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The political economy of state-led transformations in pro-poor low carbon energy: A case study of solar PV in Kenya

Rob Byrne and Kennedy Mbeva

Energy Transformations – Kenya

STEPS centre

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This paper analyses the case of the solar photovoltaic (PV) market in Kenya as a way to explore this and other issues. The Kenyan PV market is considered one of the most successful off-grid markets in the developing world and is often hailed as an exemplar of neoliberal development orthodoxy. However, based on reinterpretation of existing STEPS research into the evolution of this market, which took a niche theory approach, we argue that the Kenyan PV niche and market would not have developed without the support and active intervention of donors, many of whom – paradoxically – espouse neoliberal policy prescriptions. Drawing from discursive institutionalism, we develop a political economy lens to reinterpret our existing research, and find that the Kenyan PV niche is now facing an uncertain future, even as the solar PV market may continue to flourish.

At a more general level, we reflect on what the case tells us about future encounters between neoliberal orthodoxy and more developmentalist aspirations, encounters we might expect to increase in the process of realising the policy ambitions noted above. We argue that, if the Kenyan case acts as an example of a more general phenomenon, we need to understand policy making in its context, paying attention to historical socio-political relations across 'scales' of policy action, from the global to the local. The Kenyan case illustrates that action on the ground will likely be the outcome of messy negotiated interactions between competing and contradictory ideologies rather than determined simply by powerful global forces such as neoliberal hegemony.

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Contents

Figures and Tables

Acronyms

CIC	Climate Innovation Centre
CRIBs	Climate Relevant Innovation-system Builders
CSC	Commonwealth Science Council
DFID	UK Department for International Development
EAA	Energy Alternatives Africa
ERC	Energy Regulatory Commission
ESMAP	Energy Sector Management Assistance Programme (World Bank)
FIT	Feed in Tariff
GEF	Global Environment Facility
IFC	International Finance Corporation
IGAD	Intergovernmental Authority on Development
KEBS	Kenya Bureau of Standards
KENGO	Kenya Environmental Non-Governmental Organisations
KEREA	Renewable Energy Association
KES	Kenya Shillings
KPVCP	Kenya PV Capacity Building Project
MOE	Ministry of Energy
MEP	Ministry of Energy and Petroleum
NGO	Non-Governmental Organisation
PV	Photovoltaic
PVMTI	Photovoltaic Market Transformation Initiative
RWEPA	Regional Wood Energy Programme for Africa
SACCO	Savings and Credit Cooperative
SDG	Sustainable Development Goal
SHS	Solar Home Systems
SPL	Solar Portable Lanterns
SNM	Strategic Niche Management
UK	United Kingdom
UNGA	General Assemby of the United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

Summary

International efforts to achieve goals such as universal energy access and climate change mitigation are expected to stimulate billions of dollars of private financial flows to developing countries for clean (energy) technology transfer investments. Policies for realising these ambitions are framed in terms of neoliberal development orthodoxy, but critical voices call for more active state intervention based on arguments showing that free markets alone will not deliver the needed technologies and other innovations with the urgency required. This sets up the potential for a confrontation of contradictory ideologies in the making and implementation of policy: neoliberal orthodoxy at the level of global agreements versus state-led developmentalism at the national level. What this will mean for action on the ground, as those who promote clean energy access technologies and innovations seek to realise their development goals, is an open question.

This paper analyses the case of the solar photovoltaic (PV) market in Kenya as a way to explore this and other issues. The Kenyan PV market is considered one of the most successful off-grid markets in the developing world and is often hailed as an exemplar of neoliberal development orthodoxy. However, based on reinterpretation of existing STEPS research into the evolution of this market, which took a niche theory approach, we argue that the Kenyan PV niche and market would not have developed without the support and active intervention of donors, many of whom – paradoxically – espouse neoliberal policy prescriptions. Drawing from discursive institutionalism, we develop a political economy lens to reinterpret our existing research, and find that the Kenyan PV niche is now facing an uncertain future, even as the solar PV market may continue to flourish.

At a more general level, we reflect on what the case tells us about future encounters between neoliberal orthodoxy and more developmentalist aspirations, encounters we might expect to increase in the process of realising the policy ambitions noted above. We argue that, if the Kenyan case acts as an example of a more general phenomenon, we need to understand policy making in its context, paying attention to historical socio-political relations across 'scales' of policy action, from the global to the local. The Kenyan case illustrates that action on the ground will likely be the outcome of messy negotiated interactions between competing and contradictory ideologies rather than determined simply by powerful global forces such as neoliberal hegemony.

1. Introduction

Building pro-poor energy pathways for transformations to sustainability is now one of 17 Sustainable Development Goals (SDGs) (UNGA 2015), overlapping with international agreement to avoid dangerous climate change (UNFCCC 2015). To realise these ambitions, there are expected to be huge quantities of money flowing each year to finance sustainable energy and climate technology transfer to developing countries (Ockwell and Byrne 2016a). Whilst these ambitions are welcome, the international policy architecture that could help to achieve them is still under construction and the promised finance is slow in materialising. Moreover, despite interest in constructing architecture that might facilitate more sophisticated interventions than simply hardware-financing through ostensibly free markets (Ockwell and Byrne 2016b), the language of the international agreements for the SDGs and climate change suggests an acceptance of the continuation of neoliberal capitalism, albeit with a limited role for the state. However, given the risky and uncertain nature of the challenges these ambitions entail and the public-good nature of the benefits that would ensue, it is likely that highly-active public sector intervention will be essential. It is clear that profit-seeking private actors alone will not succeed in delivering the necessary technologies, products and services through free markets that are merely policed by state institutions (Mazzucato 2016; Mazzucato 2013; Perez 2016). If the state is to be much more active in building pathways to sustainability then we need to understand more clearly the extent to which neoliberal capitalism and what we might call the re-emergence of the developmental state will interact, potentially creating new spaces for contestation, conflict and tension in the processes through which policy is made in particular places (Hansen and Stepputat 2001; Leach *et al.* 2010b; Scoones 2016).

The purpose of this paper, therefore, is to explore such potential by examining an example of pro-poor energy-pathway construction and to see what this can tell us about the prospects for state-led transformations in pro-poor low carbon energy access under neoliberal hegemony. To do this, we revisit previous STEPS Centre research on the evolution of the solar market in Kenya (summarised below but see Byrne *et al.* 2014; Rolffs *et al.* 2015; Ockwell and Byrne 2016a), a market widely hailed as an exemplar of neoliberal capitalist development but, as we argue elsewhere, one that has been heavily-dependent on public-sector support (Ockwell *et al.* forthcoming 2017). In order to identify insights relevant to the interactions of neoliberal orthodoxy and potential state-led developmentalism, we reinterpret our previous work using a political economy lens, drawing on a discursive institutionalist perspective (Schmidt 2008) to construct our political economy framework. Furthermore, as our previous work used the strategic niche management (SNM, niche theory) approach for its analysis, we take the opportunity to begin synthesising the two perspectives into a political economy of niche-building. As a result, the paper seeks to make three main contributions. One, as a theoretical contribution, we offer a tentative synthesis between a discursive institutionalist political economy and niche theory. This synthesis begins to connect discourse, power, institutional inertia and change, and materiality, all interacting in a development context in which different visions for pro-poor low-carbon energy access are competing for dominance. Two, as an empirical contribution, we show how actors within the Kenyan solar niche, actors within the Kenyan state and actors within the neoliberal development regime have all acted strategically in their mutual encounters as they have sought to promote their own preferred energy-development pathways. And, three, at a more general level, we contribute to debates about the messy realities of policy making in particular places, suggesting that we should be cautious about assuming both the 'purity' and deterministic power of neoliberal development prescriptions when put into practice.

Our main argument posits that the evolution of the Kenyan PV niche has relied crucially on donor support for interventions that go well beyond what the new institutional economics form of neoliberal

capitalism would condone for 'market development' (Jacobson 2004; Woo 2004) to include directed technology development and the fostering of other kinds of innovation (Ockwell and Byrne 2016a). In doing so, various actors – donors and PV specialists – have created and nurtured a socio-technical niche. That is, a space in which experimentation and learning can occur, protected from the full force of market competition (Geels 2002; Raven 2005; Smith *et al.* 2014). A close examination of this niche evolution reveals that PV actors in Kenya initially acted strategically to secure protective donor resources, framing the need for active interventions in terms acceptable to what Jacobson (2004: 43) calls 'neo-liberal policy makers' working according to new institutional economics prescriptions (Woo 2004). Over time, the narrative these PV actors deployed evolved into one that is itself embracing of the new institutional economics prescription for enabling-environments. In parallel with this shifting PV actor narrative, Kenyan state actors have evolved an official narrative around PV that has converged on the same enabling-environment form. Complicating this narrative, however, state actors also implemented an entirely state-funded programme to install PV systems in off-grid schools and other public service facilities, eschewing the enabling-environment narrative when confronted with a specific context in which private actors were unlikely to find circumstances favourable to profit-seeking.

