‘Opening up’ energy transitions research for development

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The term ‘energy transition’ has gained increasing traction internationally in research and policy communities seeking tools and concepts to study and explain the transformation to more sustainable energy systems. A significant limitation of the energy transitions literature is that much of it relates to the experiences of industrialised countries in the global North attempting to transition to sustainable energy futures. Yet there is also an urgent need to understand the potential nature of emergent transitions in the industrialising countries of the global South where energy is inextricably linked to development, but also where decarbonising the energy system may not be the core or most pressing objective. This prompts the question of how well transitions concepts and frameworks, shaped largely by the experience of research based in industrialised countries, translate when applied in developing contexts. In this respect, transitions are relatively uncharted territories that hide numerous monsters, not least in the contested nature of the term itself. Understandings and expectations of energy transitions may differ across the North–South divide; thus, how transition is framed and by whom will have material implications for livelihoods, raising the spectre of social justice and other monsters in energy transitions research for development.

This chapter is concerned with opening up research, specifically the case of global-North-led research on sustainable energy transitions in the global South, to examine underlying assumptions, blind spots and gaps, but also to identify alternative ways of doing transitions research that are more responsive to the public and social priorities

of the transitioning communities. Alternative or competing priorities for transitions research are best detected through a process of co-design; in this case the co-design of community energy systems on the basis of bottom-up iterative public and community engagement, as one of these alternative ways of doing transitions research. Making transitions research 'open' from the bottom up presupposes the embedding of democratic values such as inclusiveness and social justice.

I will explore how attempts to open up transitions research through a process of co-design can facilitate or impede values of inclusiveness and social justice by drawing on the experience of the ongoing Solar Nano-Grids (SONG) project, which aims to explore ways of co-designing small-scale off-grid energy systems in rural Kenya and Bangladesh through community engagement. The SONG project emerged as a response to the perceived shortcomings in these countries of solar-home-systems (SHS) installations that provide individual households only with electricity for lighting and small appliances. While households undoubtedly gain developmental benefits from access to SHS, the degree to which they address the poverty of household members and their ability to generate an income is far less clear. In response, SONG systems aim to provide additional collective community benefits by the provision of excess energy for small-scale economic activities using, for example, posho (maize meal) mills and egg incubators.

SONG is an expressly transdisciplinary project that brings together social scientists, engineers and not-for-profit renewable-energy organisations engaged in the co-design of all aspects of the energy-transitions research, from community engagement and implementation through to monitoring and evaluation. The role of social science in SONG is distinct in a number of ways. By research, I mean social science as well as engineering research. Many of the chapters in this book are about research understood as 'scientific research', which social scientists are critically investigating from the outside, or post hoc (of which ELSI, research on ethical, legal and social implications, that arose as an extramural research programme to the Human Genome project, is a prime example). In SONG, social scientists are engaged in problem solving, not just problematising from afar, and are actively involved in the design, implementation and redesign of socio-technical systems.

SONG's approach to energy transitions research is novel in that it is taking transitions theory, and in particular the concept of niche experimentation, and applying it in practice to community niches in Kenya and Bangladesh to facilitate energy transitions. But the application of transitions concepts and tools in developing contexts is not without its practical challenges. What are the limits of research frameworks for energy transitions when they are transferred from the global North to the global South? How does co-design of energy-transitions research actually work in practice? Who and what does it need to take into account?

The chapter proceeds with a brief introduction to the transitions literature through the lens of its principal theoretical frameworks. It outlines key concepts and identifies notable limitations, including the limited but emerging application of transitions research in developing contexts. Taking the position that the absent or naive conceptualisations of the dominant frameworks stem from the neglect of issues of distributive and procedural justice, the remaining sections show how the co-design of the SONG project was fundamental to addressing these justice deficits. The chapter concludes by reflecting on implications for energy transitions research arising from applying justice principles in practice.

