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# Triggering transformative change: a development path approach to climate change response in communities

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While climate change action plans are becoming more common, it is still unclear whether communities have the capacity, tools, and targets in place to trigger the transformative levels of change required to build fundamentally low-carbon, resilient, healthy communities. Evidence increasingly supports the finding that this transformation is not triggered by climate policy alone, but rather is shaped by a broad array of decisions and practices that are rooted in underlying patterns of development. Even so, these findings have rarely penetrated the domain of practice, which often remains squarely focused on a relatively narrow set of climate-specific policies. This article builds a conceptual framework for understanding the dynamics of community-level development path transformations that may both dramatically reduce GHG emissions and significantly enhance community resilience. This framework illuminates eight critical enablers of innovation on climate change, each of which is illustrated by compelling examples of community-level experimentation on climate change across the province of British Columbia, Canada. It is concluded that community-based climate (or sustainability) policy might be more likely to trigger development path shifts if it employs a longer time horizon, recognition of adaptability and feedbacks, integrated decision making, and systems thinking.

**Policy relevance**:
This article deepens the understanding of the underlying drivers of both GHG emissions and vulnerability to climate change impacts. A development path framing of climate change responses suggests that highly nonlinear opportunities may emerge to push drivers of emissions or vulnerability over a tipping point and trigger a shift that cascades beyond the community in which the initial action took place. The findings highlight the need for policy approaches that use longer time horizons, systems thinking, adaptive management, and integrated decision making in community planning.

*Keywords*: adaptive management; climate change policies; community planning; development pathways; governance

## 1. Introduction

Global climate change, exacerbated by anthropogenic GHGs, poses an immediate and serious threat to both the ecological integrity of Earth's biosphere and the social and economic stability of society (IPCC, 2007; Stern, 2006). Success in addressing climate change at the international level has been mixed. While some countries have responded to their Kyoto Protocol commitments, others, Canada

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included, have not met their Kyoto goals. Most recently, the Canadian federal government has actively withdrawn from any international commitments to climate change targets, while, paradoxically, provincial governments are increasingly designing and implementing climate change policies. Local governments are also working to address climate change within their own jurisdictions as they have direct control of critical sources of emissions (Betsill, 2001; Bulkeley & Betsill, 2005) and are the scale at which the potentially catastrophic impacts of climate change will play out (Wilbanks & Sathaye, 2007). Spheres of influence at each of these levels of governance are overlapping, however, creating both significant challenges and interesting opportunities to transform development pathways.

This transformation is not simply technical in character. Indeed, a common finding is that low-carbon communities, or sustainable development pathways, are both technologically and economically feasible (Kainuma, Miwa, Ehara, Akashi, & Asayama, 2013; Skea & Nishioka, 2008). Instead, the challenge is largely related to governance, policy, and the search for responses that achieve multiple objectives simultaneously while avoiding politically and socially undesirable tradeoffs (Burch, 2010b). The primary objective of this article is to build a conceptual framework for understanding the dynamics of community-level development path transformations that may both dramatically reduce GHG emissions and significantly enhance community resilience. The modest progress made by international negotiations, the absence, in some cases (such as Canada), of coherent national policy, and the constrained capacity in many communities suggest that this process may be most effectively pursued through a multi-level lens – designing policy approaches that are not strictly top-down nor bottom-up, but rather harness multiple loci of agency, are experimental and creative in nature, and address the concerns of a wide array of actors.

The conceptual framework developed in this article comprises two major parts: (1) a policy-relevant definition of a development path based on existing literature and prevailing practice and (2) an exploration of how development paths change over time, including who triggers changes and how they are sustained. Building on sustainability transitions and multi-level governance literatures, a more nuanced definition of development paths is developed, along with the question of how a development path approach might directly alter sustainability and climate change policy in practice. This process illuminates critical enablers of innovation, as it is applied in an empirical context. Examples are provided from municipalities in the Province of British Columbia, to demonstrate the applicability of this approach in a community context and consider the ways that climate change policy development in communities might change to support enabling conditions if a development path lens is employed. Ultimately, this conceptual framework forms the foundation for empirical work in communities to better understand innovative climate change policy development in the Canadian province of British Columbia, and a broader research agenda that explores potential enablers of development path or sustainability transitions in communities.

## 2. What is a development path?

The term ‘development path’ has been defined as the ‘complex array of technological, economic, social, institutional, cultural and biophysical characteristics that determines the interactions between human and natural systems, including consumption and production patterns, over time at a particular scale’ (Sathaye et al., 2007, p. 700). This definition, however, is somewhat general. What

is the nature of the interactions between these characteristics? At what geographic or societal scales do paths exist, and how do they qualitatively differ between scales? What is the source of change in a path, and can it be triggered or managed?

The concept of 'pathways' has been explored in various ways by sustainability scholars, such as the efforts by Leach and colleagues to elucidate the governance processes that shape unfolding social–technological–ecological dynamics (Leach et al., 2007; Leach, Scoones, & Stirling, 2010). In their examination of pathways to a low-carbon society, Skea and Nishioka (2008) take a largely static view of communities at any particular point in time, which leaves unexamined the question of latent potential for transformation (which may be as yet unrealized). This suggests the need to identify the 'seeds' of transformation in communities, in order to inform policy that might cultivate these seeds and accelerate sustainability transitions. In order to provide greater nuance to the definition of a development path, however, the current authors integrate two disparate literatures that employ a systems lens in the context of sustainability transitions. These literatures include what has become known as socio-technical transitions theory and multi-level governance theory.