These complex and complicated dynamics provide examples of policy action in particular places and contexts, showing how actors negotiate their encounters with different visions of transformational change as they seek to realise their preferred development strategy (Hansen and Stepputat 2001; Leach *et al.* 2010b). PV niche actors initially negotiated between their vision for a highly interventionist transformational strategy for pro-poor energy access and the neoliberal development regime, but they now appear, on the face of it, to have fully adopted the tenets of that regime. Kenyan state actors eventually accepted that solar PV could have a role in increasing energy access but they appear to have adopted the neoliberal strategy of only providing an enabling-environment, perhaps because it means little in the way of committed state resources. And, curiously, neoliberal development actors appear to be promoting the enabling-environment narrative whilst providing some resources for highly interventionist actions. Although we ourselves accept that the neoliberal hegemony is real and powerful, with 'disciplining' effects (Newell and Phillips 2016), our examination of the political economy of niche-building around the Kenyan PV market shows that policy action under this hegemony is in reality messier than a straightforward imposition by powerful actors of a particular ideology.

Active Kenyan PV niche-building is still ongoing but there are signs that the neoliberal orthodoxy may indeed triumph over the more developmentalist approach that has been somewhat discernible so far. Having said this, there is another layer of complexity evolving in Kenyan energy governance as the impact of Kenya's new constitution becomes clearer. This has the potential to sweep many more actors into the messiness of policy action around energy access, multiplying development visions and demands, and potentially multiplying contestations and conflicts about how and what energy access should be pursued. How all this will play out is, of course, impossible to predict. Instead, we offer a historical political economy examination and analysis of the evolution of the Kenyan PV niche in line with Scoones' argument that we need to,

> '…take account of the historical dynamics of institutional change and the ongoing negotiations between different groups…to reveal how directions of change are negotiated through complex sociopolitical relations, involving multiple actors over time.'
> Scoones (2016: 307)

We trace the dynamics of such relations as they are revealed through PV niche actors seeking resources for niche-building and influence over national policy. These actions bring them into contact with only certain parts of the Kenyan state and the international development regime. In effect, then, we treat the state and development regime in terms of 'a dispersed ensemble of institutional practices

and techniques of governance' (Hansen and Stepputat 2001: 14) rather than monolithic entities. This allows us to observe how global and local forces interact in relational terms to co-produce specific development strategies and outcomes, rather than to assume that powerful global forces are deterministic of development pathways.

We develop our argument as follows. In the next section, we briefly discuss the main concepts we use to construct our political economy lens, drawing from discursive institutionalism (Schmidt 2008), focussing especially on ideas, interests and institutions (following Kern 2011). Although these three categories interact, close attention to ideas in particular helps us to trace and understand the political dynamics at work and how these co-produce interests and institutional change. We therefore 'decompose' further the notion of ideas using an interpretive narratives approach (Leach *et al.* 2010b; Wagenaar 2011). Having laid out our main political economy concepts, we then discuss our methodology in Section 3. This includes a justification for the case chosen, some discussion of our previous work on the Kenyan PV niche from which this paper draws, and a description of the new research work undertaken. In the same section, we discuss briefly the main concepts of niche theory and how we reinterpret these using our political economy lens. We complete the methodology section with an explanation of how we operationalise the main concepts, and provide a list of questions used for interrogating both our previous work and collecting new data. In Section 4 we give our political economy account of PV niche-building in Kenya. We offer an analytical discussion of this political economy in section 5, reflecting on this analysis and drawing conclusions in Section 6.

2. A Political Economy Framework: Ideas, Interests and Institutions

In this section, we outline our conceptual framework for analysing the interactions of political and economic forces at work in a particular context; what we take to be a political economy (Hudson and Leftwich 2014: 5). This is a broad definition open to a wide variety of interpretations and approaches so we need to develop a more granular set of concepts in order to achieve some useful analytical purchase. To do this we follow Kern (2011) who draws on a discursive institutionalist perspective (see, for example, Schmidt 2008) that he develops around a combination of discourse, institutions and interests, and with which he explains divergent policy making for socio-technical system transitions in the UK and the Netherlands. This discursive institutionalist perspective is appropriate given that niche-building can be characterised as a situation of complexity and uncertainty: it entails risks of various kinds as actors experiment with untried socio-technologies in evolving contexts. As such, actors do not have clear perceptions of their interests and so are forced to construct them as they act (Kern 2011: 1120; Hudson and Leftwich 2014: 95). In part, they achieve this construction through discursive processes, co-producing meaning from the results of their experiments and wider developments. As they construct their interests and meaning they also develop particular understandings of what institutional changes are necessary to further realise material developments that will support their interests. We discuss these three categories of ideas, interests and institutions briefly below before explaining, in the section in the methodology on operationalising our framework, how we incorporate concepts from niche theory so that we can reinterpret our previous work to provide a historical political economy of niche-building.

2.1 A Brief Conceptualisation of Ideas, Interests and Institutions

Ideas are promoted, discussed, negotiated and contested, etc., within discourses (Kern 2011: 1119; Mayrhofer and Gupta 2015: 4). And, following Leach *et al*. (2010b; 2010a), we can analyse discourse through the notion of narratives. According to Roe (1991), development narratives offer ways to discipline the complexity of the world by simplifying this complexity into plausible stories, making them attractive to practitioners as well as, we might argue, wider publics. Narratives remove from view certain aspects of the world, and place in view others. A narrative describes where we are at present and what is wrong with this (the narrative's introduction, problem-definition), elaborates a way to fix the problem (the narrative's middle[1], development strategy), and what the world will look like if the strategy is successful (the narrative's end, better outcome) (Leach *et al.* 2010a: 371, after Roe 1991). Naess *et al*. (2015: 536) include 'evidence' when considering narratives, arguing that 'narratives and evidence' provide a way to examine 'the histories and practices linked to shifting discourses, and how these shape and guide policy problems and courses of action. Whilst it is not entirely clear what the authors mean by 'evidence' and what counts as such, it is implied by the link between 'histories and practices' and 'shifting discourses', referring, perhaps, to the effect histories and practices have on discourses, and *vice versa*. As such, any development (or policy) narrative told in a particular place about particular issues will have to be persuasive in that context. In order for this to be so, it will appeal to context-specific qualities, for example local[2] culture, politics, history, economy, and link with other locally-powerful narratives. So, by analysing narratives, we are forced

[1] Alternatively, the middle might describe what will happen because of this problem (consequences if nothing is done), and the end might elaborate what we should do about it (better development strategy).

[2] Local, here, does not have to mean a sub-national region or nation. We are using it in the sense that those who the teller wants to persuade are the locals in that 'space' – the relevant audience. So, the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties, for example, might include thousands of people from across the world but there will still be policy narratives told within this 'locality' that connect with other narratives relevant to the 'culture', 'language', 'politics, etc., of the United Nations (UN) negotiations.

to consider how they achieve (or not) this appeal. Wagenaar (2011: 212-4) offers a way to analyse how stories (or, for us, narratives) achieve their appeal when, amongst other things, he argues that stories are both subjective and value-laden. They are subjective in the sense that 'good' stories are those that engage with universal and timeless themes, which enable readers to identify with the story. That is, readers can see in the story their own life-experiences and so are able to fill in the details that have been left untold. As readers, we can recognise the characters and the ambiguous situations they have to face, make judgements about what the characters do, take sides, and so on. By involving us as readers in the moral complexities of the situations presented to us, we get to consider how the abstract ideas look in reality. By value-laden, Wagenaar argues that stories depict their characters in ways that persuade us to make particular judgements about them – that they are, for example, good or bad, right or wrong. We are likely to want to see the 'good guys' win, to support their strategies or actions above those of others. In the story, for us to choose sides, there must be a moral dilemma that threatens to upset the normal order of things and that dilemma may have been caused by the actions of the 'bad guy'. To restore order, someone must act – the good guy, or the bad guy turned good.

