

Working paper:

A temporal-analytical framework exploring the nexus between democracy and climate urgency

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5 Executive Summary

This report investigates the complex and context-dependent relationship between democratic governance and urgent need to move towards sustainable transitions. It challenges the notion that democracy is either inherently supportive or obstructive of systemic environmental change, emphasizing instead that outcomes depend on the interaction of distinct temporal dynamics embedded in both democracy and transition processes.

Using a temporal-analytical framework, the report identifies four typical patterns of interaction: structural mismatch, uncertainty convergence, coordination alignment, and functional asymmetry. These patterns show how specific features of democratic systems, such as electoral cycles, multi-actor governance, and inclusive institutions, intersect with characteristics of sustainability transitions, including long time horizons, uncertainty, and multi-dimensional change. These intersections generate dynamics that may either enable or constrain transitions, depending on institutional configurations and political timing.

The report concludes that democratic systems are not uniformly enablers or barriers to transitions. Rather, the democracy–transition nexus is structured by shifting alignments and frictions that emerge through temporal mismatches, strategic political behavior, and institutional variation. By identifying these interaction patterns, the report moves beyond simple correlations and offers a mechanism-based understanding of when and how democracy shapes transition outcomes. It also highlights the importance of institutional design and temporal coordination in strengthening the capacity of democratic systems to govern long-term sustainability challenges without undermining legitimacy, accountability, or pluralism.

Introduction

The billion-dollar question for climate policy today is whether democracy helps drive sustainable transitions or stands in their way. At a time when the pace of climate action must dramatically increase, there remains a surprising lack of systematic analysis exploring the relationship between democratic governance and sustainability transitions. On one hand, democracies are often credited with enabling the transparency, civic engagement, and institutional coordination needed to meet net-zero targets (Payne, 1995; Owen-Burge, 2022; IPCC, 2022). This view is gaining ground in the energy literature, where concepts like “energy democracy,” “energy sovereignty,” and “ecological democracy” reflect a growing belief that sustainability and democratic values are not just compatible, but mutually reinforcing (Van Veelen and Van Der Horst, 2018; Timmermann et al., 2022).

On the other hand, empirical studies offer only partial support for the view that democracy fosters climate action. While some find positive correlations between democratic institutions and indicators such as emissions reductions and environmental regulation (Povitkina, 2018; Policardo, 2016; Farzin & Bond, 2005; Li & Reuveny, 2006), others argue that democratic systems may also obstruct sustainability efforts, citing electoral volatility, elite capture, and political polarization as sources of policy inconsistency and resistance to structural change. In some cases, democratic processes have delayed or even reversed climate initiatives due to short-term political incentives or fragmented public support (Compston & Bailey, 2013). These critiques have led some to suggest that authoritarian regimes that are less constrained by electoral cycles and public dissent may be better positioned to enforce stringent environmental policies (Lindvall, 2021; Persson & Povitkina, 2017; Machin, 2023; Hickman, 2010).

Others go further, suggesting that the relationship between democracy and climate action may be negligible. For instance, empirical research has found no significant link between democratic quality and CO₂ emissions, challenging the presumed climate advantage of democratic regimes (Selseng et al., 2022; Jordan et al., 2022).

This brief review points to two central questions that remain underexplored. First, what form does the relationship between democracy and sustainable transitions take? Second, under what conditions and through which mechanisms does this relationship emerge, unfold, and shape outcomes?

In attempting to answer the first question, it becomes evident that the literature is marked by deep fragmentation. Theoretically, competing concepts—ranging from “sustainable democracy” to “authoritarian environmentalism”—reflect diverging assumptions about how political regimes shape environmental outcomes. Empirically, findings remain inconclusive. A comprehensive review by Lindvall and Karlsson (2023) of 72 peer-reviewed studies underscores the complexity of the relationship between democracy and sustainability. While democratic states tend to adopt more extensive climate policy frameworks, the evidence linking democratic governance to actual reductions in greenhouse gas emissions is inconsistent. This disconnect between policy output and environmental outcomes suggests the influence of deeper structural and institutional factors that mediate implementation and enforcement.

Turning to the second question, the literature on the relationship between democracy and sustainable transitions often draws broad and vague connections and treat both democracy and transition as singular and abstract concepts (e.g., Hendriks 2008; Jhagroe and Loorbach, 2014; Velicu & Barca, 2020; Tschersich and Kok, 2022). This tendency overlooks the diversity of democratic practices and the multiple pathways that transitions can follow, risks oversimplifying the democracy–transition nexus and obscures critical variations in context, mechanism, and outcomes through which democratic systems may enable or constrain sustainable transitions.

Therefore, this deliverable seeks to address these gaps by providing a nuanced exploration of the possible interrelations between democracy and transitions: investigating the mechanisms that enable the relationship and under what conditions they align or diverge.

To explore these questions, the article unfolds in three main parts. First, we develop a framework for understanding how democracy and sustainability transitions interact, paying special attention to differences in timing, pace, and political dynamics. Next, we identify and explain four typical patterns of interaction between democratic systems and transition processes, showing when democracy can help move transitions forward, and when it can slow them down. Finally, we conclude with key insights for research and policy, suggesting how democratic institutions might be better designed to support long-term sustainability goals while maintaining legitimacy and public trust.

6 Analytical Framework

Understanding the relationship between democracy and sustainable transitions requires more than identifying correlations; it demands close attention to the mechanisms and interactions that shape how democratic systems respond to transition-related disruption. This includes examining how institutions manage instability, how public support is mobilized or eroded, how actors gain or lose influence, and how legitimacy is constructed or undermined over time. Mapping these dynamics is essential to assess not only whether democracy facilitates sustainable transitions, but how and under what conditions it does so. Without this insight, efforts to govern sustainability transitions risk becoming ineffective, politically unstable, or socially unjust.