Early studies into technological innovation (cf. Arthur, 1989; Nelson & Winter, 1982) often focused on the level of the technological artefact, rather than the broader system of policy and culture that surrounds systems of interlinked artefacts (Berkhout, 2002). Gradually, though, the unit of analysis has broadened to include 'socio-technical systems', or the linkages between a multitude of elements (such as artefacts, knowledge, capital, labour, cultural meaning, etc.), all of which are necessary for society to function (Geels, 2005b; Rip & Kemp, 1998; Schot, Hoogma, & Elzen, 1994). These systems provide stability within society, but this interlinking phenomenon may also be a potential source of path dependency, creating reinforcing systems that stabilize underlying values and characteristics of socio-technical systems (Geels, 2004). These systems also support institutional inertia and can contribute to decision-making gridlock (Dale, 2001, 2008; Dale & Newman, 2007). Despite this broadening, however, studies of socio-technical transitions often remain focused on a particular technology (de Haan & Rotmans, 2011; Markard, Raven, & Truffer, 2012), such as the shift from cesspools to sewer systems (Geels, 2006), or from carriages to automobiles (Geels, 2005a).

Studies of transitions in these socio-technical systems may be roughly grouped into four frameworks (Markard et al., 2012) or approaches. Each of these approaches contributes elements of the development path approach crafted by this article, but the fourth (transition management) provides the most fruitful linkages to the crucial issues of governance and politics. Taken together, however, these branches of transition studies highlight the importance of nonlinear change at multiple socio-technical levels, loci of innovation, institutional barriers to change, and the challenges faced in attempting to govern or steer shifts toward more sustainable pathways.

The first framework is referred to as the 'multi-level perspective' and explains change in socio-technical systems through the interplay of three nested levels. The first is the 'landscape' level, or large-scale cultural and political trajectories. Landscapes are driven by cultural norms and values that shape and frame systems and exist beyond the control of individual actors. Structure in the system is provided by socio-technical regimes (the second level): semi-coherent sets of rules or a linked patchwork of other rule regimes (such as the purely technical rule regime, the user and market regime, and the policy regime), the rules of which are aligned in some way with one another (Berkhout, 2002; Geels, 2004; Rip & Kemp, 1998). Stability in this level may also create inertia. The source of change in socio-technical systems is more likely to occur at the third level: the 'niche' (Seyfang & Smith, 2007). Niches are

protected spaces in which a radical novelty can develop, unhindered by the market forces and socio-cultural rules that typically provide relative stability in the broader socio-technical system (Geels, 2004). Rules in these niches are less certain, providing an opportunity for intentional deviation from the underlying path (Garud & Karnøe, 2003).

Strategic niche management is the second framework, and focuses on the intentional creation and nurturing of protected spaces, or 'niches' in the language employed above, that may serve as a source of change to the incumbent regime, possibly triggering a shift to a new constellation of actor/network/technology relations (Hoogma, Kemp, Schot, & Truffer, 2002; Kemp, Schot, & Hoogma, 1998; Raven & Geels, 2010).

Innovation in a niche space, such as a climate change 'experiment' (Bulkeley & Castan Broto, 2013) may be considered a systemic boundary condition whereby new artefacts and knowledge exist on the periphery of the socio-technical system and are therefore set apart from the system itself (Wiseman, 2012). In other words, while the current market system drives particular pathways of innovation, a radical diversion from that pathway (or at least the planting of seeds that may ultimately become a radical diversion) may only occur with intentional action in the realms of policy and practice. Public subsidies or strategic investments in the case of a new technology (Geels, 2005a), or through legislation in the case of innovative policy and governance arrangements, may be the intentional action that can create niche spaces and trigger a sustainability transition. Transition scholars propose other sources, or pathways of change (Geels & Schot, 2007), however, including pressure from the landscape level (or outside actors), or the build-up of internal regime tensions that ultimately lead to a reconfiguration of actor/technology/institution relations (Papachristos, Sofianos, & Adamides, 2013).

The third approach common to transitions theory explores technological innovation systems (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008; Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007; Jacobsson & Johnson, 2000) by focusing on the emergence of new technologies and their institutional or organizational contexts, as well as drivers and barriers to this emergence (Markard et al., 2012).

Transition management (Kern & Smith, 2008; Loorbach, 2010; Rotmans, Kemp, & van Asselt, 2001) is the fourth and final core framework employed by transitions studies. This set of approaches combines technical transitions with complex adaptive systems theory (Holling, 2001; Kauffman, 1995) and theories of governance (Rotmans et al., 2001; Smith, Stirling, & Berkhout, 2005). Socio-technical systems do not operate independently, but through the involvement of human actors and organizations, who, in turn, operate in the context of rules and institutions (Geels, 2004). Management of transitions from one socio-technical system to another is a complex process that must be analysed using a long-term, systems-level perspective that considers the dynamic coevolution of actor–technology–institution interactions, the importance of social learning, and the nonlinear potential of niche innovations (cf. Frantzeskaki, Loorbach, & Meadowcroft, 2012; Loorbach & Rotmans, 2010; Nevens, Frantzeskaki, Gorissen, & Loorbach, 2012). This raises the question of governance: the actors, formal and informal rules, and networks of interaction that guide the creation of such boundary conditions, potentially overcoming sources of path dependency. As such, transition management suggests the need to delve more deeply into the realm of multi-level governance (MLG) theory, and provides the core foundation of the approach employed in this article.