Naess *et al*. (2015: 536) describe *interests*, along with politics, as the 'core of classic political economy analysis', which emphasise 'the interactions of state and civil society, and different interest groups, social segments or classes'. In classic political economy, actors are assumed to be personal-utility maximisers but this assumption is critiqued on the basis that it assumes actors pursue rationally their known (to themselves) interests. According to this critique, actors do not always know what their interests are, especially in contexts characterised by complexity and uncertainty (Kern 2011: 1120; Hudson and Leftwich 2014: 95). In such contexts, actors construct their interests along with constructing meaning from the various dynamics at play within a discourse (i.e. the interacting shifting narratives within a particular discourse), and the opportunities for, and constraints to, their action. This does not preclude actors having particular knowable (by them and others) material interests, but it may not be clear how these will feature in any potentially realised socio-technical future and, therefore, whether the actors will continue to see these as their interests. The point here is that we need to be attuned to the way interests themselves evolve in tandem with evolutions in narratives, institutions, materiality and context.

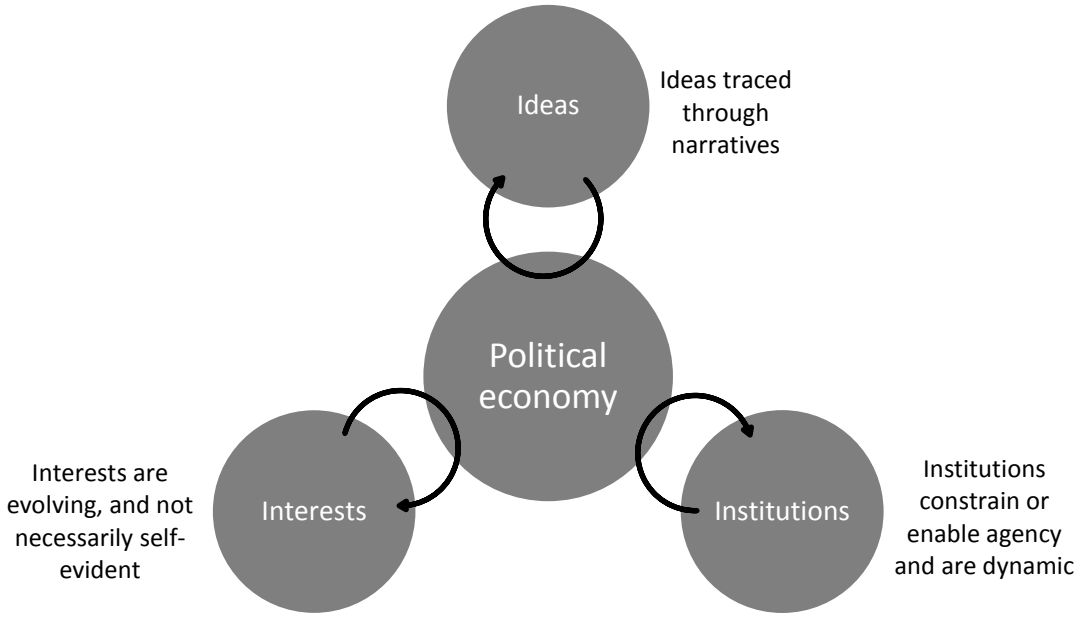
When we are analysing opportunities and constraints in regard to agency, the category *institutions* is relevant. Institutions here refer to both formal and informal (sometimes called non-formal) 'rules' that enable or constrain actors' agency (Kern 2011: 1120). Formal rules include policies, laws, regulations, standards, and other generally codified arrangements. Informal rules refer to social norms, cultural practices, values, and so on. Institutions are not determining of actors' agency but when actors wish to go beyond what institutions allow or promote they must engage in extra work to make it possible (or risk being seen as illegitimate in some way): i.e. they will have to engage in political work to persuade others that what they are doing – or wish to do – is acceptable or desirable (Hudson and Leftwich 2014: 75–7, and Section 6.2 more generally). This links the category directly to discourse and, especially, narratives, where we can see actors attempting to change institutions. And, it also links to interests, as actors may be trying to change institutions so that they align with their interests (notwithstanding the argument that actors do not always know what their interests are). Agency features strongly in this category and Naess *et al*. (2015) include actors with institutions in their analytical approach.

2.2 Summary of the Political Economy Framework

In order to achieve a more useful analytical purchase, we 'decompose' the notion of political economy into three main categories: ideas, interests and institutions. We take these to be interacting and dynamic rather than separate and static. Ideas are central to discourse and so we can conceptualise this category in terms of narratives and how they operate. Interests are not necessarily self-evident to actors; rather, we conceptualise them as co-produced discursively along with the changing

institutional context. Figure 2.1 depicts the main concepts we use to form the framework of our political economy perspective.

Figure 2.1 Political Economy through the Co-production of Ideas, Interests and Institutions



Source: Authors' construction

Having sketched the concepts we use to bring some granularity to our notion of political economy, we move in the next section to discuss our methodology. This includes some discussion of our previous work on the evolution of Kenya's PV niche, as well as a brief review of niche theory. This review of niche theory will help us to complete the construction of our framework for analysing the political economy of niche-building before moving on, in Section 4, to recount the particular political economy dynamics of the Kenyan PV niche.

3. Methodology: Case Selection, Methods and a Political Economy of Niche-building

Before outlining the research strategy, methods and analytical framework, we discuss the rationale for choosing the Kenyan PV niche as a case study to explore state-led transformations in pro-poor low carbon energy. As part of this rationale, we also provide a brief review of existing STEPS Centre research on low carbon energy in Kenya. We draw heavily from this previous research but reinterpret it using our political economy of niche-building framework, and so it is helpful to provide a sketch of what that research entails. With this existing research in mind, we then describe the research strategy and methods used for this paper. Then, as part of developing the analytical framework, we briefly review the main concepts in niche theory. Finally, we discuss how we have combined the political economy lens conceptualised in Section 2 with these niche theory concepts, as well as how we operationalise them for this paper, and how they give rise to the generic questions used to interrogate the existing STEPS research and new data collected.

3.1 Rationale for a Case Study of Solar PV in Kenya

The bulk of STEPS Centre research on low carbon energy in Kenya is focussed on off-grid solar PV, whether as solar home systems (SHSs) or solar portable lanterns (SPLs), and has been conducted using the niche theory framework (see Byrne *et al.* 2014; Rolffs *et al.* 2014; Rolffs *et al.* 2015; Ockwell and Byrne 2016a; Ockwell *et al.* forthcoming 2017). In addition, STEPS Centre colleagues, together with others, have conducted research on the political economy of low carbon energy in Kenya more generally (see Newell *et al.* 2014; Naess *et al.* 2015; Newell and Phillips 2016). In the present paper, we draw mainly from the work on SHSs and SPLs (especially Byrne *et al.* 2014; and Ockwell and Byrne 2016a) but supplement this, where appropriate, by the other work and, of course, with our new data.

The Kenyan PV niche is a useful case study for several reasons. Solar PV systems of various kinds have become increasingly attractive technologies for bringing sustainable energy services to millions across the world, promising low-carbon wins, adaptability across scales of provision, simplicity of operation and rapidly falling prices (Jacobson 2004; Byrne 2011; Bazilian *et al.* 2013). In areas of developing countries without electricity grids, SHSs and SPLs, many with mobile phone charging functionality, are being adopted in rapidly expanding markets (Bloomberg NEF and Lighting Global 2016). One of the most vibrant of these is the Kenyan PV market (Rolffs *et al.* 2015; Turman-Bryant *et al.* 2015), considered one of the most successful per capita off-grid solar markets in the developing world, and widely described as a private sector led phenomenon that has achieved its success without subsidy and with minimal international 'aid' (for example see Jacobson 2004; Jacobson 2007; and Ondraczek 2013). As such, it might be characterised as a market-led or perhaps a technology-led transformation (Leach *et al.* 2010b; Scoones 2016). However, our existing research demonstrates that this 'private-sector-led' characterisation is highly simplified. Since at least the early 1980s, donors have provided resources to support the activities of PV actors (mainly those within Kenya but also some from outside) who have gradually constructed a socio-technical niche (see below for a discussion of the niche concept) around solar technology in Kenya (Byrne 2011; Ockwell and Byrne 2016a; Ockwell *et al.* forthcoming 2017). Without this donor support, we argue, it is unlikely that there would be a successful PV market to analyse.