The socio-technical transitions literature has played a crucial role in advancing our understanding of sustainability transformations, particularly by adopting systems-based frameworks such as the multi-level perspective and transition management. These approaches have yielded valuable insights into structural conditions, historical trajectories, and the policy instruments that guide transitions over extended timeframes (Genus & Coles, 2008; Geels, 2002; Kemp & Rotmans, 2005; Rotmans et al., 2001). However, their strong macro-structural orientation often limits attention to the micro-level mechanisms, political contestation, and strategic agency that influence how transitions actually unfold (Farla et al., 2012). Scholars have pointed to the limitations of the multi-level perspective, noting its relatively weak conceptualization of agency, power, and political contestation within transition processes (Genus & Coles, 2008). Similarly, niche-oriented approaches have been critiqued for their emphasis on consensus-based governance and overly rationalized models of coordinated innovation (Shove & Walker, 2007). These critiques underscore the need for more integrated approaches that combine the strengths of systemic models with finer-grained, agency-sensitive analyses capable of capturing the complex, contested, and negotiated nature of socio-technical change.

To address these gaps and move beyond static, structural accounts, this article develops a temporal-analytical framework to explore how sustainability transitions and democratic institutions interact across time. Our entry point is the observation that socio-technical transitions and democratic systems operate according to different temporal logics. Transitions are typically characterized by deep structural shifts that unfold across long timescales, often spanning decades or more. Democracies, in contrast, are often structured around shorter-term cycles of electoral turnover, shifting public opinion, and the immediacy of political responsiveness. This apparent temporal and structural mismatch have been noted in previous literature, often framed as a tension between the slow pace of systemic transformation and the rapid turnover inherent in democratic politics (Rotmans et al., 2001; Loorbach, 2009; Voß et al., 2009; Fankhauser et al., 2015; Dietz et al., 2023).

Yet, this binary view obscures the temporal complexity embedded within both systems. Transitions are not uniformly long-term; they are composed of interlinked phases that include moments of acceleration, stagnation, backlash, and disruption. Similarly, democratic institutions do not operate on a single temporal register. They contain multiple temporalities - from the short-term cycles of elections to long-term procedures and path-dependent institutional commitments. Recognizing this heterogeneity, we propose that the democracy-transition nexus is best understood not as a simple opposition between short- and long-term logics, but as a dynamic field structured by the interaction of distinct temporal configurations.

To operationalize this perspective, we adopt a theoretical decomposition strategy. Rather than treat "democracy" and "transition" as coherent wholes, we disaggregate each into core analytical components. For democracy, we examine core dimensions such as representation, participation, and electoral cycles. For transitions, we focus on key characteristics identified in the literature—namely, normative directionality, co-evolution and multi-dimensionality, actor diversity, disruptive innovation, and uncertainty (Markard,

2018; Köhler et al., 2019; Kivimaa et al., 2020). This decomposition enables us to trace how specific democratic mechanisms engage with distinct aspects of transition dynamics across varying timescales.

This decomposition serves two purposes. First, it avoids analytical reductionism by not confining democracy to a singular institutional form (e.g., liberal-representative democracy) or transitions to one dominant theoretical framework (e.g., the multi-level perspective). It also facilitates a context-sensitive analysis, attentive to how different democratic configurations generate different temporal alignments or frictions with particular transition trajectories.

Second, it allows us to identify concrete points of interaction - where specific democratic institutions shape, and are shaped by, the logics and demands of sustainability transitions. For example, while participatory mechanisms may enhance the legitimacy of disruptive innovations, short electoral cycles may undermine the continuity of transition policies. Similarly, inclusive governance may facilitate broader societal support for transition goals but also generate negotiation costs and delays. By examining the specific institutional components and their temporal logics, we can better understand the contingent conditions under which democracy accelerates or obstructs transition processes.

At its core, the framework underscores the temporal variability and contextual dependence of the relationship between democracy and sustainability transitions. The interplay between democratic institutions and transition dynamics unfolds through shifting alignments of institutional timing, political responsiveness, and transition sequencing. By centering time as a critical analytical dimension, we offer a more precise account of how, when, and under what conditions democracy can support—or destabilize—sustainability transitions.

7 The interactions

We identify four distinct temporal interactions between core dimensions of democracy and transition dynamics. These interactions are not mechanisms in the traditional sense, but rather enduring tensions that emerge from the inherent temporalities embedded within each domain. As illustrated in Figure 1, each interaction is formed at the intersection of specific democratic dimensions (e.g., electoral cycles, multi-actor systems, inclusive institutions) and transition features (e.g., disruptive innovation, open-endedness, co-evolution). The result is a set of temporally configured relationships ranging from misalignments between short- and long-term logics to alignments across similarly scaled temporalities.

Each of these interactions produces different dynamics that can either enable or constrain transitions, depending on how they unfold in context. For example, misalignments between short-term electoral cycles and long-term innovation needs may disrupt the continuity of supportive policies, thereby slowing or derailing transition processes. Conversely, alignments between multi-actor political systems and co-evolving transition pathways can foster adaptive responsiveness and sustain momentum for change. What matters is not simply the presence of a temporal gap, but how that gap translates into political dynamics that shape the direction, pace, and stability of sustainability transitions.

Rather than framing these temporal interactions as obstacles to be solved, we argue that they constitute a structuring condition of the democracy–transition nexus. These tensions are not inherently pathological; they are “natural” outcomes of the differing temporal logics embedded in democratic and transition systems. What makes them analytically valuable is that they generate identifiable and variable dynamics – dynamics that are not fixed, but open to political intervention, design, and contestation. By focusing on these dynamics, we shift the analytical lens from immutable structures to mutable interactions that mediate outcomes. These interactions, and the dynamics they produce, are the levers through which both democratic quality and transition effectiveness can be shaped.

Next, we examine four key temporal interactions between democracy and transition processes, unpacking their underlying timing dynamics, analyzing the political and institutional effects they generate, and assessing their implications. This analysis reveals distinct patterns of constraint and enablement, offering a more nuanced understanding of the democracy–transition nexus.

