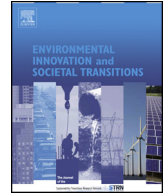




Contents lists available at ScienceDirect

Environmental Innovation and Societal Transitions

journal homepage: www.elsevier.com/locate/eist

The politics of innovation spaces for low-carbon energy: Introduction to the special issue



ARTICLE INFO

Keywords:

Politics
Protective space
Innovation
Transition
Energy

ABSTRACT

Energy systems around the globe face multiple, major pressures to transform into more sustainable ones. Over the past decades numerous, potentially sustainable energy innovations have been proposed, studied, developed and implemented to varying degrees. In the field of transition studies, scholars have used the notion of 'protective space' to study how such innovations emerge, grow, survive and decline over time, but few take an explicit political perspective on these dynamics. This editorial briefly reviews why such a perspective is necessary, and, on the basis of the contributions in this special issue, what it could entail in evolutionary, relational and institutional terms. The paper ends with six lessons for those involved in sustainable innovation advocacy.

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1. Introduction

Energy systems around the globe face multiple, major pressures to transform so as to guarantee more sustainable production and consumption of energy. Climate-change, depletion of resources, access to energy services for development and poverty reduction, and security of supply are all demanding a restructuring of current energy systems (Verbong and Loorbach 2012).

Over the past decades numerous, potentially sustainable energy innovations have been proposed, studied, developed and implemented to varying degrees. This includes, for example, on- and off-shore wind energy, solar PV technologies, carbon capture and storage, bioenergy innovations, insulation technologies, zero-energy buildings, electric vehicles and other greener cars. Some innovations like on-shore wind and bioenergy are supported by well-established innovation systems and are part of regular investment and policy portfolios in certain regions, while others like carbon capture and storage are struggling to become established (e.g. Vergragt 2012; Meadowcroft and Langhelle 2009).

What all these innovations have in common is that they are or have been characterized by (sometimes fierce) contests for social, industrial and political attention and legitimacy. Innovation advocates have had to engage with debates and discourses in the wider world in order to maintain the flow of

<http://dx.doi.org/10.1016/j.eist.2015.06.008>

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material and social resources, lobby for favourable contextual changes, such as institutional reforms, and strategically team up with or argue against advocates of incumbent innovation systems or competing niche innovations. This makes innovation processes in the context of sustainability transitions inherently political (Meadowcroft, 2009).

In the field of transition studies, scholars have used the notion of 'protective space' to study how sustainable innovations emerge, grow, survive and decline over time in the context of mature and well-established innovation systems or socio-technical regimes (Schot and Geels, 2008). Few, however, have paused to consider how such spaces are constructed and transformed and how these processes should be understood from a political perspective (Smith and Raven, 2012). Such a perspective implies not only a good understanding of how emerging niche technologies or technological innovation systems are facing politically powerful incumbent socio-technical systems, but also how claims, counter-claims and bargaining over the distribution of risks and benefits of lower-carbon innovations themselves shape their development. After all, some low carbon technologies imply controversial social and economic consequences, e.g. further concentrations of wealth (e.g. mining profits from raw materials for batteries), centralized authority (e.g. nuclear energy), landscape blight (as argued by some opponents of onshore wind), land-grabbing (e.g. biofuel crops) and geographical shifting of industries and jobs (e.g. production of solar photovoltaic cells from Germany to China). So the physical and social spaces in which these technologies develop and are deployed are infused with politics, in the sense of advocates needing continually to justify the expanding reach of their activities in the wider social world.

Practical examples of the creation of spaces for low-carbon innovation include attempts to lobby policy actors or corporate decision makers for necessary resources such as money and human skills, which can trigger further development of a low-carbon innovation (Kern et al., 2014; Wesseling et al., 2015). Low-carbon innovation advocates may also engage in attempts at actively changing their selection environments through institutional work, for example, by generating media attention in order to influence public discourse or participate in campaigning for changing national or international legislation, or technology and infrastructure standards. All of this occurs in the context of competing societal, policy and corporate agendas, problem definitions and proposed alternative solutions. Consequently, most sustainable energy innovations involve contestation (with varying degrees), e.g. over their costs, desired locations, sustainability, required policies, future potential, alternatives and so on.