The case, therefore, offers an example in which there has been a long history of interactions between international donors, many of whom could be described as supportive of neoliberal development orthodoxy, parts of the Kenyan state, and PV activists interested in promoting SHSs and SPLs as potential pro-poor solutions to the off-grid electricity-access challenge. Understanding the dynamics of these interactions, and how solar PV pathways have been constructed through them, provides us with an opportunity to generate insights relevant to the international policy ambitions of achieving

sustainable energy for all and meaningful climate change mitigation. Given that enormous quantities of private finance are expected to flow to support such policy ambitions, and that an active public sector is likely to be needed to guide, direct and even lead investment (Mazzucato 2013; Mazzucato 2016; Perez 2016), we can expect an increasing number of spaces in which neoliberal and developmentalist ideologies confront each other. Using a political economy lens on the Kenyan case is therefore important if we are to reveal how these kinds of confrontations have played out in this example, and for reflecting on how they might play out in other (confrontational) spaces in the future.

3.2 Research Strategy and Methods

The research for this paper was mainly desk-based, making extensive use of the material and analyses in our existing research on the evolution of the PV niche in Kenya (see, especially, Byrne 2011; Byrne *et al.* 2014; Ockwell and Byrne 2016a). This material was revisited to identify moments in that 'PV innovation history' where political economy dynamics would be most likely evident and, from these moments, we selected a small number for deeper research. In addition to these moments and the material already available to us, we identified the introduction of Kenya's new constitution as another important development with potentially significant political economy dynamics. We conducted nine new interviews in order to derive new information relevant to the political economy of the selected moments. We spoke with two international NGO representatives, two private sector representatives, and five senior county officials. These supplemented the over 100 hours of interview testimony gathered from the previous work. As far as possible, we also made use of new documentary material in addition to that already gathered for the existing research. For one of the selected 'moments', which began in the mid-2000s and continued to the present day, we were unable to secure any interviews despite many attempts to do so.

To help us re-analyse the previous work we reinterpreted our previous theoretical framework, niche theory, using the categories discussed briefly in Section 2 above: ideas, interests and institutions. In the next sub-section, we present this reinterpretation of niche theory before discussing how we have operationalised the concepts. Once we had operationalised our framework for a political economy of niche-building, we devised a list of questions for guiding the semi-structured interviews and for interrogating the material gathered from our previous research. With the consent of the interviewees, the new interviews were recorded and we made notes from the interviews rather than transcribing them. The identities of the nine new interviewees have been kept anonymous but those we interviewed for our previous work are named, unless they had requested anonymity during our previous work. Then, using our new analytical framework to revisit the empirical material already gathered, combined with the deeper work on key moments, we reconstructed a historical account of the political economy of Kenyan PV niche-building. This history is given in Section 4.

3.3 Reinterpreting Niche Theory Using Ideas, Interests and Institutions

Before discussing how we reinterpret niche theory using the categories ideas, interests and institutions, it is useful to give a brief account of its main concepts. A socio-technical niche can be considered to be a space in which experimentation and learning can occur as new technologies and other innovations are tested in real-world settings (Geels 2002; Raven 2005). An essential quality of such a space is that, although 'real-world', the new technology or innovation is 'protected' from the full force of market competition, where protection could take the form, for example, of a subsidy, or the new technology could be seen as a demonstration, or the innovation is the subject of a research project, and so on (Schot and Geels 2007; Smith and Raven 2012). The point of a protective space is to provide opportunities to generate learning rather than to assess whether an innovation is a success or failure. Learning, which can be of a first or second-order kind, can then inform further experimentation and further learning.

Over time, the technology or innovation is refined as increasingly robust facts and data are collected from various experiments (first-order learning) and the niche innovation is made to work in particular contexts (Hoogma *et al.* 2002: 28). If such refinements do not succeed in making the innovation work then there may be a fundamental rethink – a change of assumptions about the innovation – and a substantially new way of working with the innovation or different innovation becomes the subject of experimentation (second-order learning) (Byrne 2011: 23-4). For example, actors might be attempting to refine SHSs so that they work in a pastoralist context. Here we have what niche theory calls a socio-technical expectation about SHSs, that these solar systems can provide access to electricity for pastoralists. This expectation then guides the kind of experiments undertaken – the direction of problem-solving and learning. At some point it might become clear that the semi-nomadic lifestyle of pastoralists concerned means that fixed SHSs are not necessarily the best solution. Instead, solar lanterns might be better. This, in effect, is a change of assumptions about which solar technology to test, second-order learning, and this suggests a different expectation: i.e. a change in the direction of problem-solving and learning (Ockwell and Byrne 2016a: 61-2).

Whichever direction of learning is pursued, when the innovation is further refined so that knowledge about how to get it to work becomes increasingly clear, the expectation guiding the experimentation starts to become a socio-technical vision (Byrne 2011: 16-8). As experiments continue to be conducted, actors work with others and expand their networks, drawing in resources for further experimentation, learning and refinements (Raven 2005: 39-41). And, as they learn about a new technology or innovation in the real world, so they begin to define new practices, identify changes needed in various institutions (such as policies, laws, regulations) and lobby for these new practices and institutional changes. If they are successful in these attempts then this is referred to in niche theory as institutionalisation (Deuten *et al.* 1997: 132; Byrne 2011: 18-9).

So, the essential concepts in niche theory are: protective space; experimentation and learning (first and second order); expectations and visions; actor networks; and institutionalisation. Tracing the interacting dynamics of these concepts in operation reveals the niche-building work that must be done to establish a new technology or innovation so that it might mount a challenge to a currently dominant technology or innovation. The point of analysing such dynamics is to learn how we can guide development towards more sustainable outcomes, for example to replace fossil-fuel based energy systems with renewable-energy based systems. Dominant (unsustainable) systems of provision are referred to as socio-technical regimes in the niche literature. And, it should be noted, a niche is not the same as a market. A niche consists of the empirically-identified set of actors who are working in some form of protective way to promote a new technology or innovation. A market, which may be part of a niche, is an outcome of the exchange of money for goods and services. With this brief summary of the main concepts in niche theory we can now turn to how we reinterpret it using our political economy lens.

Niche theory does not have an explicit *narratives* category. However, expectations and visions are closely-related concepts. Further defining these, expectations and visions are conceptualised as cognitive representations of particular socio-technical futures: i.e. *ideas* about future configurations of technological artefacts and relevant social elements, such as practices, cultures, politics, etc. (see, for example, Berkhout 2006; Eames *et al.* 2006). But expectations and visions do more than just exist as ideas. They are deployed by actors in political ways, aimed at persuading others to adopt the same expectation or vision (Byrne 2011: 17-8). So there is something of an overlap between narratives, and expectations and visions. And narratives have been used successfully to analyse the evolution of expectations in the context of PV in the UK (see Smith *et al.* 2014). We can, therefore, relatively easily translate the material on expectations and visions that we gathered for the previous work into a narratives analysis. Moreover, as the previous work connected expectations and visions with the materiality of the PV niche evolution, we can also connect the narratives analysis with these material developments. This can also help us integrate the political economy category *interests*.

In terms of being able to use evidence from the previous work to reveal *interests* and interest-construction, there are several overlapping niche concepts we can identify. Most clearly, expectations (and visions) apply, together with the category for learning. This is where we can see anticipated material developments (expectations and visions), and the interaction of anticipation and actualisation (through learning), especially in socio-technical experiments (which can be conceptualised to include projects, processes and events (see Byrne 2011)). But there is also a connection with the actor-network category in niche theory. One of the reasons for building networks of actors is that they increase access to resources of various kinds. Some resources may be financial; other resources may be political, as in political support for a particular technology; some may be knowledge resources, as in expertise about a technology. So, through this category, we can see to what extent interests are being (re)constructed, maintained, established, and so on.

Table 3.1 Ideas, Interests and Institutions in Niche Theory

Political economy	Conceptual links with niche theory
Ideas	Expectations and visions reveal ideas about socio-technical futures, expressed in narratives, moral dilemmas provide persuasive forces Evolution of expectations and visions, and encounters with other expectations and visions, reveal politics and actors' strategies
Interests	Experimentation and learning reveal how interests are constructed in the face of uncertainty and change, and how interests are materialised Evolution of actor-networks reveals shared interest-construction and the nature of resources sought and secured Expectations and visions are suggestive of interests and interest-construction (perhaps implicit through framing, for example)
Institutions	Institutionalisation reveals actors' agency and constraints, traces institutional change Expectations and visions reveal the politics of institutional change

Source: Authors

The category *institutions* (and actors) is relatively straightforward in terms of making use of our previous work. Niche theory has a category for institutionalisation, and the niche literature generally takes a similarly broad view to the one described above of what institutions are. The main difference between the political economy and niche versions of this category is that the niche version is concerned with the process of embedding new or adapted institutions in socio-technical systems, whereas the political economy version is more concerned with the extent to which existing institutions enable or constrain actors' agency. Nevertheless, the specific form of political economy we are using analyses the dynamics of a political economy through the co-productive interactions of ideas, interests and institutions. In this sense, we can draw quite directly from the institutionalising processes evidenced in the previous work. Likewise, niche theory has an actor-network category and so translation to the actor dynamics within the institutions concept we are using for our political economy approach is relatively straightforward.