Table 1: Interactions between dimensions of democracy and sustainability transitions

The interaction	Democratic dimension	Transition dimension	Temporal relations	Implications for transition	Implications for democracy
The structural mismatch	Elections cycles	Disruptive innovation	Misalignment (Short vs. Long)	constrains transitions	Under-representation/ Weakening of governance
The uncertainty convergence	Elections cycles	Open-endedness and uncertainty	Alignment (Short vs. Short)	constrains transitions	Erosion of trust and expertise
The coordination alignment	Multi-actor political systems	Multi-dimensionality co-evolution	Alignment (Long vs. Long)	Enables/ Constrain transitions	Adaptive responsiveness/ Delegitimizes incumbents
The functional asymmetry	Inclusive institutions	Open-endedness and uncertainty	Misalignment (Long vs. Short)	Enables/ Constrain transitions	Policy-legitimacy gap

Notes: Table 1 presents four named interactions that arise from the interplay between specific dimensions of democracy and socio-technical transitions. Each interaction captures how a democratic dimension—such as the electoral cycle, multi-actor systems, or inclusive institutions—comes into tension or alignment with a corresponding transition dimension—such as disruptive innovation, systemic uncertainty, multi-dimensional co-evolution, or open-endedness. The column titled "temporal relations" specifies whether these dimensions are temporally aligned or mismatched, as in the structural mismatch, where short electoral cycles conflict with the long-term nature of disruptive innovation. Each interaction is then analyzed in terms of its implications for transitions (whether it constrains or enables systemic change) and for democracy such as the weakening of governance, erosion of trust, or the emergence of legitimacy gaps).

7.1 The structural mismatch

In democracies, election cycles are regularized intervals at which citizens exercise their right to vote in competitive electoral contests to select their representatives. These recurring periods of electoral competition serve multiple democratic functions: they confer legitimacy to the political system, create opportunities for citizens to express preferences and ensure accountability and responsiveness (Katz, 1997). By establishing predictable timeframes for renewing public consent, election cycles institutionalize the principle that legitimate authority derives from the will of the people. However, electoral cycles create structural incentives that drive political opportunism. Politicians prioritize policies with visible short-term benefits over those with delayed payoffs, regardless of voter preferences (Sheffer et al., 2017).

In contrast, disruptive innovation represents a gradual, often decades-long process wherein resource-constrained newcomers challenge established incumbents by initially targeting overlooked market segments with simpler, more accessible, or more affordable products. Over extended timeframes, these innovations steadily improve their capabilities, eventually migrating upmarket and displacing dominant firms (Christensen, 1997; Christensen & Raynor, 2003). This lengthy evolutionary trajectory plays a critical role in sustainability transitions by undermining existing socio-technical regimes and catalyzing sustainable practices adoption. The transformative potential of these slow developing but ultimately revolutionary technologies and business models has been recognized as essential for breaking entrenched path dependencies (Geels, 2010; Smith et al., 2010). While these innovations introduce radical alternatives that accelerate sustainability shifts, their emergence and diffusion over prolonged periods fundamentally depend on supportive policy frameworks (Schot & Steinmueller, 2018; Rogge & Reichardt, 2016). Government interventions, particularly phase-out policies establishing clear long-term transition timelines, create necessary conditions for disruptive innovation by signaling enduring market directions and reducing investment uncertainty across extended time horizons (Kivimaa & Kern, 2016; Rosenbloom et al., 2020). The incompatibility between short electoral horizons and the extended timeframes of innovation development creates systematic barriers to technological transformation in climate-critical sectors.

This structural mismatch, As illustrated in Figure 1, creates a critical challenge for climate policy development in democratic systems. While disruptive innovation processes require sustained policy support over extended timeframes, democratic governance creates a fundamental tension as policymakers face a structural misalignment between the long-term nature of climate-related transitions and the short-term incentives created by electoral cycles. This misalignment leads legislators to prioritize policies with visible benefits before the next election rather than investing in transformative changes whose benefits may only materialize decades later (Pereira et al., 2024).

This tension produces two problematic outcomes for sustainable transitions: either critical policy decisions are indefinitely postponed, or they are implemented but subsequently modified or reversed with changing administrations, as evidenced by the policy volatility observed in the United States' swinging stance on the Paris Agreement. The United States joined the Agreement under the Obama administration in 2016, withdrew under Trump in 2017, rejoined under Biden in 2021, and withdrew again under Trump in 2025—just hours after taking office. These reversals reflect a broader pattern in which each administration pursues a fundamentally different climate agenda, undermining the long-term policy continuity essential for climate action and innovation. The resulting uncertainty impedes effective market orientation toward clean technologies and disrupts the institutional stability needed to support transformative innovation.

The Australian carbon tax further illustrates this dynamic. The carbon pricing mechanism, implemented by the Labor government in 2012 within The Clean Energy Future Plan, established signals for low-carbon innovations in the energy sector. However, its subsequent repeal following the 2013 election created policy discontinuity directly attributable to electoral change. As Crowley (2017) documents, Abbott's "pledge in blood" to "axe the tax" made climate policy an early casualty of political ambition, demonstrating how

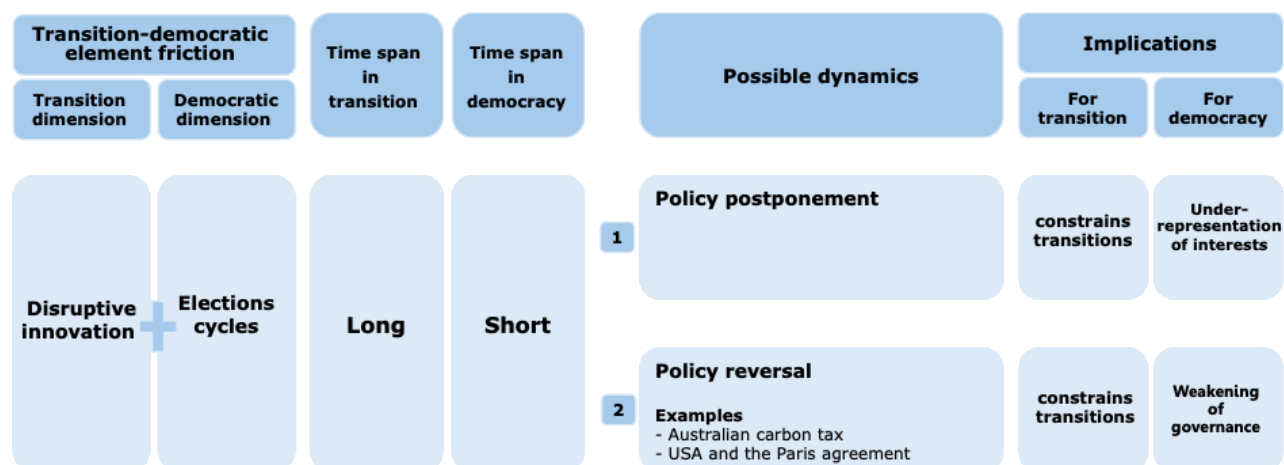
partisan electoral politics can dismantle effective climate initiatives despite their environmental and economic benefits, creating policy uncertainty that undermines long-term investment in sustainable innovation.