Limitations of transitions research frameworks and concepts

The term 'transition' emerged from a body of literature on socio-technical transitions (Geels, 2005; Geels and Schot, 2007) that refers to system-wide changes involving the complex reconfigurations of technology, policy, markets, material infrastructure, scientific knowledge, and social and cultural practices over time towards more sustainable systems, in areas such as energy (Newell and Mulvaney, 2013). Systems-level innovations occur through 'the interplay of dynamics at multiple levels' (Geels, 2005: 368). A micro-level niche is nested within and interacts with a patchwork of meso-level regimes and macro-level landscape developments to form a socio-technical system. The core notion of this multi-level perspective framework is that the increasing traction of niche innovations from below and pressure exerted from above by changes in external factors at the landscape level serve to

destabilise the extant socio-technical regime, thus creating opportunities for niche innovations to become systemically embedded.

Of particular relevance to the focus of this chapter on the community niche as an innovation space for the development of off-grid energy systems is strategic niche management, a subcategory of the multi-level perspective. A niche refers to a protected space or 'incubation room' (Geels and Schot, 2007) at the micro level, where 'radical innovations' (Geels, 2011) are nurtured away from the normal pressures of market forces and technical performance to enable essential learning to take place (Smith et al., 2014). The niche performs an important function in propagating transformative innovations and providing a footing for their future establishment in the dominant socio-technical regime. A key aspect of the strategic-niche management framework is that it directs attention to the co-evolution of stakeholders' visions of particular innovation-enabled futures, the learning gained from experimenting in everyday settings and the societal embedding of new socio-technical practices relevant to that particular innovation (Ockwell and Byrne, 2015).

The design and implementation of socio-technical transitions projects, however, have too often been narrowly framed as linear, top-down processes driven by the techno-economic priorities of implementers that limit the ability to provide just and equitable solutions responsive to the priorities of the communities in transition. This has led to an increasing recognition of the need to address the justice deficits of transitions processes. The following paragraphs identify two prominent deficits in the socio-technical transitions literature – a lack of consideration of the politics of framing and of socio-spatial relations and dynamics – that must be attended to if transitions are to evolve beyond their apolitical and technocratic origins to become more socially just (Goldthau and Sovacool, 2012).

Politics of framing

The act of transitioning from one socio-technical system to another is inherently political, yet existing analyses do not adequately address the politics of transitions (Lehtonen and Kern, 2009; Meadowcroft, 2009; Smith and Stirling, 2007). Alongside theories about the multi-level dynamics of system innovations, socio-technical transitions research

has developed prescriptive formulations for the management of transitions towards more sustainable ends. Such forms of transitions management have traditionally been led by policy and stakeholder elites, who have been criticised for their tendency toward techno-economic determinism and their lack of critical reflexivity regarding who participates in, and the politics of, transitions by management (Lawhon and Murphy, 2011). Reflexive questions such as 'Whose transitions?' and 'A transition from what to where?' aim to reveal the politics of whose priorities should steer the transitions agenda.

In any particular energy transition, the matter of who gets to define what transition means will have a direct bearing over the outcomes of the transition. Is it a transition from traditional to modern sources of energy, or from centralised to distributed energy systems and governance (or vice versa), or from no or low access to energy to secure and reliable access? For energy-impooverished rural communities in developing countries a transition may not be about renewable energy but rather the more fundamental issue of access to energy, whatever its source. A key point is that it depends on who is allowed to define the agenda. So the issue of whether a particular transition should aim to mitigate energy poverty, broadly speaking, or to increase access to energy, or even to reduce carbon emissions, is essentially an issue of the politics of framing and the radically different political understandings and actions that underpin these claims. How a transition is framed, and by whom, may have material implications for those whose livelihoods will be improved or impoverished.

In an attempt to open up the politics of transitions, Stirling (2014) draws a stark distinction between singular linear transitions driven by technological innovation and progressive transformations involving social as well as technological innovations shaped by a plurality of values and visions. Stirling argues persuasively that truly transformative and sustainable systemic change emerges out of the collective, bottom-up, socio-culturally embedded energy knowledge and practices of those in transition.