First explicitly applied to analyses of 'Europeanization' (Benz & Eberlein, 1999), MLG theorizes the reallocation of authority away from the central state to regional authorities (Hooghe & Marks, 2001), non-state actors, and even cross-boundary networks. The roots of MLG are diverse, and grow out of studies of federalism (Riker, 1964), decentralization (Prud'Homme, 1995), and analyses of both

European integration and the relative influence of European state governments in various policy areas (Deutsch, 1954; Lindberg & Scheingold, 1970), often with a historical institutionalist flavour (as in Pierson, 1996). MLG approaches are frequently applied to subnational governance of environmental issues, with a particular focus on climate change as an issue that requires 'integrated action at multiple levels of government' (Schreurs, 2010, p. 88).

A recognition of the advances made by subnational actors, in particular in the US, has led some scholars to conceptualize climate change governance beyond the international regime (Betsill & Bulkeley, 2007; Okereke, Bulkeley, & Schroeder, 2009), drawing particular attention to the role of subnational actors as implementing agents of domestic policy (Dilling, 2007; Rabe, 2008). MLG as a theoretical frame has been particularly useful for studies of the role of cities in climate change mitigation, given that cities are politically, jurisdictionally, and financially bounded by higher levels of government (Betsill & Bulkeley, 2006; Burch, 2010a; Schroeder & Bulkeley, 2009). In other words, while the urban or community scale is an important context within which to explore sustainability transitions (and climate change responses more narrowly), an MLG approach highlights the dynamic interactions amongst scales (Bulkeley & Betsill, 2005), mirroring the systems-based approach of the sustainability transitions and socio-technical systems literatures. Furthermore, it highlights the potential influence of fluid, issue-oriented alliances between levels of government and various actors (a polycentric model) in contrast to a more hierarchical model in which competencies are distributed rather than overlapping (Bulkeley & Betsill, 2003; Hooghe & Marks, 2003).

Ultimately MLG embodies the notion that greater collaboration amongst academic approaches, and across theoretical and empirical models, is required to gain a more coherent understanding of political phenomena (Bache & Flinders, 2005). Emerging governance arrangements among state and non-state actors may 'support an appropriate balance between permanence and change' (Pahl-Wostl, 2009, p. 358) – an important attribute in the face of the uncertainty and complexity associated with climate change, for instance. MLG also recognizes the critical role of network formation between key actors and quasi-institutional intermediaries in helping to inform and shape policy.

MLG theory paired with socio-technical transitions literature reveals the nested scales of governance and networks that contribute to particular development trajectories that lead to vulnerability and high emissions. Taken together, these theories suggest that emissions trajectories arise from patterns of production and consumption, costly transportation and energy provision infrastructure, vested political interests, regulatory environments, and deeply held values contributing to unsustainable development trajectories.

In sum, these literatures illustrate that a development path:

- Operates at the scale of socio-technical systems and systems of governance, which consist of social systems (formal and informal rules, habits, and norms), networks amongst actors, diverse technologies, and ecological systems
- Is an emergent property of a system, imbued with values, norms, rules, and habits rather than a measurable set of conditions/characteristics
- Exhibits a particular set of interlinking regime rules and behaviours, including inertia and cascading effects over time
- Is reinforced at multiple levels, with varied capacities and constraints on local agency occurring at each level.

This description of a development path builds upon the fields of transition management and MLG in a number of crucial ways. The current authors weave together elements from each of the four approaches to transitions described above: cities are viewed as niche spaces, tracing how policy can trigger the creation and diffusion of these niches, taking elements from strategic niche management. Explicit consideration is given to the pressures and dynamics at multiple levels of governance and networks of interaction, a trait in common with the multi-level perspective (and MLG), while considering the influence of barriers and drivers that is central to technological innovation systems. As discussed, however, the development path approach builds most directly upon transition management, especially its focus on governance, and its explicitly normative and prescriptive approach, taking sustainable development as the ultimate long-term goal of transitions (Loorbach, 2010).

To these approaches, however, three new or deepened elements are added that address key gaps in these literatures. The first is a more explicit focus on the politics and policies that characterize transitions (called for by Markard et al., 2012), which is a particular strength of MLG theory over transitions. This shift away from a focus on technologies follows more closely the definition of a transition proposed by de Haan and Rotmans (2011, p. 92), who describe a transition as a 'fundamental change in the structures, *cultures* and *practices* of a societal system, profoundly altering the way it functions' (emphasis added). A development path approach also deepens the contextualization of transitions to look not just at conditions for change, such as tension and pressure (de Haan & Rotmans, 2011), but also the roots of these conditions beyond the narrow social system that serves a particular function. In other words, a development path approach enhances both temporal contextualization (building on past efforts to identify path dependencies in technologies and infrastructures) (cf. Berkhout, 2002) as well as systems or societal contextualization (more common to historical institutionalist approaches to path dependence, as in Pierson, 2000; Pierson, 2004). Third, the current authors' characterization of a development path contributes to a shift away from a static or simplistic depiction of transitions (de Haan & Rotmans, 2011; Jacobsson & Johnson, 2000) to a more complex, fluid, and multi-system perspective. A careful examination of power, its origin, allocation, and evolution, is a further dimension that remains under-explored[1] by transitions theory. This important theme is beyond the scope of this article, but is an avenue for future study.

The sections that follow take as a starting point these key features (i.e. an emergent property of multiple socio-technical systems, imbued with inertia, and reinforced at multiple levels of government) as a characterization of development paths. These features allow for a fuller exploration into why change to currently unsustainable development paths is imperative, who or what may trigger a shift towards a more sustainable path, and the overall potential for this shift to occur.