The papers in the special issue explore both theoretically and empirically the politics of 'protective spaces' for low-carbon energy innovations from a range of theoretical perspectives, in a variety of empirical contexts. Section 2 continues with a discussion of the importance of taking a political perspective on low-carbon energy innovation. Section 3 briefly introduces four theoretical perspectives for the analysis of protective spaces, motivated by the approaches found in the various contributions in this special issue. Section 4 introduces and summarizes these contributions. The final section draws lessons for those involved in the promotion of sustainable innovations.

2. The politics of low-carbon energy innovation

The identification of innovation and technological development as a political endeavour is not new. Pioneering scholars in the emerging field of innovation studies such as Chris Freeman and Amílcar Herrera pointed out, in response to the original Limits to Growth report, how environmental innovations require changes in over-arching social and economic institutions, and that this was an inherently political endeavour (Cole et al., 1973; Herrera et al., 1976). Redirecting technological change in more environmentally sustainable directions requires policy, and hence political, action (Foray and Grubler, 1996; Rosenberg, 1976). Around the same time, studies into the roles played by technology in society identified the social choices involved in its development, as well as the social consequences of the choices made in technological developments, all of which made technology development a site of political contestation (Winner, 1977; Noble, 1984; Feenberg, 2002). However, while these early studies acknowledged how politics can shape emerging trajectories of technological developments, they were not entirely successful in translating these insights into analytical frameworks that put political aspects centre stage. Instead, approaches like national systems of innovation (Freeman, 1995; Lundvall, 1992) or technological innovation systems (Bergek et al., 2008; Hekkert et al., 2007) became very popular as frameworks for formulating policy advice. While these recognize politics, e.g. by acknowledging the

central role of ‘political networks’ in institutional change (Jacobsson and Bergek, 2004), they rarely analyse political dimensions in any detail.

In the context of deliberately governing innovation and technological development towards more overtly normative outcomes, like sustainability, interest in political issues is regaining attention. Notably, in a somewhat implied way, the early development of strategic niche management acknowledged these themes from an earlier generation of studies of innovation and technology. The concept of second-order learning in niche experimentation for instance, points to the way in which regime routines (e.g. institutional, cognitive, investment, user, policy and industrial norms) are a powerful impediment to further niche development (Kemp et al., 1998). As such second-order learning as compared to first-order learning signals how improvements in the prospects of the socio-technical niche innovation are dependent upon wider changes to social and political structures. Yet, the political work needed to act on second-order lessons, and deliberately ‘stretch and transform’ selection environments, rather than ‘fit and conform’ to these structures (Smith and Raven, 2012), has been underplayed. Perhaps this muting arose through the development of transition management in a context of advice to political incumbents rather than political challengers (Smith and Kern, 2009), although arguably this is changing (Narberhaus et al., 2014). Acting upon lessons arising from niche experimentation, which point to the need to radically destabilise and reform inhibiting regimes, will always struggle to find a willing audience, when it criticise the social structures reproducing vested economic interests, positions of political authority, cultural privileges, social norms, technological designs, and research agendas; unless there are accompanying political strategies in place to address these critical findings and issues (Scrase and Smith, 2009).

Criticism was quick to point to the limited attention given to power and politics in early transition studies (Smith et al., 2005; Shove and Walker, 2007; Meadowcroft, 2009); and there have been suggestions as to how this may be remedied (Avelino and Rotmans, 2009; Lawhon and Murphy, 2012; Geels, 2014; Hess, 2014). However, none has yet looked specifically at the politics of constructing protective spaces in general, and for low-carbon energy technology development in particular. Politics has tended to be evoked in relation to countering regimes, rather than something that is inherent in constructing protective spaces for experimentation.

As such, this special issue picks up on initial, somewhat speculative work by Smith and Raven, to begin to explore the politics of low-carbon niches more systematically (Smith and Raven, 2012). Here politics is understood in a variety of ways:

- The first is discursive, which highlights the contested interpretations over the performance, actual and prospective, of low-carbon technologies, and particularly how the framing of such performance is key to shape legitimacy for progressing the development of the technology.
- The second kind of politics is material: mobilizing the resources needed to develop the technology further, ensuring adequate provision of facilities, infrastructures, skills and so forth. Such material politics speaks to the kinds of bargaining between different interdependent, resource-holding actors.
- A third kind of politics is institutional: the work needed to build alliances for the reform of key institutions, such as energy policies, market rules and investment standards or social values.

