,
 Ribes, A., and Robin, Y.: Human contribution to the record-breaking June and July 2019 heatwaves in Western





- Europe, Environmental Research Letters, 15, 094077, https://iopscience.iop.org/article/10.1088/1748-9326/aba3d4/pdf, 2020.
- Vinichenko, V., Cherp, A., and Jewell, J.: Historical precedents and feasibility of rapid coal and gas decline required for the 1.5° C target, One Earth, 4, 1477-1490, https://doi.org/10.1016/j.oneear.2021.09.012, 2021.
- Wainwright, J. and Mann, G.: Climate Leviathan: A Political Theory of Our Planetary Future, Verso Books, London, 224 pp., ISBN 9781786634306, 2018.
 - Wang, S., Corner, A., and Nicholls, J.: Britain Talks Climate: A toolkit for engaging the British public on climate change, https://climateoutreach.org/reports/britain-talks-climate/, 2020.
- Winkelmann, R., Donges, J. F., Smith, E. K., Milkoreit, M., Eder, C., Heitzig, J., Katsanidou, A., Wiedermann, M., Wunderling, N., and Lenton, T. M.: Social tipping processes towards climate action: A conceptual framework, Ecological Economics, 192, 107242, https://doi.org/10.1016/j.ecolecon.2021.107242, 2022.
 - WRI: ClimateWatch Net Zero Tracker, https://www.climatewatchdata.org/net-zero-tracker, 2023.
 - Wunderling, N., Winkelmann, R., Rockström, J., Loriani, S., Armstrong McKay, D. I., Ritchie, P. D. L., Sakschewski, B., and Donges, J. F.: Global warming overshoots increase risks of climate tipping cascades in a network model, Nature Climate Change, 13, 75-82, http://dx.doi.org/10.1038/s41558-022-01545-9, 2023.
 - Yerxa, D. A.: British Abolitionism and the Question of Moral Progress in History, University of South Carolina Press, Columbia, SC, 286 pp., ISBN 9781611170153, 2012.





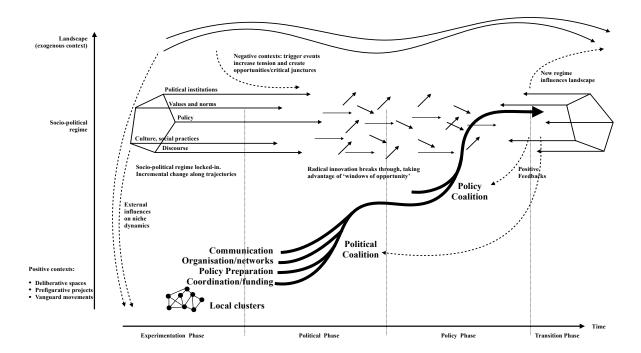


Figure 1: Enabling political tipping points for rapid decarbonisation: a multi-level model (adapted from Geels and Turnheim, 2022).

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