## 3. Exploring development path change

The challenge of addressing global climate change, including dramatically reducing GHG emissions to 80% below 1990 levels by 2050, suggests that current models of urban development, energy provision, and consumption will need to be altered dramatically. In fact, eco-efficiency (Korhonen & Seager, 2008) and incremental change (Konnolla & Unruh, 2008) may only serve to perpetuate unsustainable trajectories. A fundamental shift in socio-technical systems and trajectories may be exactly what is required to sufficiently address the challenge of climate change (Rotmans et al., 2001; Rotmans

et al., 2000). How this is cultivated within the policy constraints of communities poses interesting questions about what policy, technology, and social tools exist to generate the enabling conditions for this type of transformative change.

Research and practice show that innovations are occurring in the climate policy and green technology arena. Mounting evidence, however, suggests that these actions are insufficient to dramatically reduce emissions and enhance community resilience. For instance, despite a long history of international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) (Harris, 2007) and multiplying local, regional, and national climate change action plans, global emissions are steadily increasing (Raupach et al., 2007). Furthermore, it is clear that climate change impacts are already being felt around the world (Parmesan & Yohe, 2003), and are exacerbated by existing inequalities, poverty, illiteracy, and economic instability (Adger et al., 2007; Adger, Brooks, Kelly, Bentham, & Eriksen, 2004; Brooks, Adger, & Kelly, 2005).

Thus, two dimensions can be observed that contribute to the scale of the challenge of responding to climate change: the first simply relates to the quantity of emissions that must be reduced in order to stabilize climate change and the multitude of ways in which resilience must be enhanced. The second, however, is more complex: emissions and vulnerability trajectories, as described above, appear to be deeply imbued with inertia or path dependency, and thus are resistant to change (Burch, 2010a, 2010b).

The scale of this challenge suggests the need to capitalize upon every opportunity to introduce and embed GHG emissions reductions and adaptation to projected impacts into decisions at every level. Indeed, it has been suggested that unless climate change policies are embedded in deeper changes in underlying development paths, it will be prohibitively expensive and disruptive to achieve our climate goals (Morita, Nakicenovic, & Robinson, 2000; Nakicenovic & Swart, 2000; Robinson et al., 2001; Swart, Robinson, & Cohen, 2003). This suggests the desirability of integrating climate policy with broader sustainability goals relating to economics, social dimensions, technology, and environment (Bizikova, Burch, Cohen, & Robinson, 2010; Robinson et al., 2006; Sathaye et al., 2007). It also supports the notion of moving beyond a static or single-system analysis of sustainability transitions, as described earlier. With this view, sustainability must be woven throughout a broad range of policy priorities. For example: community development practices, fiscal mechanisms, health and education policies, and arts and culture could be mobilized to enhance community resilience. Decisions including strategically timed capital improvements that consider life cycles and vulnerability, strategic land-use, urban form, energy and transportation benefits, and assessments of the benefits versus costs of retrofitting existing public, commercial and residential assets are all part of the mix (Robinson et al., 2008). As such, the initial goal is to identify the levers or tools that might be used to trigger a shift in the underlying development path. Following on this, the task then becomes to ensure that the shift becomes embedded or 'institutionalized' in daily practice, but is also adaptable to changing future conditions. In other words, the primary goal of the approach developed here is to build upon key theoretical and empirical insights (regarding, as mentioned, the need for a broader approach to reaching climate goals than climate policy alone) and knit together the complementary insights of MLG theory with socio-technical systems analysis, to propose a new set of policy priorities.

Given this imperative to fundamentally shift development paths towards more sustainable ones, and build policy that might support this shift, in this section we explore the dimensions of development path change. In particular, we are interested in who (stakeholders, levels of government,

individual champions, or leaders) might trigger a shift, what new alliances and partnerships are emerging, and what specifically might change.

### 3.1. Who triggers a shift?

The first dimension of *who* might trigger development path shifts relates to the specific leaders/actors, and the second dimension pertains to how these actors relate to one another, particularly through network formation (Dale & Onyx, 2005). It is clear that climate change policy development at the nation-state level, and resulting negotiations amongst them, has produced mixed results at best. Furthermore, power is shifting away from the central state to a diverse array of subnational and non-state actors (Hooghe & Marks, 2001). Even so, a significant suite of measures that directly target key drivers of emissions pathways lie within the jurisdiction of national governments (such as fuel efficiency standards and regulations on international trade).

At the other end of the spectrum, municipal governments control waste management and land-use planning. Other domains are more complex. In the province of British Columbia, for instance, responsibility for transportation planning resides in an uncomfortable middle ground, funded by the provincial government, planned at the regional level, but fundamentally determined by municipal land-use plans (such as density enhancement and the creation of compact, complete communities). Similarly, the City of Vancouver is the only municipality in the province that is empowered to create its own building code, while all other municipalities must follow the British Columbia building code. It is clear that policy coherence between the municipal, provincial/state, and federal levels is crucial in order to account for the overlapping spheres of authority that are relevant to significant reductions in GHG emissions. Moreover, policy alignment and coherence in decision making regarding development patterns, including land use, transportation, and energy infrastructures, and management of short- and long-term risks, can reduce emissions and build resilience simultaneously. In other words, niche spaces for climate change experimentation may be created at the community scale, but, without some measure of alignment with at least provincial goals, it is unclear that these experiments will be translated into other community contexts and be adopted at a scale that significantly alters emissions pathways and community resilience. This suggests a blend of de Haan and Rotman's (2011) 'reconstellation' (top-down or government-led structural changes like privatization) and 'empowerment' (small-scale initiatives that gradually gain power and influence in a system).