The next section explores in more detail some of the theoretical perspectives that shed light on the politics of protective space.

3. Perspectives on protective space

There are different ways in which protective space has and can be conceived of in the transitions literature, referring to broader debates on ontological perspectives on transitions (Geels, 2010; Garud and Gehman, 2012; Stirling, 2011). One major line of thought in transition processes and the dynamics of protective spaces draws intellectually on evolutionary understandings of innovation and socio-technical change. The argument goes that incumbent selection pressures prohibit path-breaking innovations to gain market share, and therefore need temporal and selective protection against these pressures. As such, from an evolutionary perspective, ‘protective space’ is primarily constituted by shielding measures (e.g. in the form of public policies such as subsidies or regulatory exemptions)

that protect radical innovations against selection pressures from incumbent regimes (Schot and Geels, 2008). Although shields are neither static nor given but constructed and negotiated through political and social processes (Ulmanen et al., 2009; Howarth and Rosenow, 2014), so far few studies have explored the dynamics of protective measures in much detail.

The evolutionary perspective in transition studies has been challenged by relational perspectives (Jorgensen, 2012; Piterou and Steward, 2011; Genus and Coles, 2008). One of the key differences here is that evolutionary perspectives tend to make more or less analytically distinct delineations between innovation and context – usually defined from the analyst's perspective – whereas, in relational perspectives boundaries between innovation and context are unstable and always in the making. Relational perspectives put centre stage the actor-networks and follow the ways in which these actors themselves draw boundaries in differentiated ways. As such, in a relational perspective protective space is constituted by dynamic interactions between connected actors, the flows of information, finance, reputation, tools, knowledge and so on and so forth between them, and the controversies that emerge out of these interactions and flows. In such a perspective, neat analytical distinctions between what is inside or outside a protective space quickly starts to blur (Smith, 2007; Smith and Stirling, 2007). Protective boundaries are an empirical question rather than an analytical choice.

Institutional perspectives have been part of the transition studies field from the beginning, though becoming much more prominent recently (Jacobsson and Johnson, 2000; Geels, 2004; Fuenfschilling and Truffer, 2014; Kern, 2011; Wirth et al., 2011; Coenen and Lopez, 2010). In particular, institutional perspectives that highlight the discursive constitution of institutions relevant to socio-technical transitions have been found to be helpful analytically (Jensen, 2012; Volkmar and Schenner, 2011; Ulmanen et al., 2009; Pesch, 2015). Taking a discursive-institutional perspective, 'protective space' is then constituted by alternative framings and institutional settings necessary for the development of alternative technologies, e.g. through the work of collective institutional entrepreneurs (Battilina et al., 2009; Jolly and Raven, 2015).

A fourth perspective could be added here, i.e. a 'geographical perspective'. Indeed, a turn to geography in transition studies has brought much attention to rethinking the notion of space and the spatial scales and localities over which the above processes operate (Coenen et al., 2012; Raven et al., 2012; Truffer et al., 2015).¹ However, geography literature itself has been developing through evolutionary, relational and institutional perspectives and this would make a separate geography category overlapping with these three. Their relevance for a geography-informed transitions research agenda are explored in more detail elsewhere (Hansen and Coenen, 2015).

4. Papers in this special issue

The papers in this special issue relate in different ways to these three perspectives (Table 1). This section briefly discusses each of the contributions and their relevance to the theme of this special issue.

The paper by Matthew Lockwood on 'Creating protective space for innovation in electricity distribution networks in Great Britain: The politics of institutional change' adopts a discursive-institutional perspective and focuses on the case of distribution networks in the UK. Lockwood argues that innovation in distribution networks will be a key enabler of transitions in energy systems. His analysis focuses on the politics of changing regulatory institutions, which are key for the future development of the grid infrastructure, given that networks are natural monopolies. Therefore, the politics of protective space in this case mainly play out through institutional politics around the regulator. Conceptually, his analysis draws on the work of Mahoney, Thelen and Campbell and shows a variety of niche spaces,

¹ The transitions literature shares terms with geography, but whose meaning and usage is to some extent different (Bridge et al., 2013). Terminological conflation includes 'space' itself. The transitions literature means not a geographical space (whether Cartesian or relational), but rather locations where the rules are different for technology development, and selection pressures are held at bay in various ways. Thus, protective spaces can be located within or between organisation (e.g. a research lab in a university, or a long-term strategy unit in a firm), in physical localities (e.g. remote, off-grid villages, or industrial districts looking to diversify), or in cultural milieu (e.g. environmentalists).