Electoral cycles consistently compromise the policy stability needed for transformative innovation through predictable patterns such as shortened political planning horizons and heightened aversion to policies with deferred benefits. This fundamental tension between democratic processes and the need for consistent long-term policy frameworks represents a critical governance dilemma for sustainable transitions that require both democratic accountability and regulatory predictability.

The two outcomes discussed – policy postponement and reversal, have significant implications for both democratic governance and the dynamics of sustainability transitions. For democracy, these outcomes reveal a structural tension between the short-term responsiveness of electoral cycles and the long-term consistency required for addressing complex socio-ecological challenges. Policy postponement reflects a tendency to avoid politically costly decisions, often sidelining critical sustainability measures from the agenda. The consequence is a potential underrepresentation of interests, particularly those of future generations and marginalized communities. Reversal, meanwhile, illustrates how partisan turnover can undermine policy continuity, which in turn may erode public trust in institutions and diminish credibility of democratic commitments to long-term goals. This can also weaken governance by disrupting coherent policymaking and long-term planning.

For sustainability transitions, these dynamics are equally consequential. Postponement delays systemic change and perpetuates carbon lock-in, and reversal destabilizes investment environments and disrupts socio-technical learning processes. This fundamental tension between democratic processes and the need for consistent long-term policy frameworks represents a critical governance dilemma for sustainable transitions that require both democratic accountability and regulatory predictability.

Figure 1: Structural mismatch illustration



7.2 The uncertainty convergence

Open-endedness and uncertainty are defining features of transition processes, creating a landscape where numerous promising initiatives compete within short time horizons, making prediction of successful pathways virtually impossible (Geels and Schot, 2007; Rosenbloom, 2017). Importantly, uncertainty is not evenly distributed over time; rather, it often manifests intensely over short periods during which rapid shifts can occur. These bursts of uncertainty arise from the nonlinear dynamics of innovation, including sudden breakthroughs, unexpected failures, or rapid shifts in cost-performance ratios. They are further amplified by volatile political and sociocultural processes, which can experience swift reversals, accelerations, or shifts in public priorities and policy agendas (Köhler et al., 2019).

Uncertainty also lies at the heart of electoral cycles. Elections are not only moments of democratic choice, but also short, intense periods marked by deep unpredictability—especially regarding who the winners and losers will be, what policy directions will prevail, and how competing visions of the future will resonate with the public. Much like transition processes, where uncertainty tends to concentrate in critical episodes that reshape trajectories, electoral cycles compress volatility and contestation into tightly bounded timeframes. This temporal intensity makes electoral politics and sustainability transitions deeply intertwined through their shared susceptibility to abrupt, high-stakes uncertainty. Both are shaped by rapidly changing conditions, contested interpretations of risk and opportunity, and the struggle to define legitimate courses of action under pressure.

Such concentrated episodes of uncertainty do not occur in a political vacuum. On the contrary, they often open up opportunities for political contestation, particularly in relation to high-stakes systemic changes like the shift to low-carbon technologies. In these moments, political actors may use strategic framing to shape public perception of proposed changes (Meadowcroft, 2009). This is particularly evident during election campaigns, when politicians seek to manage risk perceptions among voters and align with dominant public concerns. Because the costs and benefits of transitions are hard to predict, actors may emphasize uncertainty or negative consequences to justify delays or resist policy commitments (Jordan & Matt, 2014).

In the context of technological solutions, political actors may frame proposed innovations as risky, costly, or ineffective, appealing to voter anxieties, especially under conditions of economic precarity or institutional distrust (Bergman & Eyre, 2011). These frames serve not only to generate skepticism but also to justify policy inaction, thereby delaying or weakening commitment to transition pathways (Boswell et al., 2011). Election periods intensify this behavior. Politicians frequently attempt to discredit opposing agendas by challenging their credibility and effectiveness, particularly when seeking to consolidate electoral support. This tendency becomes especially pronounced in contexts where scientific evidence, factual claims, and political ideologies intersect. The discourse surrounding climate change exemplifies this dynamic, as debates have shifted from policy solutions to questioning the legitimacy of science itself (Rekker, 2021). As such, they may highlight uncertainties or potential failures associated with new technologies—such as renewable energy infrastructure, electric mobility, or carbon capture—to cast doubt on their viability (Sovacool & Hess, 2017). This is particularly true when technological transitions threaten entrenched interests or when the costs are immediate, but benefits are long-term (Pierson, 2000). These dynamics reflect what Markard et al. (2016) identify as the inherently political nature of sustainability transitions, where uncertainties about costs, benefits, and timing create opportunities for strategic framing during electoral competition.

The 2019 Australian federal election illustrates how political actors strategically exploit technological uncertainty for electoral advantage. As part of his election campaign, Prime Minister Scott Morrison exploited the uncertainty surrounding electric vehicle technology to frame Labor's policies as threatening the Australian way of life, even though both parties support similar EV adoption goals. Morrison deliberately increased practical uncertainty about charging infrastructure ("Are you going to take the extension cord

out of your fourth-floor window?”), vehicle capabilities (“It won’t tow your caravan. It won’t tow your boat”) and charging times (attacking Shorten’s “eight to ten minutes” claim). By framing these technological uncertainties as evidence that Labor wanted to “end the weekend” and prevent Australians from going to their favorite camping spots, Morrison legitimized the transition challenges into populist rhetoric that positioned himself as a defender of ordinary citizens from elite-imposed lifestyle changes. This strategic amplification of technological uncertainty allowed Morrison to simultaneously support electric vehicle technology in principle while attacking implementation timelines, demonstrating how transition uncertainty is being weaponized as a campaign tool rather than a challenge requiring evidence-based policy solutions.

Similarly, Germany's 2025 election debate shows this same pattern with renewable energy. Despite strong growth in wind power development, CDU leader Friedrich Merz strategically characterized wind turbines as “ugly” “transitional technology,” while AfD candidate Alice Weidel threatened to dismantle what she termed “windmills of shame.” Both politicians deliberately amplified aesthetic and permanence uncertainties to position themselves as protectors of traditional landscapes against elite-imposed technological solutions, demonstrating how transition uncertainties become weaponized campaign tools rather than technical challenges requiring evidence-based approaches.