NGOs, civil society partnerships, and quasi-institutional intermediaries play an important role in developing buy-in as well as facilitating engagement with the public that ultimately elicits public visions of a sustainable future and enhances the legitimacy of sustainability initiatives. These actors play a critical role in providing access to financial resources and to intellectual capital, particularly for smaller communities. They provide an important bridge for MLG arrangements between governments at larger scales and at the local level.

### 3.2. What is shifting and how?

The multi-level perspective argues that transitions come about through interactions between processes at three levels: (1) niche-innovations build up internal momentum, through learning processes, price/performance improvements, and support from powerful groups; (2) changes at the landscape level create pressure on the regime; and (3) destabilization of the regime creates windows of opportunity

for niche-innovations. The alignment of these processes enables the breakthrough of novelties in mainstream markets, where they compete with the existing regime (Geels & Schot, 2007).

Experimental innovations occurring in niche spaces across different sectors and scales globally require mobilization via broad-scale networks to guide and scale the overall potential of transitioning to a more sustainable socio-technical regime. This raises questions of governance and the interlinking patchwork of actors, institutions, and organizations operating with formal and informal rules at diverse scales, including networks of interaction among them.

Systems of governance have the potential to guide the creation of boundary conditions or niche spaces, mobilize 'experimental' learning more broadly, potentially overcoming sources of path dependency (Bos, Brown, & Farrelly, 2013). Transitions involve learning-by-doing, experimental approaches, multi-scale governance approaches, and deliberative learning agendas that optimize the knowledge and relational capacities among the diversity of actors functioning in a socio-technical system (Bos et al., 2013; Geels & Schot, 2007). No transition is planned and coordinated 'from the outset', but every transition becomes coordinated at some point through the alignment of visions and activities of different groups. This convergence is an achievement that emerges during transitions (Geels & Schot, 2007).

How information about successes and failures becomes mobilized across niche spaces points to the role of social learning. As noted in Bos et al. (2013, p. 398), 'Learning, and in particular social learning, nurtured through the process of experimentation, is considered very important in overcoming stable and difficult-to-change socio-technical systems.' The potential for an innovation or combination of innovations to transition out of a socio-technical regime and toward a new, more sustainable one, is a complex process that must be analysed using a long-term, systems-level perspective. In an effort to elucidate the manner of change in socio-technical systems, Geels (2005c) distinguishes between pattern and mechanism. Mechanisms can play a role in speeding up/slowing down processes or lead to changes in direction. Patterns stretch over the entire process of system innovation (re: development path innovation), whereas mechanisms identify points, over shorter time periods, to intervene in the system. Geels (2005c) uses these to move beyond the contingency and complexity of actor networks to embrace how these local interactions add up to patterns on a more aggregated level. This is important for understanding how niche-level innovations become radical enough to influence regimes and potentially landscape scales such as climate change.[2]

Technological transitions are one element of the type of shift in development required to meet the climate change challenge. Green technologies such as solar, biomass, and wind represent a mobilizing shift in energy technology; however, without a shift in public policies, cultural meanings, institutional and material infrastructure, novel network formation and public/private partnerships, and user and market preferences, the shift will be only technological and not sufficiently transformative. The question then becomes what are the necessary constituents of system-wide change? Technology plays an important but not determinant role in the system; technological artefacts tend to shape the types of innovation that are required by society. It is, however, society and culture that determine which technologies are amplified to shape society, leading to a transformative development pathway shift. Rules are not just constraining (making some actions more legitimate than others), but also enabling (creating convergence of actions, predictability, trust, reliability) (Geels & Schot, 2007).

In sum, it is not simply technologies, but constellations of actors, governance approaches, and values that are fundamentally altered in a development path shift. Social learning and

experimentation are crucial drivers of this process, as are pressures from linked, but external, systems. Furthermore, this process is complex and emergent, and thus beyond traditional control and management (cf. Allenby & Sarewitz, 2013). Rather, experimentation and engagement are crucial dimensions of this emergence, and represent a very different approach for policy and governance.

### 3.3. Challenges to change

As previously argued, path dependency is a key barrier, whereby alternatives become increasingly less likely over time as learning accumulates, irreversible choices are made, and inter-related elements of a system become deeply intertwined (Berkhout, 2002; Pierson, 2004). Path dependency also stifles innovation as transition strategies are often thought to be impossible as the financing options are not available, especially in larger-scale issues such as transportation patterns. This often results in barriers to the design and implementation of sustainability-oriented policies, both in the private and public sectors. Path dependency may characterize a number of the institutional processes by which capacity is built and utilized, as well as the clusters of technologies that are employed in response to a problem like climate change (Berkhout, 2002; Dusyk, Berkhout, Burch, Coleman, & Robinson, 2009; Geels & Schot, 2007). As such, this phenomenon presents unique challenges to those attempting to create policies that challenge the institutional or technological status quo. High start-up costs, coordination and learning effects in policy development, and adaptive expectations are identified as likely reasons for path dependency in institutions (Pierson, 2004).

Finally, a puzzle is encountered: is the goal to embed or entrench a new, more sustainable development path (i.e. create 'good' path dependency) or can some balance between flexibility and efficiency be found? Either option requires changing the rules of the game (e.g. policy development) either to ensure the continuation of sustainable practices, or to create mechanisms for adaptive management. Institutional lock-in, bureaucratic rigidities, lack of integrated decision making, policy alignment and coherence all interact to act as a powerful barrier to development path change. As a development path is defined here as an emergent property, then adaptive management is necessary in order to establish flexible guiding indicators that point the way towards a more sustainable path, one that may be altered in the future as values, capacities, and priorities shift.