Socio-spatial relations and dynamics

The socio-technical transitions literature is also notable for a relative absence of reflection about the specific spatial contexts and conditions

in which empirical case studies are situated, not least from a comparative perspective. Coenen et al. (2012: 969) claim that socio-technical transitions processes are characterised by ‘missing or naïve conceptualisations of space’, and that such ‘analyses have overlooked where transitions take place, and the socio-spatial relations and dynamics within which transitions evolve’. A lack of sensitivity to specific socio-spatial dynamics of transitions means that the intrinsic diversity arising from the variety of local, social, cultural and institutional conditions, and stakeholder priorities and resources across those spaces has not been adequately acknowledged or taken into consideration. Coenen et al. make the point that transitions researchers would do well to take a closer look at the spatial unevenness and inequalities of transition processes whether it be from the perspective of global research and policy networks or of local community niches.

Recently, transitions scholars have begun to address the lack of attention to the role of space (see Raven et al., 2012; Smith et al., 2010) by paying particular attention to the places in which niches are created, their organisation and scale of production, and how these places are shaped by relations between and among key stakeholders. Attention to space and scale is vital, given their potential importance when analysing energy transitions that span local and global contexts, such as the creation of global networks in which poorer parts of the global South provide resources for the energy ambitions of the richer North (van der Horst and Vermeylen, 2011), or where, in a globalised market for limited resources, they face the adverse knock-on effects of global-North investments in energy production (Raman and Mohr, 2013). Geels (2010), too, recognises the theoretical limitations of the existing literature for dealing with the additional complexities of emergent or future sustainability transitions, including the uncertainty involved in anticipating their potential impacts across time and space.

In this chapter, the off-grid nature of SONG systems necessitates a specific local perspective of the socio-spatial dynamics of community-energy-transitions niches rather than the local global perspective of niche development trajectories used by Geels and Raven (2006) in the multi-level perspective to describe how local niche experiments can be scaled up as cumulative local outcomes reveal generic lessons and rules for widespread adoption. While recognising that the local is always situated in broader networks that operate at different scales

and that a purely local-scale transition analysis risks ignoring the fact that localised activities and resources are subject to external pressures, a broad local–global perspective is beyond the scope of this current chapter.

Bridging the justice divide in North–South energy transitions research

The socio-technical transitions approach has in recent years begun to be applied in developing countries. A special edition of *Environmental Science and Policy* introduced by Berkhout et al. (2010) applied these ideas to developing Asia, to see what they revealed about the wider impacts of socio-technical innovations developed via niche experiments. A similar case study on technology innovation and transfer focuses on China (Wang and Watson 2010). Work on energy transitions in sub-Saharan Africa is limited, but researchers from the University of Sussex have published a number of studies focusing on SHS in Kenya. Byrne (2011) has shown how attempts to replicate the success of a Kenyan SHS initiative in neighbouring Tanzania failed as insufficient attention was paid to the specificities of the local context. A subsequent related study by Byrne et al. (2014) further demonstrates that context matters, as innovation processes are shaped as much by political, social and environmental forces as by powerful economic and institutional interests. Being aware of context is therefore critical for the replication of transitions initiatives across neighbouring territorial borders. Moreover, given its limited application in developing countries, it is reasonable to question the relevance of the literature framed by research agendas in the global North to the direct insertion of the findings into global South contexts. Assumptions underpinning global North research agendas, including those about universal access to electricity, the nature and pace of change between energy systems, and the priorities for systemic change, might not directly translate in developing contexts.

The absence of attention to the political and socio-spatial dimensions within the dominant frameworks for conceptualising sustainable-energy transitions may stem from a neglect of issues of distributive and procedural justice. Eames and Hunt (2013: 47) reason that 'Given the fundamental role that energy and energy technologies play in

restructuring socio-economic and socio-ecological relations it is perhaps surprising that greater attention has not previously been paid to exploring the equity and justice implications of energy systems transitions.⁵ When researchers from the global North intervene in sustainable-energy transitions for socio-economic development and improving livelihoods in energy-impovertised rural communities in the global South, questions of equity and justice take on a more critical edge. But is providing universal access to clean, affordable and reliable energy enough to resolve injustices in energy systems transitions? Pulido (1996) suggests that changes to power relations, cultural practices and systems of meaning are also required, beyond mere (socio-) economic restructuring and redistribution. This hints at the inadequacy of principles of distributive justice by themselves to acknowledge and address the range of valid issues of justice. A contemporary of Pulido, Lake (1996) agrees that it is impossible to have thorough distributive justice without justice in the procedures for producing that distribution.