While these examples show how politicians exploit technological uncertainty by opposing transitions, former U.S. President Barack Obama's “clean coal” rhetoric demonstrates a more nuanced strategy. During his 2008 campaign and throughout his administration, Obama embraced carbon capture and sequestration technology as a solution that could reconcile continued coal use with climate action. This strategic ambiguity around “clean coal” enabled Obama to postpone confronting the inevitable economic disruption in coal communities while appearing to address climate concerns (Berg, 2012). By promoting an uncertain technological solution that ultimately remained commercially unviable despite billions in federal funding, Obama could position himself as supporting both coal workers and environmental protection. This case illustrates how politicians can exploit technological uncertainty not only by rejecting transitions but also by promoting speculative technologies that postpone the acknowledgment of difficult trade-offs, effectively using technological uncertainty as a bridge between competing constituencies.

The interaction between short electoral cycles and transition uncertainty, illustrated in Figure 2, generates profound implications for both democratic governance and transition processes. Electoral pressures incentivize political actors to manipulate immediate uncertainties surrounding transition technologies and policies for tactical advantage, as evidenced across multiple contexts. This systematic exploitation creates two parallel consequences: for transitions, it produces policy volatility and implementation gaps as politicians repeatedly reframe, delay, or abandon transition initiatives based on electoral calculations rather than technical merit. For democratic governance, this dynamic erodes public trust in both expert knowledge and policy processes as citizens increasingly perceive transition policies through partisan frames rather than as collective challenges requiring evidence-based solutions. The resulting governance paradox presents democracies with a fundamental challenge: the mechanisms ensuring democratic responsiveness simultaneously undermine the capacity to navigate transition uncertainties effectively, as politicians find greater electoral utility in weaponizing uncertainties than resolving them.

Figure 2: Uncertainty convergence illustration



7.3 The coordination alignment

Multi-dimensionality and co-evolution are key features of transition processes, highlighting the complex, interrelated and long-term nature of systemic change. Socio-technical systems comprise interconnected elements—technologies, markets, user practices, cultural meanings, infrastructures, policies, and industry structures (Köhler et al., 2019). Due to this complexity, transitions are slow and non-linear, unfolding over extended periods through interdependent developments across multiple societal domains that must shift in coordination (Köhler et al., 2019). Co-evolution refers to the way these different dimensions influence each other over time. Firms and institutions shape, and are shaped by, both market dynamics and socio-political expectations. This ongoing interplay requires coordinated change across sectors, values, and governance structures (Kemp, Loorbach, & Rotmans, 2007). For example, new technologies may drive policy changes, while evolving cultural values may shape market demand. At the same time, these changes feed back into technological development and institutional responses. Thus, transition processes are dynamic and temporally layered, requiring sustained commitment and alignment among multiples actors, structures, and systems

A core structural feature of democratic governance is its multi-level and multi-actor configuration, which disperses authority across local, national, and transnational arenas and includes both state and non-state actors. This complexity, as Saito-Jensen (2015) notes, reflects a shift in power where nation-states operate within broader networks involving civil society, subnational authorities, and international institutions. This institutional complexity often generates a disjunction between the arenas of policy formulation and those of implementation and mediation, producing coordination challenges. However, such fragmentation also underpins the normative foundations of democratic legitimacy. The deliberative and inclusive processes required to navigate competing interests across multiple levels inherently extend decision-making timelines. Yet this procedural slowness is not merely a structural byproduct—it constitutes a functional asset. By necessitating broad consensus and sustained engagement, democratic governance embeds a long-term temporal horizon into policymaking, thereby enhancing both the legitimacy and durability of societal transformations.

Both democracy and sustainability transitions are inherently long-term in nature. Democratic governance relies on slow, consensus-based processes to build legitimacy, while transitions unfold over extended time spans, requiring sustained coordination across interdependent sectors. Yet their temporal logics often conflict, creating a paradox where two long-term systems can generate inertia unless cross-level and cross-sector coordination is deliberately reinforced. When these two forms of complexity intersect, they form a dual dynamic that can either hinder or enable progress, depending on the alignment of actors, interests, and institutional timing.

The first and most prevalent outcome of this dynamic is a constraining effect, which we refer to as multi-actor friction dynamics. In democratic systems, actors often hold competing interpretations of what the problem is, how urgent it is, and which responses are legitimate or feasible. This diversity, while central to democratic legitimacy, increases the likelihood of policy friction. The multi-dimensional nature of transitions requires coordination across interdependent sectors, each with its own stakeholders, institutional logics, and temporal rhythms. This complexity amplifies disagreements, as progress in one domain (e.g., carbon tax policy) often depends on advances in others (e.g., finance, technology, infrastructure), each governed by distinct actors with divergent mandates and interests. This fragmentation necessitates continuous negotiation and compromise, which slows decision-making and increases the number of veto points in the system. As a result, transitions often stall not due to lack of knowledge or technological feasibility, but because the political system lacks the coherence and agility required for coordinated, cross-sectoral action (Pierson, 2004). The same features that ensure democratic legitimacy—pluralism, deliberation, institutional checks—also raise the transaction costs for promoting transitions.

In contrast, under favorable conditions, the same dynamic may facilitate change by opening a structural alignment window that enables transition. When actors operating across different domains and governance levels identify overlapping interests—such as aligning economic competitiveness with sustainable innovation, or climate adaptation with public health—strategic coalitions can form. These are typically ad hoc, issue-specific alignments formed around a shared window of opportunity. As described in Kingdon's (1995) multiple streams framework, such moments occur when problem recognition, policy proposals, and political receptiveness align to permit decisive action. Such coalitions do not represent a durable reordering of the political landscape but are instead temporary formations capable of bridging institutional divides to produce focused, time-sensitive action. By that, they play a crucial role in activating the long-term trajectories that transitions require (Meadowcroft, 2009).