## 4. Implications of development paths for climate change policy and practice in communities

A development-path framing of climate change responses and sustainability in communities suggests particular strategies for triggering innovation and enabling a sustainability transition. This section draws out the specific characteristics of innovative community-level climate change responses that, taken at the scale of community policy development, might have the potential to do more than marginally or incrementally reduce emissions or enhance resilience. Rather, these characteristics or conditions might enable a more fundamental transition towards a sustainable development path. In order to anchor these strategies in an empirical context, we draw examples from the province of British Columbia.

### 4.1. Context: provincial climate change policy and local experiments in British Columbia

Beginning in 2008, the provincial government of British Columbia announced a suite of climate change policies and initiatives that would dramatically alter both the expectations of municipalities and also the tools they had at their disposal to achieve emissions reductions. Although some municipalities in the province had been starting to address GHG emissions since the implementation of the Partners for Climate Protection Program (a milestone-based system offered through a partnership between ICLEI (International Council for Local Environmental Initiatives) and the Federation of Canadian Municipalities) (Federation of Canadian Municipalities, 2007), these efforts had been piecemeal and largely unsupported at the provincial level.

The cornerstone of the provincial climate policy was a revenue-neutral carbon tax. Beginning at $10/tonne of carbon dioxide equivalent ($CO_2e$) in 2008, and rising by $5 per year until 2012, the revenues from the carbon tax were designed to flow back to British Columbia residents through income and business tax reductions (rather than accumulating as a source of general revenue for the province) (Province of British Columbia, 2008). Municipalities that paid this carbon tax on fuel purchased for their fleets and heating of municipal buildings (for instance) would receive a carbon tax rebate if they demonstrated that they were making progress towards becoming carbon neutral in their own operations, through the creation of GHG inventories, implementation of reductions strategies, and the purchase of carbon offsets. The British Columbia Climate Action Revenue Incentive Program (CARIP) was initiated to redistribute carbon taxes back to municipalities.

Added to the carbon tax was the Climate Action Charter, a voluntary commitment made by municipalities to measure and report their GHG emissions, become carbon neutral by 2012, and create compact, complete communities. A British Columbia Green Building Code was created, which increased standards for water and energy efficiency, and the Local Government (Green Communities) Statutes Amendment Act required municipalities to integrate GHG reduction targets into their core planning documents (Province of British Columbia, 2008).

The provincial government acknowledged, however, that these strategies, even if implemented to their fullest extent and with complete success, would only take the province 73% of the way to their goal of reducing GHG emissions by 33% below 2007 levels by 2020 (Province of British Columbia, 2008). This suggested the need for innovative action on the part of other actors, and other levels of government, mirroring the insights offered by MLG theory. A preliminary scan of municipalities across the province and collaboration with partners from civil society, utilities, and research institutes (Burch, Herbert, & Robinson, in preparation) showed that some municipalities across the province were developing and implementing actions that may address some of the deeper drivers of emissions trajectories, and perhaps have the potential to trigger longer-term development-path shifts. It is clear, however, that transformative change in the underlying development path may only be fully evident in hindsight, making challenging the task of identifying the 'seeds' of such transformation and the key enabling conditions. The sections that follow here begin to identify a series of conditions that may allow for deeper longitudinal analysis of transformation in the province (and elsewhere).

Based on the conceptual framework developed in Section 2, the current authors have identified the following enabling conditions, which may be necessary yet probably not sufficient conditions for moving towards a sustainable development path. The identification of these enablers contributes directly to our efforts to move beyond a static or single-system view of sustainability transitions, and

instead employ a more holistic development-path approach. For each of these conditions, examples are provided from municipalities in the province of British Columbia in order to demonstrate the applicability in a community context and to provide the foundation upon which deeper investigations and analyses will occur (Table 1).

### 4.2. Evaluating the potential for long-term development-path transformation

A development-path framing of climate change responses suggests that highly nonlinear opportunities may emerge to push drivers of emissions or vulnerability over a tipping point and drive a shift that cascades beyond the community in which the initial action took place. The enabling conditions described above share four core characteristics that emerge from a development-path framing and hold the potential to transform emissions trajectories:

- *Longer time horizon*: Planning beyond a single electoral cycle opens up the possibility of aligning with building turnover, and avoids the devaluation of assets (such as coal or heavy bitumen) that must remain either untapped or managed through carbon capture and sequestration, if transformative emissions targets are to be reached. This echoes a fundamental tenet of sustainability transition work, in which a longer timeframe is key to understanding system dynamics (Loorbach, 2010). Monitoring of key indicators, for instance, requires an investment in the collection and analysis of data beyond that which might be present in a single electoral cycle of three or four years. Similarly, exploring the potential of synergies between adaptation and mitigation requires timelines that allow the emergence of longer-term benefits (or at least multiple benefits that become apparent at different times, rather than a single benefit with a simple and short-term payback period). The carbon tax in British Columbia provides a measure of certainty with regard to the costs and rewards of mitigation activities into the future (assuming the tax remains intact), and further evidence of this longer timeframe is present in the City of Vancouver's transportation plan, which reaches to 2040, and its GHG emissions targets that have been set for both 2020 and 2050 (City of Vancouver, 2012a, 2012b).
- *Systems thinking*: networks of neighbourhoods, communities in a region, and patterns of interaction between a wide variety of actors may serve to avoid larger-scale technological and/or social lock-in. As discussed in Section 2, this requires a shift from considering a single socio-technical system to an exploration of the linkages between many systems. This type of systems thinking is evident in the consideration of both adaptation and mitigation, as was done in the case of Surrey.
- *Adaptability and feedback*: Monitoring, community engagement, and collaborative models of organizational structure provide opportunities for the emergence of synergies and contribute directly to the systems-based approach described above. The cities of Vancouver, Surrey, Victoria, and others have implemented systems of monitoring and verification, of varying levels of rigour and breadth, that satisfy this condition.
- *Integrated decision making*: Expanding governance systems through participatory processes and widening the scope of the climate change problem to encompass a wider array of issues. This necessitates a greater degree of policy alignment within, and policy congruence between, levels of government, integration of planning processes and climate change adaptation and mitigation, and alignment of goals at a strategic management and operations level. This is particularly