In North–South collaborations it is imperative, therefore, that the key justice deficits of the dominant theoretical frameworks in relation to both the distributive and procedural dimensions of transitions research and practice should be addressed. Drawing on Schlosberg's (2007) work on defining what environmental justice means, this chapter proceeds with the argument that the theory and practice of justice necessarily include distributive justice (to address socio-spatial inequalities), but must also embrace notions of justice based in a recognition of differences and broad participation in the politics of transitions in the form of procedural opportunities. Accordingly, distributive justice refers to how the spatio-temporal distribution of risks and benefits is felt across social groups and communities and within and across generations, while procedural justice relates to who is granted both access to and participation in decision-making processes, as well as whose and what knowledge, interests and values are afforded recognition in such processes (Schlosberg, 2007).

Drawing on the specific case of SONG systems implementation for socio-economic development and livelihoods enhancement in two community niches – Lemolo B and Echareria – in Nakuru County, Kenya, the sections below detail instances where principles of distributive and procedural justice were applied in practice to inform the

co-design of energy transitions in these communities. It is important to note, as observed by Lake (1996), that principles of distributive and procedural justice are mutually interdependent.

The co-design of just energy transitions in Kenya

Distributively just transitions

Fundamentally, a just transition requires attention to how the socio-spatial organisation of community niches affects community cohesion and the capacity of individuals to decide on a common energy future. To this end, the SONG project aimed to alleviate existing socio-spatial inequalities and prevent new ones, driven by factors such as age, gender, ethnicity and income, through an inclusive process of co-design.

The highly dispersed nature of the dwellings in the two villages selected by the Kenyan partner necessitated a redesign of the nano-grid systems to enable the distribution of power by portable batteries rather than lines, to accommodate the long distances between the solar array and central charging hub and individual dwellings. Redesigning the system this way meant that access was not limited to just those few households in a required radius, but also meant that the siting of the solar array was determined more by what would be a suitably secure and accessible location for the whole community than by who would benefit most from having the array sited nearby. Such decisions are highly political, even within a relatively small community niche. In the case of Echareria, the village consists of three spatially, socio-economically and tribally disparate settlements of internally displaced people. The settlements correspond to waves of intercommunal conflict linked to electoral violence. The first settlement was established in 1992, and households were given large blocks of land at the bottom of a hill, while the second and third settlements were established in 2001 and 2007–2008, respectively, and located progressively up the hill on decreasingly smaller blocks of land. The SONG project team, sensitive to the socio-economic and cultural asymmetries in the community, was therefore mindful not to create or exacerbate any tensions between these different groups by ensuring that physical and financial access to the system was as equitable as possible.

Women and children tend to be disproportionately affected by adverse health and environmental impacts caused by toxic smoke and fumes from ‘unclean’ energy as energy-related air pollution occurs mainly in and around households, particularly in developing countries. The major energy sources in both communities were kerosene for lighting and wood for cooking and heating. Replacing kerosene with solar electricity for lighting will improve air quality and help to reduce eye and respiratory infections, which are listed among the top ten diseases at the health clinic located nearest to Lemolo B. While electric cookers are beyond the load capacity of the SONG system, the women and children of the two communities stand to benefit from the transition to solar electricity in other ways, including improved educational achievement of children relative to those from non-electrified households; enhanced livelihood opportunities for women, leading to their improved economic status and self-reliance; and increased leisure time. Such claims support the point of Smith et al. (2010) that sustainable-energy transitions are more about distributed social mobilisation than technological innovation. Attention to differences across the full spectrum of intragenerational relationships to energy in the community niche is therefore important so that any concerns about distributive justice might be investigated within this ‘[micro]geography’ of beneficiaries and risk-bearers’ (Eames and Hunt, 2013: 58).

Finally, the anticipated human and environmental harms to future generations caused by anthropogenic climate change are widely acknowledged and debated in the climate justice literature (Okereke, 2010). Yet the intergenerational injustices, or opportunities, arising from sustainable-energy transitions are less well studied but equally deserving of attention, particularly as today’s youth and subsequent generations will bear the consequences of transitions already underway. The aspirations of youth and future generations in terms of the role of energy in socio-economic development and livelihoods enhancement are likely to differ substantially from those held by their parents or village elders. This justice dilemma highlights the difficulty of taking future generations into account in current transitions, while also raising questions about what are the best research processes to use to deliver procedural justice.