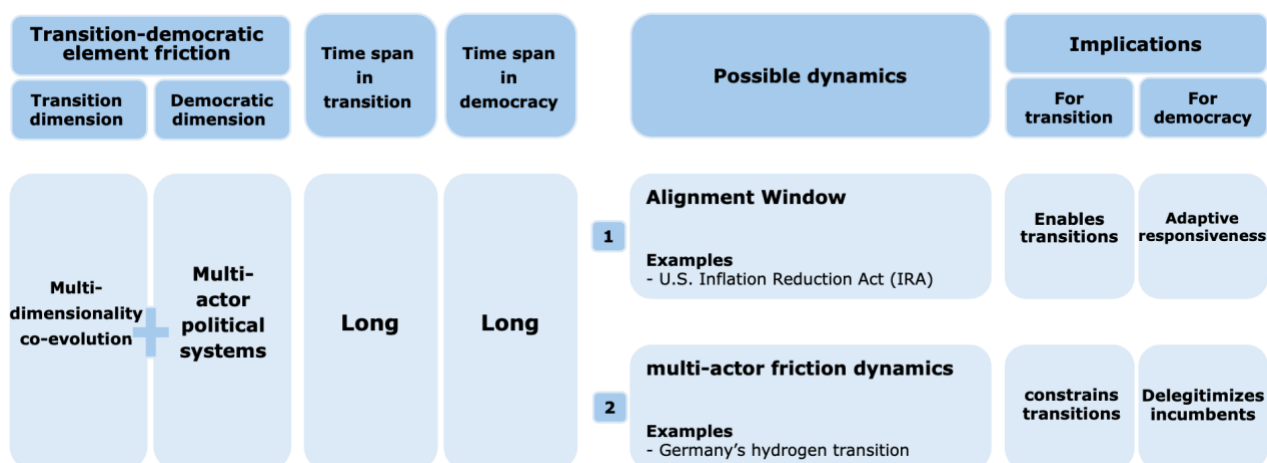
Germany's hydrogen transition demonstrates how the interaction between democratic fragmentation and the multi-dimensional nature of systemic change can constrain long-term climate transformation. As Flath, Kemmerzell, and Knodt (2022) emphasize, the National Hydrogen Strategy—intended to guide a decades-long decarbonization pathway—faces persistent implementation challenges rooted in Germany's federal governance structure. Vertically, responsibilities are distributed across federal ministries, Länder governments, and implementing agencies, each with distinct institutional interests, electoral pressures, and temporal horizons. Horizontally, hydrogen policy spans energy, transport, industry, and research—each governed by different sectoral logics and bureaucratic silos. These fragmented mandates produce overlapping competences, policy inconsistencies, and competition over funding and infrastructure siting. In pluralist democratic systems, the diversity of actors and interests, while normatively legitimate, increases the number of veto points and negotiation layers. When transitions unfold over long timescales and across interdependent sectors, the absence of sustained cross-level and cross-sector coordination slows momentum. In Germany, the hydrogen case illustrates how the very structures designed to ensure deliberation and accountability can become systemic bottlenecks for transformative change.

In contrast, the passage of the U.S. Inflation Reduction Act (IRA) illustrates how democratic systems can enable long-term transitions under specific political and economic conditions, despite institutional fragmentation. As Guri Bang (2023) argues, the IRA was not the result of a unified climate strategy, but of a temporary alignment between diverse interests around economic recovery, energy security, and

geopolitical competition. This reframing of climate action as industrial policy and inflation control created a strategic policy window—what Kingdon (1995) terms the convergence of problem, policy, and politics—through which climate policy could advance in a historically polarized system. Rather than overcoming fragmentation, the IRA worked through it, building issue-specific coalitions that bridged federal, state, and private actors via incentives and subsidies. While the legislation itself reflects a short-term political compromise, it initiates a long-term shift by embedding low-carbon investment into economic structures and institutional routines. This case demonstrates the enabling mechanism identified in democratic transitions: when fragmented actors temporarily align around overlapping interests, even pluralist systems with high transaction costs can catalyze decisive steps in multi-decade transformation trajectories.

The interaction between democratic fragmentation and the multi-dimensional nature of transitions, illustrated in Figure 3, generates dynamics that may carry important implications for both sustainable transitions and democratic governance. For transitions, the fragmentation inherent in democratic systems appears to contribute to recurring implementation delays, inconsistent policy signals, and coordination challenges across sectors and levels of government. Even where strong strategic goals exist, as in the case of Germany’s hydrogen strategy, institutional complexity can limit follow-through and reduce momentum. While temporary alignments, such as those seen with the U.S. Inflation Reduction Act can generate moments of progress, their ad hoc nature raises questions about the long-term coherence and stability of transition pathways in pluralistic systems. For democratic governance, these conditions may increase the risk of political disillusionment, particularly when delays and inconsistencies are perceived as evidence of institutional dysfunction. In such contexts, populist actors may gain traction by presenting themselves as alternatives to slow-moving or unresponsive governance, potentially undermining public trust in democratic institutions. At the same time, the flexibility and openness of democratic systems may offer pathways for adaptive responses, particularly through the formation of cross-cutting coalitions that align around shared interests. these dynamics suggest that the interaction between democratic complexity and multi-dimensional transitions can act as both a constraint and a potential source of resilience, depending on the specific configuration of interests, institutions, and timing.

Figure 3: coordination alignment illustration



7.4 The functional asymmetry

As discussed in section 8.2, the inherently unpredictable and open-ended nature of transition processes frequently peak in short, intense periods of rapid change. During these periods, uncertainty becomes especially pronounced, and transformative shifts can unfold with little warning. Inclusive institutions are a hallmark of democratic systems, characterized by broad access to political participation and equitable economic opportunities. Scholars' attributes sustained economic growth and innovation to democratic institutions, based on the assumption that democracy fosters a free environment that encourages individual initiative and creativity (Popper, 2005; Acemoglu et al., 2019; Yoon et al., 2024). Inclusive institutions are not temporary configurations but enduring structures with a strong capacity to persist over time, often shaping the developmental trajectory of nations for generations. Acemoglu and Robinson (2012) argue that inclusive economic institutions are characterized by secure property rights, an unbiased legal system, and public services that level the playing field, thereby encouraging innovation and investment. Inclusive political institutions, meanwhile, are pluralistic and allow for broad participation in governance, with constraints on the exercise of power.

Within this framework, inclusive political institutions ensure that power is distributed, responsive to the citizenry, and constrained by the rule of law, while inclusive economic institutions secure property rights, uphold contract enforcement, and provide access to education and markets. These inclusive arrangements are mutually reinforcing: pluralistic political institutions enable the formation of inclusive economic institutions, which in turn support a dynamic and prosperous economy. In contrast to extractive institutions, which concentrate power and wealth among elites and stifle innovation, inclusive institutions create incentives for investment and creativity by ensuring that individuals can reap the rewards of their efforts. As such, they not only underpin democratic governance but also contribute to long-term economic performance and social stability by establishing enduring structures that shape behavior across generations.