Table 3.1 provides a summary of how niche theory concepts can be translated to our political economy categories of ideas, interests and institutions. The next sub-section discusses how we operationalise these concepts for gathering new, and interrogating our existing, evidence.

3.4 Operationalising Ideas, Interests and Institutions

This sub-section attempts to make explicit how we have operationalised the set of concepts discussed above. This brief discussion is organised according to the three political economy categories but we include reference in each category to where evidence from the niche theory categories detailed in our existing work on the evolution of the Kenyan PV niche can be found, as summarised in Table 3.1.

We use narratives and framings as the basic tools to analyse ideas, drawing primarily on the evidence we have for the evolution of expectations and visions. Following Leach *et al*. (2010b; 2010a), we determine narratives in terms of the problem-strategy-outcome construction and so interrogate texts (documentary evidence and interviews) to look for these elements. To establish framings, we identify what actors, evidence, objects and abstractions (e.g. market forces) are discussed and how they are deployed. And the way framings and narratives combine can provide insight into the moral forces at play: what the normal order of things is; who the 'good guys' and 'bad guys' are; what the moral dilemma is we are compelled to judge and what the judgement is we are expected to make.

Our conceptualisation of interests includes both the material and the political, and we have adopted the argument that interests are socially constructed rather than self-evident or known to actors before they act. From our previous niche analysis, experimentation and learning provide the primary source of evidence for interrogating how actors construct and materialise their interests. We operationalise interests in terms of the material and political resources available to an actor, and in which they have invested, paying attention to how an actor constructs their interests in co-production with evolving ideas and institutions in the face of change. Material resources include money ('in the bank', or anticipated from future financial flows and profits), hard investments (e.g. in technological infrastructure), and 'soft' investments (e.g. in contracts, knowledge and skills, business models and strategies, relationships). Political resources include formal institutional position (for example, politician, ministry official, cleric, NGO), informal institutional position (for example, opinion-leader, elder, head of household), and legitimacy and credibility (for example, the degree to which an actor is respected, consulted, and by which other actors).

As discussed in the section on conceptualising a political economy of niche-building, the concept of institutions is already defined in operational terms. Formal institutions include policies, laws, regulations, standards. Informal institutions include cultural practices, social norms, values, and so on. But we are interested not just in identifying institutions, we also want to analyse how they enable or constrain actors and how actors attempt to change institutions. Here, we expect that there is a close interaction between institutions and narratives. From our previous work, we draw primarily from the niche theory categories of institutionalisation, and expectations and visions, to reveal the agency of actors and the politics of institutional change. As for the concept of actors, we take this to mean individuals or groups, whether those groups are organisational actors or alliances of some kind. We draw evidence from our previous work, most obviously, through tracing the evolution of actor-networks but actors appear throughout: for example, they develop and deploy ideas, construct interests and seek institutional stasis or change.

3.5 Questions for Guiding Interviews and Analysis of Our Previous Research

Bringing the operationalisation of our main concepts together, we derive the questions to use for guiding the new semi-structured interviews, and for guiding analysis of the material gathered in the previous research. The first four questions relate to ideas, the next three relate to interests, and the final six relate to institutions.

Ideas

1. What is the problem-definition?
2. What development strategy is being advocated?

3. What outcomes are those advocating the strategy claiming? What outcomes are those actors claiming if the strategy is not followed?
4. What framing appears to be in operation?

Interests

5. What material resources are available to an actor?
6. What political resources are available to an actor?
7. How does an actor construct their interests in the face of change, bearing in mind their material and political resources?

Institutions

8. Who are the relevant actors and actor-groups?
9. What formal institutions are currently in operation?
10. What informal institutions are currently in operation?
11. How do these formal and informal institutions constrain or enable the agency of different actors?
12. What formal and informal institutional changes are different actors seeking, and why?
13. How are different actors attempting to realise their preferred institutional changes?

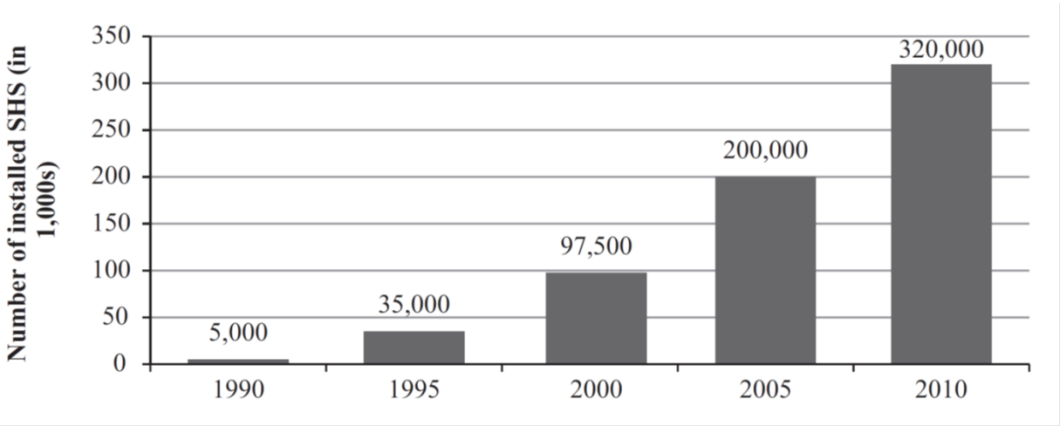
3.6 Summary of the Methodology

In this section, we have presented a rationale for choosing the Kenyan PV niche as a case study relevant to the political economy of state-led transformations in pro-poor low carbon energy. In essence, our argument is that the case represents an example where actors with different interests and significantly different levels or sources of power have interacted to co-produce what is seen by many to be an exemplar of neoliberal development orthodoxy, but which we contend to be far more complicated than a private sector led phenomenon. As such, the case can reveal the messiness of policy making in particular places rather than assume deterministic outcomes based on the relative power of the actors involved, and so provide insights on how future confrontations between ideologies – neoliberal and developmentalist in this case – will play out as global policy ambitions such as sustainable energy for all and meaningful climate change mitigation are put into practice. We have constructed a methodology that allows us to reinterpret through a political economy lens our existing work on the Kenyan PV niche, supplementing this existing work with a handful of new interviews and new documentary evidence. As part of achieving this reinterpretation, we have attempted to translate niche theory concepts into those that constitute our political economy lens: ideas, interests and institutions. This tentative political economy of niche-building framework stands as one of the contributions of this paper. The next Section presents the case as a historical political economy of PV niche-building in Kenya. Following this, in Section 5, we present an analysis of the case using our political economy lens before concluding the paper in Section 6.

4. Case study: a Historical Political Economy of the Kenyan PV Niche

The Kenyan market for SHSs has long been celebrated as a success, especially when compared with other developing countries (Hankins 1990; 1993; Hankins and Bess 1994; Acker and Kammen 1996; van der Plas and Hankins 1998; Jacobson 2004; 2007; Ondraczek 2013). Beginning in the mid-1980s, the SHS market became quickly established (Hankins 1990) and has grown rapidly during most of the period since, as can be seen in Figure 4.1 (Ondraczek 2013). The market is described by many analysts as unsubsidised (Ockwell *et al.* forthcoming 2017), providing an exemplar of the neoliberal mode of development wherein private sector actors deliver energy services through free markets to those at the bottom of the income pyramid (Prahalad 2006). However, as we demonstrate in our account of the evolution of the SHS market (and the more recent SPL market), the description of a private sector led development phenomenon is highly simplified. By taking a niche-building perspective – incorporating the range of activities various actors employed to build the actor-networks, institutions and capabilities relevant to creating a successful market – and doing so through a political economy lens, we see the extent to which different development strategies have negotiated each other over time in their encounters through technology experiments and policymaking. This reveals a much more complex array of dynamics than are suggested by the simplifying private sector story and, as PV actors continue to struggle to further develop the niche, it is unclear whether the previous successes in niche-building will be maintained or whether stricter neoliberal ideas of development will triumph. As Kenya enters an uncertain period of energy governance under its new constitution, these dynamics may become increasingly complex with possibilities either for pluralising energy pathways or for opening new sites of contestation and conflict.