**Table 1.** Eight enabling climate change policy conditions with the potential for engendering sustainable transformative change

| Enabling condition | Description | Example |
|---|---|---|
| 1. Participatory governance and social inclusion | Deep and ongoing engagement between state and non-state actors, including civil society and the private sector, both in policy design and implementation phases | Municipal planners and engineers work closely with social planning advocates and environmental NGOs in the community of Revelstoke to design a District Energy Expansion Plan and an Integrated Community Sustainability Plan; the City of Victoria has had sustained and innovative engagement with climate change and sustainability planning using participatory scenario consultation, for instance |
| 2. Considering synergies and tradeoffs with other priorities | Embedding in policy development and implementation an explicit exploration of linkages between climate change responses and economic development, social equity, non-climate environmental priorities (such as biodiversity), etc. | The City of Surrey is framing climate change responses as part of a broader approach to sustainability, opening up links to community revitalization, job creation, and fuel poverty |
| 3. Set ambitious targets with specific deliverables, creative funding mechanisms to support them, and appropriate timing | Specific targets for GHG reduction set that both contribute to targets at higher levels of government and acknowledge a balance between what is feasible and desirable; timing of targets may include aligning with building turnover and election cycles | The City of Vancouver is the only community in British Columbia with control over its own mandated building code, which helps to create policies such as LEED Gold standards for all new development in the city; GHG reduction targets include reducing community-based emissions by 33% below 2007 levels by 2020, brought about through a portfolio of strategies (including landfill gas recovery, neighbourhood energy utilities, requirements for construction of carbon-neutral buildings, and others) |
| 4. Employing a diverse set of tools to reach targets | Creatively employing building codes, bylaws, community engagement, and other tools to coordinate efforts and accelerate progress | The City of Surrey is exploring how new Development Cost Charges can facilitate green building, and push developers to meet higher standards; the City has also passed a new bylaw requiring new buildings in the city centre to be equipped to plug into the District Energy System<br>The City of Victoria has undertaken 'bottom-up' target setting with participants from high-emissions and high-energy-consuming sectors to develop feasible targets and identify priority areas for action |

*Continued*

**Table 1.** Continued

| Enabling condition | Description | Example |
|---|---|---|
| 5. Monitoring and evaluation of key indicators (beyond simply GHG emissions) | Defining and constructing systems for gathering data on collaboratively defined and comprehensive measures of community sustainability | The City of Surrey has created a web-based sustainability dashboard for which data is collected on 87 indicators, such as tree canopy cover, proximity measures (i.e. what percentage of the population lives within 400 m transit of schools, parks, and groceries), and vehicle kilometres travelled |
| 6. Iterative, adaptive management | Based on insights provided by monitoring and evaluation, opportunities are regularly available to adapt plans and policies, include new stakeholders, account for emerging science, take advantage of unexpected synergies, and avoid tradeoffs | The City of Victoria includes resiliency in its Sustainability Action Plan and is currently developing key indicators that monitor performance in an adaptive way |
| 7. Strategic partnerships that coordinate efforts and integrate decision making | Link to policy innovation, and coherent framework, coupled with evidence of the importance of quasi-institutional intermediaries | The City of Revelstoke benefits directly from partnerships with both BC Hydro (the provincial electricity utility) and the Columbia Basin Trust[3] The Carbon Neutral Kootenays, a partnership between three regional districts and the Columbia Basin Trust, has collaborated to help 35 rural municipalities and First Nations develop community energy and emissions plans and identify key actions for GHG reductions; 100% of participating governments have undertaken some actions, including those small communities that would otherwise not have the capacity to do so |
| 8. Leadership | May originate in the technical, political, or community realms, but creates niche spaces in which innovation can occur, exploiting opportunities to achieve multiple objectives simultaneously | The City of Vancouver established the value of leadership on climate change and sustainability in the early 1990s, altering the political calculus for successive municipal administrations and building momentum behind local sustainability precincts, district energy, landfill gas recovery, compact communities, and a suite of other measures |



important given the diffusion of authority captured by MLG theory, and the inconsistencies that can be a symptom of decentralization. The overarching suite of climate change policies implemented by the province of British Columbia takes steps toward this level of policy alignment, but deep inconsistencies remain. Within cities, such as Surrey, a sustainability frame may help to reveal policy inconsistencies and bring the broader operation of the city in line with long-term sustainability goals.

These conditions merge early empirical insights from the British Columbia cases with the theoretical perspectives presented earlier in this article, and suggest that a development-path lens may assist in an assessment of the 'transformative potential' of community action on climate change. Inevitably, not all of these cases are diverging radically from past practices, nor will all of them transform emissions pathways and vulnerability. Nonetheless, steps have been taken in each case that may provide lessons to other communities seeking to pursue the same path.