The interaction between inclusive democratic institutions and the uncertainty inherent in transition processes operates through a critical temporal and functional asymmetry. In this context, functional asymmetry refers to the divergence between the stabilizing functions of long-term institutional frameworks in democracy and the volatile, short-term nature of transitional uncertainty. Whereas transitional periods are often characterized by disorder, rapid shifts, and unpredictability, inclusive institutions serve a distinct function by embedding rules, norms, and mechanisms that foster stability, predictability, and adaptability. This asymmetry enables inclusive institutions to mitigate transitional uncertainty by offering credible commitments and information processing through mechanisms such as secure property rights, the rule of law, and broad political participation (Yoon et al., 2024). By institutionalizing norms and incentives that support transparency, accountability, and public engagement, democratic systems foster the emergence and diffusion of technological innovation.

Empirical literature suggests that these institutional features are not only stabilizing but also catalytic for innovation in the domain of green technologies and environmental performance (Zecca & Nicolli, 2021; Carayannis et al., 2021). This capacity to support innovation is critical for sustainable transitions, as it enables societies to adapt to changing conditions while maintaining social cohesion and economic viability. Thus, the resilience and adaptability of inclusive institutions allow them to absorb the shocks of transitional uncertainty while actively shaping pathways toward sustainable development through innovation.

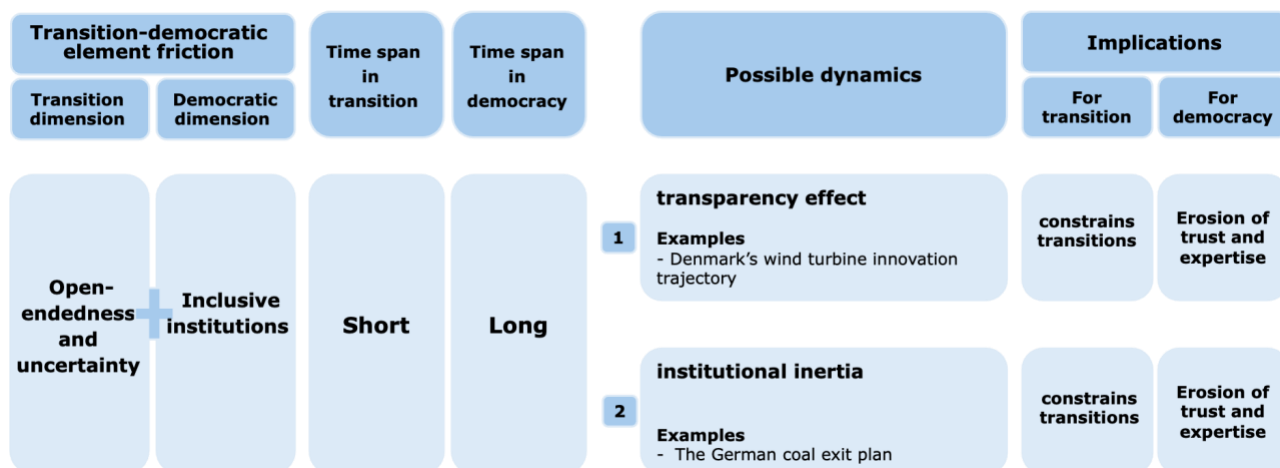
The Danish case, as analyzed by Kamp, Smits, and Andriess (2003), highlights how inclusive democratic institutions can facilitate effective responses to the uncertainty of socio-technical transitions by ensuring broad access to information and embedding learning into the policy process. Denmark's wind turbine innovation trajectory was characterized by a highly decentralized and participatory approach, where a wide range of actors—including local communities, user cooperatives, small firms, and technical experts—were actively engaged in generating, sharing, and utilizing knowledge. This inclusive environment allowed for the accumulation of experiential learning, feedback from practical application, and rapid adaptation of designs, all of which were essential for coping with the complexities and uncertainties of emerging wind

technologies. Democratic norms supported transparency, stakeholder engagement, and responsiveness, which allowed policies to be adjusted based on real-world performance and user feedback. This Inclusive, learning-oriented approach contributed to steady technological improvement and the successful scaling of wind energy. In contrast, the Dutch case—where innovation was primarily driven by centralized research institutions and technical planning—lacked similar mechanisms for integrating experiential knowledge and adjusting strategies based on on-the-ground realities. As a result, the Dutch wind energy program struggled to adapt effectively, illustrating how inclusive democratic institutions that promote information exchange and institutional responsiveness can better support innovation under conditions of uncertainty.

The interaction between inclusive democratic institutions and the uncertainty inherent in socio-technical transitions, displayed in Figure 4, highlights the critical role that democratic governance can play in enabling sustainable development. Transitions often unfold through non-linear processes marked by unpredictability, rapid change, and contested outcomes. Inclusive institutions—characterized by transparency, pluralism, and rule-bound procedures—help mitigate this uncertainty by embedding learning processes, facilitating broad access to information, and fostering adaptive policymaking. As the Danish case illustrates, when democratic systems enable decentralized experimentation and continuous feedback between society, markets, and the state, they can produce robust pathways of innovation. Conversely, when institutions fail to process experiential knowledge or adjust policy accordingly, as in the Dutch case, transitions may falter. Thus, inclusive democratic institutions not only stabilize the transition environment but also act as engines of innovation and adaptability.

For democracies, the growing imperative of sustainable transitions implies a rethinking of the relationship between governance and markets. The high levels of uncertainty intrinsic to these transitions cannot be effectively managed through market mechanisms alone. Rather, democracies that seek to guide socio-technical change must be prepared to intervene in markets through policy frameworks grounded in normative commitments—such as environmental responsibility, intergenerational equity, and social inclusion. Such intervention is not antithetical to democracy, yet it challenges the notion of state neutrality and in cases where there is no broad public support, such action may lack legitimacy. At the same time, this role exposes democracies to potential tensions, particularly in the face of populist movements that resist expert-led governance and disrupt institutional stability.