Newell and Mulvaney (2013) make the related point that, to avoid reproducing or exacerbating existing intra- and intergenerational environmental inequalities in terms of exposure to ill health and localised degradation linked to global environmental threats, as discussed above, transitions also need to be environmentally just.

Procedurally just transitions

If communities provide a direct source of information on the effects of transitions on their social relations, cultural practices and livelihoods (and vice versa), how can transitions research be procedurally just if participation is contingent solely on the basis of having socio-technical expertise? Drawing parallels with Scharpf's (1999) thesis that democratic legitimacy refers to both the inputs and the outputs of a political system and that the two dimensions are mutually reinforcing, it can be assumed that the absence of attention to principles of justice in transitions would limit the public value of such processes. Thus, for any profound and lasting system change to occur, it is vital for households and communities to become co-designers and co-producers of their own energy transformation. By making little or no provision for communities to become informed about and included in the process of transitions research, implementation and governance, transformative change is impeded. Merely implementing transitions research agendas in the interest of the public good is not enough; the extent to which the justice dimensions of transitions research are recognised and attended to will have a direct bearing on its effectiveness in terms of creating public value for the communities involved.

A major limitation of previous SHS implementation in Kenya by development agencies and researchers has been a lack of routine engagement with project communities about their socio-economic priorities and aspirations, and the role of energy in achieving these. Where this has been the case, the public value of transitions research was not co-produced, rather it was imposed in a top-down fashion and the views of those who were to use the services were not adequately taken into account. Legitimate public value requires service providers to be more responsive to the needs of service users. The SONG project aimed to remedy this oversight by using the communities' views and

values to inform the goals of the research and the design of the solar-energy systems. To this end, the project team recognised the need for more direct and innovative opportunities for the two communities to participate in the script of community energy services and technologies. Transitioning communities should not only receive the energy services they need, but also play a role as co-designers in the shaping and delivery of those services.

This challenge is influencing the way the SONG project is approaching the design and implementation of the SONG systems, with an emphasis on mutual learning and iterative development and deployment. To engage the transitioning communities in the co-design of their own energy futures, the project team embarked upon an in-depth community-engagement process with the twin aims of assessing the energy needs and aspirations at the level of the household, and assessing the socio-economic priorities and aspirations of the wider community. We adopted a mixed-methods approach to inform the design and development of SONG systems tailored to the particular contexts of each of the communities, including: a physical survey to map the spatial distribution of households, existing services, natural resources and proximity to external services; a household survey to identify the socio-demographic make-up of each and their livelihoods, the range, cost, and purpose of fuels and appliances currently used and expenditure on each; and semi-structured interviews with county- and national-level stakeholders to understand the broader socio-political barriers to and opportunities for electricity access for rural communities. The combined findings and continuity of contact helped us to gain a comprehensive understanding of the local niche contexts and to identify key issues for in-depth exploration in subsequent focus groups.

When considering how to structure our focus groups we were mindful of the potential distributive intra- and intergenerational injustices in each of our communities, as discussed above. But intra- and intergenerational justices also have a procedural dimension. We accordingly organised our focus groups into three broadly representative social groups – elders, women and youth – with the assumption that each broad category would have a different relationship to energy provision and use and therefore differing expectations of transition based on (among other things) their status, gender and age. For clarification, the gender balance among the elders was heavily biased

towards men, while the gender split among the youth, defined in Kenya as between the ages of 18 and 30, was only slightly biased towards men.

A transition to a sustainable future and the deep structural changes that it entails places responsibility on communities to work cooperatively and inclusively to make decisions. However, this expectation may place a burden on communities if they lack cohesion. As Fuller and Bulkeley (2013: 68) note, 'area-based communities do not immediately imply the ready existence of a "community", there may be multiple overlapping communities of interest.' The notion of a community is a relatively recent and somewhat artificial construct in the case of Echareria, which consists of sequential settlements of internally displaced people from different tribal groups and with decreasing socio-economic means. Thus, enacting a sustainable-energy transition in this community niche not only raises critical issues of distributive justice in terms of the ways in which risks and benefits are allocated, but equally critical issues of procedural justice, depending on whether the transition can address more fundamental issues of inequality in terms of members' recognition and participation in community decision making. Including the knowledge, interests and values of participants from all three settlements was vital to achieving a balanced set of views in the household survey and focus groups.