Table 1

Contributions in this special issue.

Authors	Empirical focus	Country focus	Evolutionary perspective	Relational perspective	Institutional perspective
Lockwood	National smart grids initiatives	UK			x
Hodson, Burrai and Barlow	Built environment in Manchester	UK		x	
Lauber and Jacobsson	Renewable Energy Act	Germany	x		x
Raven, Kern, Verhees and Smith	Solar PV, off-shore wind and CCS	Netherlands, UK	x		x
Boon and Bakker	Electric vehicles and medical drugs	Netherlands	x		x
Valderama and Jørgensen	Metro in Copenhagen	Denmark		x	
Markard, Suter and Ingold	Energy policy	Switzerland			x

which were created to encourage innovation within the distribution networks. However, such institutional change has been contested and has so far taken the form of ‘layering’, meaning that new rules and objectives were added on top of existing ones. Support mechanisms for R&D have been added to, rather than replaced incentive regulation. What the paper adds to the existing literature on protective space is to provide more detail on the interrelationship between the ideas associated with the niche, the wider perception of crisis, regime discourses, the nature of supporting evidence and the fit with wider public sentiment. This opens up interesting avenues for further research in better conceptualising the interplay of these aspects in the context of transitions.

The paper by Mike Hodson, Elisa Burrai and Catherina Barlow on ‘Remaking the material fabric of the city: alternative low carbon spaces of transformation or continuity?’ adopts a relational perspective to analyse the politics of protective spaces around 30 ‘alternatives’ to retrofitting the city of Manchester that go beyond ‘dominant’ approaches. Conceptually, the paper extends the literature on the politics of protective space with insights from urban studies, and in particular the work from Doreen Massey and David Harvey. The authors give centre stage to the relational spaces that are assembled in the interplay between alternatives and dominant retrofitting attempts, and ask the question whether this relational space leads to transformation or continuity of what constitutes the remaking of the city. The analysis distinguishes between five types of alternatives emerging in Manchester and shows that the low carbon remaking of Manchester is imagined in different ways. Typical for a relational perspective on protective space, the analysis also demonstrates that the interplay between alternatives and dominant approaches is complex and full of negotiations. Although alternatives come with transformative imaginations about the city of Manchester, they are often sustained through continuity of and engagement with dominant actors and processes thereby weakening their radical edges and local moorings.

The paper by Volkmar Lauber and Staffan Jacobsson on ‘The politics and economics of constructing, contesting and restricting socio-political space for renewables—the German Renewable Energy Act’ combines evolutionary, innovation studies perspectives with attention to the discursive-institutional struggles around renewable energy policy in Germany. Their analysis focuses on the history of the German Renewable Energy Act (EEG) since 2000 and shows how intensely contested this policy mechanism has been at times. Conceptually, it draws on the [Smith and Raven \(2012\)](#) distinction of ‘fit and conform’ and ‘stretch and transform’ empowering of niches and shows how the EEG had initially been designed as a ‘stretch and transform’ strategy which has come under increasing pressure from a now dominant ‘fit and conform’ discourse, which is interpreted as being partly driven by incumbents trying to save their established business models. Lauber and Jacobsson provide important detailed historical evidence on how the politics of protective space plays out over long periods of time and how it is partly influenced by material developments (e.g. the rapid deployment of renewables, learning rates

and cost developments), ideological factors (beliefs in technology-neutral policies) as well as power positions of different actors. As a consequence they argue for a better integration of 'politics of policy perspectives' with wider insights from transition studies and the field of economics of innovation.