Figure 4.1 Number of SHSs Installed in Kenya 1990–2010



Source: Ondraczek (2013: 409)

4.1 Telling Tales: Constructing a Narrative of the Embryonic PV Niche

Up until about 1984, there was no SHS[3] market in Kenya. Solar PV equipment was available from some suppliers in Nairobi who stocked the equipment for the so-called 'project market' that consisted of installations for powering community and commercial services, for example rural clinics, vaccine refrigerators, school lighting and TV/VCR, water pumping, outdoor lighting, and telecommunications (Ockwell and Byrne 2016a: 73-5). The SHS market is said to have its beginning in a series of four PV lighting installations in schools around Mount Kenya, starting in 1984 and running into 1986 (Hankins 2007). The first of these PV systems was installed at Karamugi Harambee Secondary School, where

[3] The term 'solar home system' had not been coined at this time but we use it for simplicity.

Mark Hankins, a US Peace Corps volunteer at the time and later important actor in the Kenyan PV niche, was teaching science. In late 1983, Hankins had met with Harold Burris, an ex-Peace Corps volunteer who was looking to make a living in Kenya (he was married to a Kenyan), and they had discussed the possibility of installing a PV lighting system at Karamugi instead of the school purchasing a diesel generator. After some persuasion, the school agreed to trial PV lighting systems in four classrooms (Ockwell and Byrne 2016a: 77). Within six months of the installation, the headmaster, several teachers and others in the local community wanted similar systems for their homes (Hankins 1993: 32; Kimani and Hankins 1993: 93). Hankins showed the Karamugi installation to representatives from the Peace Corps and this excited interest from them in supporting further school installations, as Hankins recalls:

> The Karamugi installation was a coup: it involved some Peace Corps leaders coming to the school and talking about how this was a great thing. So there was definitely a sense that this was a great idea and so let's talk to the people in USAID about it.
> Hankins (2007)

Eventually, this led to Hankins and Burris working on a project to install PV systems in the three other schools in the series of four mentioned above. This time, the United States Agency for International Development (USAID) funded 50 per cent of the cost and the schools funded the rest (the Karamugi installation was funded by the school itself) (Ockwell and Byrne 2016a: 78-9). Both the Peace Corps and USAID had already shown a strong interest in supporting the use of renewable energy technologies in their development work. USAID had funded the installation of some of the community services facilities mentioned above (e.g. rural clinics and vaccine refrigerators), which was the result of an attempt to marry their interest in funding pro-poor electrification projects with a more general US interest to develop alternatives to a dependence on oil in its domestic economy (Byrne 2011: 61-4). And the Peace Corps had been interested since 1979 in promoting renewable energy installations for community services (Peace Corps 1984). So a project to install school lighting systems powered by PV was clearly in line with the interests of both USAID and the Peace Corps. However, there was a stipulation that the installations be accompanied by the training of technicians, something which Hankins and Burris proceeded to develop. This installation-and-training combination then became a template that Hankins used extensively for many subsequent years in Kenya and elsewhere (Ockwell and Byrne 2016a: 82). And, just as had happened following the Karamugi installation, others wanted lighting systems for their homes after they had seen them installed in the schools.

In response to the demand for home lighting systems that followed the Karamugi installation, Burris set up a business, which he named *Solar Shamba*, and 'got heavily into the marketing' (Hankins 2007). Later he also employed eight of the technicians who were trained in the subsequent USAID-supported three-schools project. Most of the others were employed by the Nairobi PV suppliers (Ockwell and Byrne 2016a: 79). With a number of companies now focussed on marketing SHSs in the area around Mount Kenya, and, especially due to the efforts of *Solar Shamba*, the market grew quickly over the next few years. Precise figures are impossible to determine or verify but there could have been as many as 500 SHSs installed by early 1987 (for various estimates, see Hankins 1990: 2; Perlin 1999: 135; Hankins 2001: 2). Despite this rapid growth, Burris became increasingly isolated from other actors in the embryonic PV niche – he was notoriously critical of the many actors he considered to be guilty of poor technical practice and thereby made many enemies – and he found it increasingly difficult to operate his business. Around the end of 1987 or early 1988, Burris left Kenya (Ockwell and Byrne 2016a: 87).

Hankins left Kenya around the same time as Burris but was looking for a way to return (Hankins 2007). In 1989, he began a master's degree in renewable energies at Reading University in the United Kingdom (UK) and went to Kenya for his dissertation research. He found that the SHS market had continued to flourish and he was therefore able to survey a number of installations to find out how

consumers were using – and abusing – their systems (Hankins 1990). The dissertation documented how the supply chains were working and how people in rural areas were actually using the technology, which included some examples of productive uses as well as immediate improvements in the quality of their lives. He learned about some of the problems in the market, some of which were to do with technical issues and some to do with user practices. And he could point to the fact that thousands of systems had been sold through the private market (Ockwell and Byrne 2016a: 93).

This last observation formed an important part of the introduction to Hankins' dissertation, and it is here that we see what may have been his first attempt to articulate a coherent story of this Kenyan PV market phenomenon. Specifically, he says:

> In Kenya over 4,000 solar electric lighting systems were installed in rural homes between 1984 and 1989. In the inoculation stages of the technology between 1984 and 87, about 500 home units were installed, and demand grew rapidly thenceforth … The phenomenal growth of the Kenyan market has occurred almost entirely on a commercial basis, as external aid has not played an important role in dissemination of home lighting systems, except for training projects involving rurally-based electricians. Prospective system buyers must pay in cash, as credit has not been available from any companies until 1989.
>
> With design improvements, credit availability, better local marketing, servicing, and consumer education, small lighting systems could meet the needs of rural people on a much wider scale. Hankins (1990: 2–3)

According to Hankins (2007) the 'message' in his dissertation was 'picked up by the World Bank' and certainly, as we recount below, the International Finance Corporation (IFC) later implemented a project in Kenya to transform the scale of the market. But, more immediately, Hankins was able to use his findings to win funding for conducting further research into SHS markets in Kenya and elsewhere, publishing these in Hankins (1993) and in Hankins and Bess (1994), as well as writing a textbook of solar lighting system design (first published as Hankins 1991; updated in 1995; and then in 2010). Furthermore, together with Burris and the NGO Kenya Environmental Non-Governmental Organizations (KENGO), he won funding from the African Development Foundation to run a workshop in Nairobi in 1992 on installing SHSs, and this attracted participation from actors across East and Southern Africa (including some from the Kenyan Ministry of Energy) (Ockwell and Byrne 2016a: 92). Out of this workshop, Hankins had a number of project opportunities but had to implement them through a legal entity. He therefore started his own company, Energy Alternatives Africa (EAA), and this became a leading player in the PV market in Kenya, as well as in several other African countries, over subsequent decades.

EAA developed and used the story of the Kenyan PV market phenomenon, which Hankins had begun to articulate in his dissertation, to win funding from donors for many PV projects over the ensuing years. Hankins and colleagues would identify a problem in the market and then construct an argument that the private sector – who, according to this argument, had led the creation of the market – were being hampered by the identified problem from developing the market further. The argument was then used to persuade a donor to provide resources so that the problem could be solved with an intervention of some kind. This was a successful strategy, winning resources from a wide range of donors for a wide range of projects. A selection of the projects, and their donors, included (for detailed accounts of these projects, see Byrne 2011; and Ockwell and Byrne 2016a):

- building a solar training facility in Tanzania (funded by the Commonwealth Science Council, CSC)
- running annual two-week training courses at the Tanzanian solar training facility (funded by CSC, Sida, APSO, Hivos, and Ashden Trust)

- developing solar batteries (funded by Ashden Trust and the World Bank's Energy Sector Management Assistance Programme, ESMAP)
- developing balance-of-system components such as charge regulators (funded by the Micro-Enterprises Support Programme)
- test-marketing solar lanterns (funded by ESMAP)
- conducting increasingly large surveys on different aspects of the Kenyan and other solar markets (funded by ESMAP and the World Bank, amongst others)
- experimenting with micro-finance for SHSs (funded by ESMAP and Ashden Trust)
- formulating an alternative Kenyan energy policy (funded by the UK Department for International Development, DFID)

In the process of implementing these and other projects, EAA worked with a wide range of PV actors in Kenya and elsewhere. According to Ockwell and Byrne (2016a: 98), for example, over the period from 1995 to the early 2000s, EAA worked 'with at least 39 different dealers and suppliers in 16 cities, towns and villages around Kenya, and at least five of the dealers were involved in more than one project'. In addition to these and the donors already mentioned, EAA worked with several local manufacturers and with a number of researchers from outside Kenya. However, the extent of their networking was not confined to the implementation of projects or hosting visiting researchers. Hankins had also started an informal network of local PV actors in 1992 – SolarNet – and this continued for many years, including the publication of a regular news magazine starting in 1998, only officially closing in 2010 (Byrne *et al.* 2014: 97).