For instance, fundamental change in how governments 'do' policy and govern is required to embed enabling conditions in a sustainable development pathway. Many analysts have talked about a fundamental shift from government to governance (Dale, 2001; Sabel, 2001; Young & Maltke, 1993), changing the 'rules of the game'. The suggestion here is that, in order to address climate change, large-scale collective (e.g. policy) decisions on infrastructure, land-use patterns, built environment, and social mobilization are required. Institutional barriers need to addressed, and partnerships created between the research, private, and practitioner communities for faster adoption of sustainable technologies and greater knowledge diffusion. Climate change adaptation and mitigation necessitates unprecedented coordination, as well as policy congruence and collaboration within and between levels of government. Strategic coordination between levels of government and other relevant actors is necessary for the effective implementation of policies and strategies that generate social learning and policy innovation that can influence behavioural change at the macro-, meso-, and micro-levels. The challenge then is to ensure coordination and policy alignment between different departments and levels of government. Particularly relevant is policy congruence between government departments related to health, environment, and transportation, if the rules of the game are going to be changed to influence more sustainable development pathways.

This involves a much more collaborative, open-ended, and horizontal policy development process (Dale, 2001) and constant exploration about what critical policy linkages have to be made in vertical operations delivery to achieve climate change action. This suggests that 'arrangements that include a wider group of stakeholders interacting across different levels, perhaps drawing on principles of coalition building or deliberative democracy, may better address the dynamics and complexity of climate change' (O'Brien, Hayward, & Berkes, 2009, p. 12). These arrangements reflect the realities of MLG, but are also important triggers of multi-system sustainability transitions. An expanded policy-development process includes social learning that is reflective of an iterative process of feedback with the sectors and majority of key stakeholders affected by those policies and involved in its development (Dale, 2007).

Despite promising signals that communities are pursuing innovative strategies with significant potential, the ultimate implications of these strategies require further investigation about how each of these enabling conditions and policies are being nurtured in the local community context and whether, and in what combinations, communities are triggering, or taking steps to trigger, broader shifts in the development path. Additional data collection in communities across the province, including in-depth qualitative and quantitative analysis and cross-case comparison, is currently being undertaken to more accurately determine this.

## 5. Conclusions and future directions

Efforts to address climate change at the international level have yielded varying levels of success, leading to an increasing focus on the multi-level governance of climate change and the importance of both state and non-state actors. Running parallel to this shift in focus is the recognition that GHG emissions and vulnerability emerge out of a complex web of trajectories that are path-dependent and rarely under the direct control of any single actor. This article gathers these insights to deepen a definition of the development path, and explore the usefulness of this framing in the context of community-based responses to climate change.

The authors' definition of a development path suggests that it is a multi-level phenomenon that is governed at multiple scales and imbued with inertia, giving rise to both emissions trajectories and vulnerability. Triggering a fundamental shift in the underlying path may require the cultivation of innovation in 'niche' spaces and in policy formation, including participatory models of governance that engage a broad spectrum of actors to devise solutions that deliver multiple social and environmental benefits simultaneously.

This framing ultimately brings to the fore a further set of questions, the answers to which will inform the design of more transformative responses to climate change, and broader sustainability transitions in communities. These questions are both theoretical and empirical in nature. For instance, given nested scales and blurry system boundaries, how can it be known if a development path has actually changed, and how can the causes be confidently attributed to the change? Empirically relevant questions that directly pertain to policy development and implementation in communities include the following. How can change toward sustainability be normalized, or embedded in practices and procedures? How is a balance struck between this 'institutionalization' of sustainability and the flexibility required to adapt to changing future conditions (such as changing values or new climate science)? What are specific indicators of a sustainable development path, such as flows of energy, waste, and materials, social integration and equity, and technological innovation?

Ultimately, the conceptual framework developed here will form the foundation for empirical work that examines examples of communities that are implementing strategies that may be viewed as transformative rather than incremental. It should be restated that the province of British Columbia provides a regulatory environment (e.g. carbon neutrality in municipalities) to monitor on-the-ground climate change policies and practices that may be transformative at the community scale. The diversity of approaches taken at the community scale in fulfilling and leading on this climate change mandate offers a unique living laboratory from which to examine the ways innovative and embedded climate policy can ultimately influence sustainability policy and overall development paths. The purpose of this future work will be to explore the roots of these actions, the mechanisms devised to govern them, and their capacity to transform development pathways in the future. While the eight enabling conditions (Table 1) have been identified as key elements of a development-path transition, it remains unclear to what extent all eight have to be present and/or what combinations are required. It is clear, however, that lessons taken from this particular Canadian context may be useful for other regional and local governments interested in taking transformative action on climate change and sustainability principles.

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## Notes

1. While power is not a key component of most transitions studies, attention to this theme has grown in the last five years. Hoffman (2013), for instance, examines the ways that power itself is transformed in the process of a transition, through creativity that triggers novel responses beyond the habitual. Avelino and Rotmans (2011) develop a conceptual reframing of power that is helpful in the context of sustainability studies, and that adds the dimensions of dynamism and nonlinear change that are so central to transitions.
2. Sociotechnical landscapes do not determine, but provide deep-structural 'gradients of force' that make some actions easier than others. Geels and Schot (2007) distinguishing three types: (1) factors that do not change or that change only slowly, such as climate; (2) long-term changes, such as German industrialization in the late 19th century; (3) rapid external shocks, such as wars or fluctuations in the price of oil.
3. The Columbia Basin Trust (CBT) was established in 1995 in order to ensure the equitable distribution of benefits arising out of the Columbia River Treaty (a 1961 agreement between the US and Canada to share the costs and benefits associated with dams developed along the Columbia River). The CBT currently provides expertise and ongoing funding to communities in the region, supporting programmes on environmental, social, and economic issues.

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