Figure 4: Functional asymmetry illustration



8 Conclusion

This report has explored the complex relationship between democratic governance and sustainability transitions by foregrounding the role of temporal interactions. In doing so, it has responded to the two guiding research questions: What does the relationship between sustainable transitions and democracy look like? And under what conditions, and through which mechanisms, does it manifest? Rather than asking whether democracy is inherently a constraint or enabler of systemic change, the analysis has approached the democracy–transition nexus as a field structured by temporal asymmetries, political contestation, and institutional variation. The analysis suggests that there is no singular or universal relationship between democracy and sustainable transitions. Instead, this nexus is mediated by a dynamic interplay of institutional configurations, political strategies, and centrally, temporal logics. While democratic institutions are often associated with short-term responsiveness and transitions with long-term structural change, this distinction is not fixed. Both democracy and transition processes are composed of multiple and shifting temporalities– elections and procedural continuity in the former, and both gradual evolution and sudden disruption in the latter. The findings demonstrate that the interaction of these temporal structures does not produce uniform outcomes but generates distinct configurations of interaction, ranging from friction and delay to moments of alignment and acceleration. Democratic systems are not inherently enablers or barriers to transitions.

To move beyond abstract claims, the report has introduced a typology of four temporal interaction patterns: Structural mismatch, Uncertainty convergence, Sustained friction and Functional asymmetry. Each of these patterns identifies how specific dimensions of democratic systems intersect with specific dimensions of transition in temporally structured ways. These intersections generate not only constraints, like policy volatility, delay, or fragmentation, but also enabling mechanisms, such as adaptive learning, legitimacy through inclusion, and the formation of cross-sectoral coalitions.

This typology offers a mechanism-based understanding of how democracy and transition interact under different conditions. It allows us to specify when and how temporal alignment or misalignment produces distinct political and institutional outcomes. For example, short-term electoral incentives may weaken continuity in innovation policy, while inclusive institutions can stabilize expectations and channel uncertainty into productive experimentation.

By centering time as a core analytical dimension, this framework contributes to a more differentiated understanding of transition governance. It equips researchers and policymakers with conceptual tools to assess temporal design — how institutions are structured to handle long-term challenges, how coalitions emerge or fracture across time, and how policy signals are stabilized or undermined. It also responds to a recurring gap in the literature: while many studies have shown positive correlations between democratic institutions and sustainability outcomes, they often fall short of explaining how and under what conditions these relationships unfold (e.g., Povitkina, 2018; Policardo, 2016; Farzin & Bond, 2005; Li & Reuveny, 2006). Rather than adding another correlation, this report introduces a typology of temporally structured interaction dynamics that specify the conditions under which democratic features shape transitions. These interactions offer hypotheses that can be empirically tested and further refined. In doing so, the framework aligns with ongoing efforts to move beyond associational findings and toward mechanism-oriented explanations (Goetz et al., 2020; Pickering et al., 2022).

Looking ahead, this perspective also offers a foundation for investigating emerging threats to democratic legitimacy, including populist backlash. The very temporal tensions that complicate sustainability governance such as delays, perceived inefficiency, and policy inconsistency, may be exploited by populist actors seeking to discredit democratic processes. This raises critical questions for future research: How can democracies build temporal resilience? What institutional reforms can align short-term responsiveness with

long-term coordination? And how might strategies for managing transition timeframes strengthen rather than weaken democratic legitimacy?

Importantly, this analysis reframes the democracy and transition nexus not as a binary of compatibility or incompatibility, but as a field of structured tensions. These tensions are not pathological failures but conditions that can be managed, mediated, or even strategically leveraged. They invite attention not just to what transitions require, but to how democratic systems can evolve to meet those demands without sacrificing legitimacy, accountability, or pluralism.

Aligning the working paper's analytical focus with Trans4Demo's objectives allows us to highlight the following challenges and forms of directionality.

1. Fast politics, slow transitions

Elections arrive quickly; transitions evolve slowly. Governments may set ambitious goals, yet soon confront a new campaign, new partisan incentives, or shifting public pressures. Long-term transition pathways can appear fragile when filtered through short-term political horizons. These gaps—between promised direction and volatile political timing—are often where social movements mobilise, highlighting perceived drift, delay, or loss of ambition.

The broader mitigation logic that follows is straightforward: societies need mechanisms that keep long-term trajectories legible and trustworthy even as governments change. When long-term aims remain visible, monitorable, and publicly interpretable, short-term democratic accountability and long-term transition continuity can reinforce, rather than undermine, one another.

2. Uncertainty as a political fault line

Climate transitions inherently involve technological, economic, and social uncertainty. Yet uncertainty is not evenly distributed across time: it tends to intensify during moments of political competition. Elections and crises compress volatility, creating opportunities for actors to politicise or weaponise uncertainties. In these high-pressure windows, fears and doubts can become powerful tools for mobilisation and polarisation.

The underlying mitigation logic here is about transforming uncertainty into a shared object of interpretation rather than a divisive political instrument. When societies have institutional and civic spaces in which to deliberate what is known, contested, or unknown, uncertainty becomes less amenable to strategic manipulation. Such spaces enable collective sense-making and reduce the volatility associated with compressed political timeframes.

3. Many actors, many speeds

Sustainability transitions involve an array of actors—governments, cities, industries, unions, farmers, communities, activists—each operating on different temporal registers. Municipalities may innovate rapidly; national legislatures move more slowly. Industries plan for decades; social movements mobilise in days. These asynchronous rhythms generate recurring frictions not only between institutions, but between competing imaginaries of the future.

Here, the broader mitigation logic points toward coordinated pluralism: approaches that allow diverse, and often contentious, actors to interact, negotiate expectations, and align their trajectories without erasing their differences. When structured arenas exist for conflict to surface, be processed, and be channelled, actor diversity becomes a resource for transition robustness rather than a vector of fragmentation.

4. Slow-changing institutions in a rapidly shifting world

Core democratic institutions—rule of law, rights, participation, public administration—are inherently slow-moving. This temporal stability can be frustrating for those demanding rapid transition, but it also provides crucial anchors during periods of disruption. Social movements often push against institutional inertia, yet they also depend on these institutions to articulate grievances, contest decisions, and demand accountability.

The working paper highlights an important insight: the very slowness of democratic institutions can stabilise transitions amid uncertainty, provided these institutions remain open to learning, adaptation, and engagement with societal pressures—including those articulated by movements. In this sense, institutional persistence and civic dynamism can be mutually reinforcing rather than mutually exclusive.

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