Throughout this period, Hankins and colleagues repeated in various publications and project proposals the basic argument that the Kenyan PV market was a private sector phenomenon, although they did give credit to donors – or aid – for supporting training. However, the story was often simplified by others, and descriptions of the market such as 'unsubsidised' often appear in accounts[4] by various analysts (for example Jacobson 2004; 2007; Ondraczek 2013). In other words, beginning in 1990, Hankins and colleagues established the basic and enduring claim that the Kenyan PV market was private-sector led, and constructed a narrative around this that was used to attract resources to support their vision of SHS market development or, in our terms, to build a particular SHS pathway.

4.2 Wishful Thinking: Seeking Market Transformation

In connection with how Hankins' MSc dissertation was 'picked up by the World Bank', during the early 1990s the then recently established Global Environment Facility (GEF) was looking for project ideas to help promote renewable energy technologies in developing countries and eventually, together with the IFC, decided to try to scale-up the promising Kenyan PV market. Originally involving the World Bank and GEF, and conceived in terms of offering a prize for solar PV commercialisation, the project-concept was passed to the IFC and redesigned around the notion of competitive procurement from private companies within selected countries (IFC 2007: 40). Over a period of about two and a half years, including some consultation with PV niche actors, the IFC developed a proposal for market transformation in three countries: Kenya, Morocco and India. In assessing the Kenyan situation, the proposal referred to what it described as a 'true free market for PV products' (IFC 1998: 12), suggesting that the IFC had adopted the simplified version of the story that Hankins and colleagues had constructed. It took another two years to gain approval but, in July 1998, the IFC began implementation of this Photovoltaic Market Transformation Initiative (PVMTI) financed by the GEF (IFC 1998: C1; Gunning 2003: 81). The initiative made finance of US$ 5million available on both the

[4] One of the few exceptions is Jacobson (2004: 43–4), who provides a useful discussion of the debates of the time about subsidies. In essence, he argues that 'soft' subsidies were often not seen as 'bad', even by neoliberal policymakers. These kinds of subsidies could be construed as market development support in contrast to direct subsidies on PV module prices.

demand and supply sides of the Kenyan PV market, and was to be implemented over ten years. Finance for customers would enable them to overcome the high initial cost of PV modules, and therefore release pent-up demand. Finance for companies would allow them to purchase in bulk and so reduce their costs, hence lowering prices to consumers. In other words, PVMTI could be characterised as a 'hardware-financing' intervention (Ockwell and Byrne 2016b; 2016a).

Although PVMTI did acknowledge various issues in Kenya that were hampering development of the PV market, the bulk of effort focussed on establishing finance deals. In principle, the initiative was to provide a range of support services in addition to securing deals, including capacity building and addressing poor-quality products (Gunning 2003). However, negotiations to secure deals proved to be arduous, protracted and, ultimately, fruitless (Ngigi 2008; and see Byrne 2011: 127-9, for a fuller account of these negotiations), and so perhaps there was little opportunity to provide the other support services initially intended. Only one deal actually saw the finance and installation of SHSs , a deal of US$ 600,000 agreed with the Muramati Tea Growers Savings and Credit Cooperative (SACCO) (Byrne 2011: 128). It had taken three years of negotiations between PVMTI and the Muramati SACCO to secure the deal but it began to fall apart after implementation started. There were technical problems with the batteries for the systems, and the SACCO was unhappy with the service provided by the technical partner (Rolffs *et al.* 2014: 17). Following a 'very bitter' meeting with the Muramati stakeholders, the project was wound up and the money returned (Ngigi 2008). Despite the initial promise of the deal, and initial enthusiasm amongst the SACCO members, only about 150 to 170 SHSs were financed (IFC 2007: 42).

The protracted negotiations and continuing failure to secure deals led to increasing disquiet and impatience among local PV actors, and disparaging letters began to appear in the SolarNet news magazine (for example Bresson 2001: 5-6; de Bakker 2001: 4-5; Muchiri 2001: 4). And EAA, Hankins' company which had been part of an unsuccessful proposal into PVMTI, became one of the project's biggest critics (Ngigi 2008). As the disquiet and impatience hardened into resentment, local PV actors began discussing amongst themselves other ways in which PVMTI might provide some tangible benefit to the market (van der Vleuten 2008). In 2003, they approached PVMTI requesting help with capacity-building (Magambo 2006: 1). The following year, as a result of this lobbying and as well as frustrations within the PVMTI hierarchy itself (Ngigi 2008), the project was restructured (IFC 2007: 42). There was already a widely-held acknowledgement of poor quality in the Kenyan market, and systematic evidence of technician-training and technical-quality needs had been gathered by Arne Jacobson[5] (Jacobson 2002b; 2002a). So PVMTI agreed to strengthen the capacity-building element of its original design, both in terms of the money available (as grants rather than finance) and in terms of a clear programme of activities (in contrast to the vague statements given in the original proposal). In June 2006, the Kenya PV Capacity Building Project (KPVCP) got underway (PVMTI 2009) with a grant of USD 350,000, together with 'in-kind contributions and co-financing' of US$ 115,000 (IFC 2007: 42). The KPVCP grant was used to support the recently formed Kenya Renewable Energy Association (KEREA), the development of a PV curriculum, PV training courses, the production of three manuals (user, vendor, and installer manuals), and a quality assurance programme (Magambo 2006; IFC 2007: 42; Nyaga 2007; PVMTI 2009). In October 2006, in addition to the grant money specifically provided for KPVCP, PVMTI increased the proportion of grant money allowed for general technical assistance from 10 per cent to 20 pre cent of its US$ 5million budget (IFC 2007: 42). PVMTI was then extended to 2011 and, according to Ngigi (2008), these capacity building efforts and resources helped redeem the project's credibility amongst local PV actors.

[5] Arne Jacobson was a student from the University of California Berkeley and had been in Kenya since the late 1990s conducting research for his PhD. He was also involved in various PV activities, including writing a column for the SolarNet magazine on technical tips for PV systems.

4.3 A Seat at the Table: Engaging with State Actors

Overlapping with the implementation of PVMTI, local PV actors began to interact in substantive ways with certain parts of the Kenyan state. Perhaps the most notable of these interactions was with the Kenya Bureau of Standards (KEBS) through which local PV actors were central to efforts to develop Kenyan standards for PV equipment. But later interactions included attempts to influence national energy policy and the development of PV regulations. The extent to which PV actors have succeeded in influencing state actors is unclear. Some developments indicate a substantial influence, while others suggest that any influence has been superficial. State *practice* in regard to PV has been variously ambivalent, hostile, supportive or active. Official state *policy* has generally been vague and noncommittal, and has occasionally been undermining of PV development.

Kenya's first energy policy, formulated in 1987, included only cursory treatment of PV. In fact PV gets only two comparatively substantive mentions in the document:

> Solar photovoltaic energy (P.V.'s) can be used for water pumping, rural electrification, electric fencing, telecommunication systems, and micro-electronic devices.
> ROK 1987: 76

> To promote the use of [solar and wind] sources of energy the Ministry will undertake rigorous research, design, development and dissemination of these two technologies. Installation of solar and wind systems will be carried out for generation of electricity and water pumping in rural areas over the plan period [1987-2000].
> ROK 1987: 103

At this time the focus of the Kenyan energy policy was on cooking, energy efficiency in the industrial and commercial sectors, and transmission efficiency in the national electricity grid. The problem that the policy was intended to address was characterised as one of secure energy-supply for social and economic development, with an emphasis on economic growth. To address this problem, the strategy was to promote improved cookstoves and industrial energy conservation, and to reduce electric power system losses. Bearing in mind that the SHS market at this time was tiny, Hankins (1990: 2) put the number of SHS installations in Kenya in 1987 at 500, it is unlikely that state actors would consider it worth any attention in its energy policy, even if they knew of its existence. Some state actors did know something about PV, it would seem, as import duties of 45 per cent were removed from PV equipment in 1986 after lobbying, it is claimed, from the World Bank and private sector actors (Acker and Kammen 1996: 92; Jacobson 2004: 142). But, again, considering the small number of SHSs installed, perhaps this removal of duties was seen as inconsequential by state actors. Still, duties on solar modules were raised again in 1992 (to 53 per cent), then reduced in steps over the 1990s to zero in 2002 (Jacobson 2004: 142-3), and VAT of 16 per cent was imposed on solar goods in 2013 (Ockwell and Byrne 2016a: 122).