Issues of distributive and procedural justice in North-South energy transitions collaborations do not cease to be important upon the physical implementation of the transformative technology. Pulido (1996) claims that injustices cannot be resolved solely through (socio-) economic restructuring or redistribution, but also require changes to existing social relations, cultural practices and systems of meanings. This still holds if energy transitions are to be truly transformative. In Kenya, the SONG team witnessed first-hand the continuing control and maintenance of one mini-grid system by its project implementers, who are based in the global North. This approach to governing is the antithesis of a just transition. The SONG project has taken the opposite route. It has worked with existing leaders and governance structures to facilitate the setting up of broadly inclusive and formally constituted village energy committees (VECs) in each of the communities. The role of the VECs is in part to ensure the project has a social value to the community as a whole by running a number of small enterprises

such as egg incubators or posho mills, where the income is used to further expand the range of community services, to support individual entrepreneurialism or to extend to poorer members of the community access to energy services. The VECs will also have the responsibility to implement maintenance and repair training programmes for local youth for the better management of the systems over their lifetime.

Conclusions

This chapter was concerned with opening up global-North-led research on sustainable-energy transitions in global South contexts to examine the underlying assumptions, blind spots and limitations, in an attempt to identify alternative ways of doing transitions research that are more responsive to the priorities of the transitioning communities. As an example of one of these alternative ways of doing transitions research, the SONG project aims to generate sustainable-energy solutions and transformative change in two Kenyan communities through the co-design of socio-technical systems on the basis of bottom-up iterative community engagement and the integration of social-science and engineering research. The SONG project's ambition is novel in that it has taken the theoretical concept of niche experimentation and applied it in practice to establish community innovation niches to facilitate energy transitions.

A review of the socio-technical transitions literature, predominantly focused on the experiences of industrialised countries in the global North, identified a number of conceptual limitations that can be broadly construed as a neglect of issues of distributive and procedural justice that limit the ability of transitions research and its implementation to provide just and equitable solutions for transitioning communities in the global South. Addressing two prominent justice deficits among these – a lack of consideration of the politics of framing and of the socio-spatial relations and dynamics – was considered fundamental to achieving socially just energy transitions in the specific contexts of the community niches in Kenya. The co-design of the SONG project can thus be seen as a response to the limitations and justice deficits of the dominant transitions frameworks.

Attention to the principles of distributive justice related to socio-spatial relations and dynamics in the two community niches was

important to ensure that inequalities driven by age, gender, ethnicity and income were alleviated and not exacerbated by the SONG project. Issues of intra- and intergenerational justice, while absent in transition frameworks, were nonetheless important in the SONG project for drawing attention to the vital roles of gender and age in co-designing socio-technical systems that are responsive to different intra- and intergenerational priorities and aspirations, while promoting the equitable distribution of potential benefits and risks across space and time.

The lens of procedural justice spotlighted the heightened politics of transitions in the global South, and reminded the SONG project team of the need for opportunities that are both inclusive and interactive so that community members can participate in the script of their own community energy services, be co-designers in the shaping and delivery of those services, and thus be the co-producers of their own energy transitions. The case of Echareria has shown the need to take into account the political issue of community non-cohesion, to prevent the reproduction or exacerbation of any tensions between different social groups and to enhance the community's capacity to decide on a common energy future. If energy transitions for development are to be truly transformative and just, then they must incorporate opportunities for the community to develop local governance processes and capacity building that are respectful of existing hierarchical governance structures, but extend participation beyond them, to ensure the effective and inclusive management of transitions to sustainable energy futures.

In conclusion, this chapter began with the premise that making transitions research 'open' from the bottom up presupposes the embedding of democratic values such as inclusiveness and social justice. In practice, however, translating Northern concepts and assumptions into global-South contexts highlighted the challenges of social justice and spatial positioning that underlie attempts to co-design transitions research that spans distinct geographical and socio-cultural boundaries.

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