The paper by Rob Raven, Florian Kern, Bram Verhees and Adrian Smith on 'Niche construction and empowerment through socio-political work' also combines an evolutionary innovation studies perspective with a discursive-institutional perspective. Their paper develops three propositions on the ways in which sustainable technology advocates engage with their relevant wider contexts in attempts to create, maintain and expand protective spaces for their innovations. Conceptually, the paper differentiates between shielding, nurturing and empowering niche innovations. The three propositions are explored with empirical data from six case studies on solar photovoltaic energy, off-shore wind and carbon capture and storage technologies in the UK and the Netherlands. The results of this meta-analysis highlight the strategic challenges that sustainable technology advocates face when attempting to widen protective spaces. These challenges include dealing with the non-linear dynamics of development pathways when attempting to secure more active public and social support, balancing transformative ambitions with negotiating such support and linking narratives about the socio-technical performance of innovations with prominent socio-political agendas.

The paper by Wouter Boon and Sjoerd Bakker on 'Policy learning in socio-technical transitions' also combines an evolutionary perspective with an institutional perspective, particularly honing in on the dynamics in regulatory institutions protecting niche innovations. Conceptually, the paper extends the literature on the politics of protective space with insights from the literature on policy learning. They develop an analytical framework distinguishing between five dimensions of protective policy measures – the width, depth, duration, tools and legitimacy of protective measures. Empirically, the authors draw on fieldwork on battery electric vehicles and compare this with fieldwork in the pharmaceutical sector on medicines for unmet medical needs. Their analysis demonstrates the distributed nature of policy learning in relation to niche protection across various niche and regime actors, as well as across various social groups, and highlight the learning challenges in developing protective measures in real-time under such conditions.

The paper by Andres Felipe Valderama Pineda and Ulrik Jørgensen on 'Creating Copenhagen's metro – on the role of protective spaces in arenas of development' takes a relational perspective on protective spaces. Conceptually the paper draws on the concept of arenas of development (Jørgensen, 2012) resting in a flat ontology rather than the apriori structured ontology in the multi-level perspective. Empirically they analyse the successful emergence of the metro as a new mode of mobility in Copenhagen. They position these developments in the context of Copenhagen's ambitions to not just be the biggest Danish city, but to become a European metropole. They show how metro actors engaged with three existing arenas key to the regional power balance of town-city relationships, the country-wide transportation strategy and the Copenhagen mobility strategy, and successfully problematized and re-organised them. The new relations created in this process constituted a new arena that enabled a reframing of both the metro and the context in which the metro developed. The paper highlights two implications for a politics of protective space perspective: the need to account for failed courses of action and the role of the special ad-hoc committees created in socio-technical decision making processes.

Finally, the paper by Jochen Markard, Marco Suter and Karin Ingold on 'Socio-technical transitions and policy change—advocacy coalitions in Swiss energy policy' takes a discursive-institutional perspective. Conceptually, the paper draws on the Advocacy Coalition Framework in political science in combination with socio-technical systems perspectives in transition studies. Empirically, the paper analyses changes in advocacy coalitions in the Swiss energy system between 2001 and 2014. It does so through an empirical identification of the key advocacy coalitions, held together by their core-beliefs about the future of the energy system, and the ways these coalitions have been shifting as evidenced in their responses to three energy policy consultations. The analysis finds a coalition around 'pro-ecology beliefs' and a coalition around 'pro-economy' beliefs. These coalitions have remained rather stable over a period of 13 years. However, the analysis also demonstrates that the positions have become less polarized over time, and that changes in secondary beliefs indicate increasing support for energy transition policies, despite otherwise stable coalitions.

5. To conclude: a few lessons for (low-carbon energy) niche advocates

Politics is at the heart of transformation processes and, therefore, an issue that cannot be avoided by anyone concerned with environmental and climate challenges (Scoones et al., 2015). We end this introduction by briefly identifying a number of lessons from the papers in this special issue for those involved in the day-to-day business of creating, maintaining and expanding protective spaces for sustainable innovations.

The **first lesson** is that *patience and persistent advocacy work* is required—inertia in incumbent systems is great, but may be eroded by a combination of exogenous events, such as the climate change debate, or major disasters like that in Fukushima, or paradigmatic political shifts changing the rules of the game – illustrated in the various contributions in this special issue. A key challenge, however, is that in relation to climate change, temporal windows to act are closing rapidly. To make the most of these dynamics, there are additional specific lessons related to creating, maintaining and expanding protective spaces that we elaborate on below.

The **second lesson** is to acknowledge and identify the *heterogeneity in relations with opposing coalitions*. As demonstrated by Jochen Markard and colleagues, “distances”, in terms of policy core beliefs, to some actors may be in fact be quite small and such actors could be approached for a dialogue. A possible way forward would be to use “policy brokers” who may act as “matchmakers” or create arenas in which actors meet and learn from each other. However, as Valderrama and Jorgensen as well as Hodson et al. demonstrate, such arenas should not be understood as neutral sites, but as political endeavours in themselves, replete with power relations, which are important in reframing relationships between innovation and context.

The **third lesson** is that such political bridging of opposing coalitions need to built on the well-known insight that credible and attractive *narratives* are routinely deployed to promote interest in, and increase legitimacy for a new technology. Hence, the ability to engage in convincing storytelling is a key aspect of those involved in protective spaces. Indeed, Boon and Bakker emphasize that articulating a narrative invites actors outside the niche to express their approval and in that way validate and legitimate a new social practice. Those who may be approached with such narratives, and eventually engage in the coalition, are thus, as Raven et al. argue, not only those directly involved in innovation processes, but also those who may be in a position to influence decision making processes in various ways.

The **fourth** and related **lesson** is that whilst sustainability transitions rest on assumptions about transformative change, *transformative strategies mostly meet realities that only change incrementally* and this is where political negotiation skills are required. The distinction between “fit and conform” and “stretch and transform” strategies and associated discourses that several authors in this special issue have utilised, suggests that there are a number of ways to advocate a particular technology and careful consideration is required when choosing a discursive strategy. For instance, Hodson et al. demonstrate how initial transformative initiatives may lose their radical edge when encountering mainstream actors and processes.

The **fifth lesson**, as shown by Lauber and Jacobsson, is that the *assessment of costs of a new technology*, which is a key aspect in socio-technical narratives, is a *profoundly political endeavour*, which is open to, and persistently used for, manipulation. As the cost issue figures prominently in various narratives, there is a need to develop new, more reflexive expertise in the field of cost assessments and devote efforts to critically address various statements on costs.² Examples of these are social cost-benefit analysis or taking into account all environmental externalities.³ This expertise necessarily includes an understanding of technical change and learning processes, as discussed by Lauber and Jacobsson, as these have a strong bearing on cost developments.

² Indeed, Siemens (2014), which is the leading supplier of offshore wind turbines, has devoted efforts to calculating the “true costs of energy” in response to what they perceive as a too narrow cost definition used in much of the discourse on energy policy.

³ It has recently been argued that none of the world’s major industries would be profitable if they paid for the natural capital they used. <http://grist.org/business-technology/none-of-the-worlds-top-industries-would-be-profitable-if-they-paid-for-the-natural-capital-they-use/>.

The **sixth** and final **lesson** is that the *competence of public bodies* is vital for a constructive dialogue and effective policy changes. As Lockwood argues, a decisive event in Ofgem's changed policy in the UK was the recruitment of a new Technical Director who had an engineering background in an organization that was dominated by "purist" economists. With this background, the Technical Director was struck by a sharp decline in R&D by distribution network operators, which threatened their ability to innovate in "smart grids". It is thus of importance to argue for public bodies to have the required competences, just as private firms need to have competences to interpret a dynamic world and to absorb exogenous knowledge. Indeed, for an 'interventionist' state, this is an important condition (Mazzucato and Perez, 2015). Boon and Bakker further develop this theme of competences, emphasizing that the dynamic nature of and the capabilities needed to deal with regulations indicate that both regulating and regulated actors learn how to execute and anticipate rules. Hence, competence in industrial dynamics and the mutual interactions between politics, policy and those dynamics is essential for both regulators and regulated.

Acknowledgements

This special issue comes out of a workshop and a 3-year research project funded by the Netherlands Organisation of Scientific Research NWO with grant number 463-09-001 and the UK Economic and Social Research Council ESRC with grant number ES/H022864/1. We are grateful to all workshop participants and special issue contributors and to Jeroen van den Bergh for feedback on this editorial.

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Available online 15 August 2015

26 June 2015