This neglect of PV began to change in the period just before the development of an updated energy policy, the first since 1987, a draft of which was published in 2004 (MOE 2004). It is difficult to know for certain but it appears that some deeper interactions between PV actors and some state actors may have helped to create a somewhat more favourable and supportive official view of PV from the state. These deeper interactions began with the process of formulating PV standards, which got underway in April 1999 (Gisore 2002: 47-8). For this process, KEBS formed a small committee with about 12 PV actors, which spent a few years meeting regularly to discuss and deliberate on what PV standards would be appropriate for Kenya (Loh 2007). Whilst this was proceeding, the then Acting Director of the Renewable Energy Department in the Ministry of Energy (MOE), Daniel Theuri, collaborated with EAA on some background papers for an Intergovernmental Authority on Development (IGAD) project 'Regional Household Energy Policy' (Theuri and Hankins 2000; Osawa and Theuri 2001; Theuri and Osawa 2001). And, through a process beginning in 2002, various PV actors, led by EAA, developed an

alternative national energy policy in parallel with the official policymaking process led by MOE (see Ockwell and Byrne 2016a: 112–22, for a detailed account of PV and state actor interactions around standards, regulations and energy policy). Although there were occasionally tense interactions between actors involved in the two policymaking processes, it would appear that the official policy did adopt some of the views of long standing PV advocates. This is apparent in some sections of the policy, which refer to the PV market in terms similar to those used in the well-established story of the private-sector-led phenomenon and various market failures constraining further growth. For example, MOE (2004: 19-20) repeats the, by then, long-articulated diagnosis of 'barriers' to PV market growth in Kenya:

Among the constraints to accelerated market penetration are:

- lack of legal and regulatory framework and institutional support to promote widespread use of solar energy and protect consumer interests;
- high capital costs of the systems relative to consumer incomes. Despite gradual reduction of the indirect taxes by the Government over the years, the cost of solar home systems has remained beyond the reach of many potential consumers;
- erosion of consumer confidence because of inappropriate system standards, faulty installations, importation of sub-standard systems and poor after sales service;
- rising thefts of photovoltaic panels installed in rural homes, thus discouraging their purchase and by extension growth;
- lack of awareness on the potential opportunities and economic benefits offered by solar technologies; and,
- lack of appropriate credit and financing mechanisms to facilitate acquisition of solar technology by the rural population and urban poor.

The draft policy later echoes the story of the private sector led phenomenon:

> Over the last three years, the number of [solar] home systems installed has grown at an average of 20,000 units per annum. This growth is attributable to aggressive marketing by the private sector with limited support from the Government in form of low taxes on panels. (MOE 2004: 31)

Interestingly, although there is acknowledgement of a public sector role, the role of donors has completely vanished in this account. Other parts of the policy document also suggest a warmer attitude to PV compared with the earlier period, although it does not develop any specific strategies for PV beyond broadly supportive statements. In effect, the draft policy takes an enabling-environment view of the challenge of PV promotion. That is, it takes a line that is in keeping with the still-present background free-market ideology, especially as articulated in the new institutional economics variety (Jacobson 2004: 43-4).

This somewhat more favourable view of PV continues into the latest version of the energy policy; one that has been developed to accommodate Kenya's new constitution, which splits energy policy duties between the national and county government levels. Whilst it does provide a list of strategies and policies intended to promote PV (see below), they are mainly in rather generic statements that echo the 2004 policy and are similarly concerned, in essence, with an enabling-environment (for example, standards and regulations, certified training, information for consumers) (MEP 2015: 58):

1. Undertake awareness programs to promote the use of solar energy

2. Enforce regulations on standards.
3. Regular review of standards for solar energy technologies and equipment.
4. Provide incentives to promote the local production and use of efficient solar systems.
5. Enforce regulations on building codes on water heating and lightning.
6. Provide a framework for connection of electricity generated from solar energy to national and isolated grids, through direct sale or net metering.
7. Enhance penalties for theft and vandalism of solar systems.
8. Support hybrid power generation systems involving solar and other energy sources to manage the effects caused by the intermittent nature and availability of solar energy.
9. Roll out installation of solar PV systems in all the remaining public facilities in the off-grid areas.
10. Procure and distribute solar lanterns to light up rural, peri-urban and urban areas.
11. Undertake RD&D on solar technologies.

The only instrument introduced explicitly between the 2004 and 2015 energy policies that could be seen as active promotion of PV was the feed-in tariff (FIT) (MOE 2012), although the solar FIT has been criticised by local actors for being unattractive (see Newell and Phillips 2016: 45, who report that the former Permanent Secretary of the Ministry of Energy is alleged to have lobbied to fix the PV FIT deliberately low so as to deter investors).

4.4 Where Markets Fear to Trade: the State Gets Active in PV

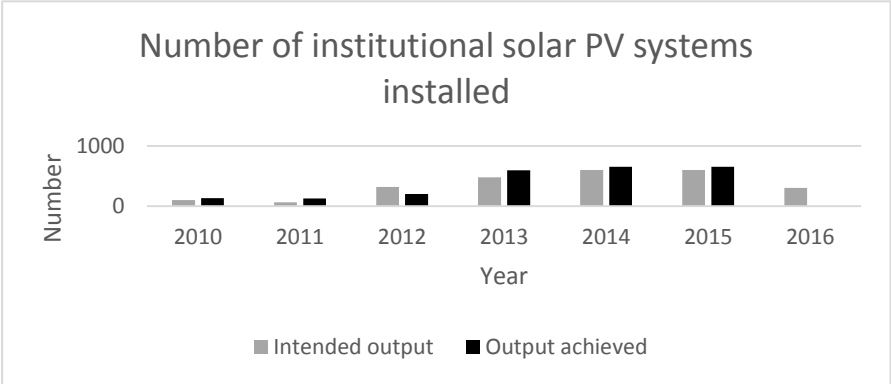
However, in 2005, the MOE did implement a significant PV programme (Hankins *et al.* 2009: 3), an Institutional PV Systems Programme, even though this was not signalled in the 2004 draft energy policy. As described in Ockwell and Byrne (2016a), the Programme seems to have emerged as an *ad hoc* response to pressure on the MOE from the President's Office soon after Mwai Kibaki was elected President in 2002. According to this account, Kibaki had promised the people in the Northeast Region – an area of arid and semi-arid land with little electricity grid infrastructure and sparsely populated, predominantly by pastoralists – that they would get electricity upon his election. When the MOE was told to find a way to fulfil this promise, it is said that the only quick solution would be to use PV systems. The idea was to electrify schools and then to move onto other community services facilities. Whilst there have been problems with the programme (NGO 1 2016; NGO 2 2016), including allegations of corruption amongst state officials and the companies who installed the systems (Mutimba 2007; Otieno 2007), it has indeed electrified a huge number of remote schools and other facilities. By August 2016, more than 4000 schools had been electrified with PV systems, according to ministry data reported by Wanzala (2016), at a cost of billions of Kenya Shillings (KES). The precise figure is not known but see below for some partial estimates. And the 2015 energy policy indicates a continuation of the programme to complete electrification of all off-grid public facilities (point 9 in the list cited above from MEP 2015: 58). It is difficult to verify the number of school systems, but our own analysis, based on various Kenyan Treasury reports of sectoral spending, suggest the figure of 4000 could be an overestimate. Figure 4.2 shows the results of our own data gathering, suggesting the number of installations to be closer to 3000, but this does not include the results for 2016. In the period between 2005, when the programme began implementation, and 2010, when the Treasury reports start, there were 150 systems planned for installation and the MOE was expecting to spend in excess of KES 600m (approximately US$ 8.5million at the time) (Mbithi 2007). The value of the SHS market in Kenya at this time was around US$ 6m per year, and so the Institutional PV Systems Programme represented an annual addition of about 30 per cent to this value (Ockwell and Byrne

2016a: 116-7). By 2014, Mbithi (2014) reports that about 1000 systems had been installed at a cost of KES 2billion (approximately US$ 23million).

Considering the ambivalence that the Kenyan state had previously shown in PV, it is surprising that it suddenly initiated such a large publicly-funded programme. Of course, the power of the President played an important role, forcing the MOE to act quickly to do something. PV, it seems, was the only viable option to meet the President's demands. But it is difficult to establish whether this was the only reason. No state actor agreed to be interviewed about the programme and so we only have comment from 'outsiders'. One of these suggested that the programme may have been seen favourably because of its scale (Private Sector 2 2016). Whereas SHSs tend to be small, say 20W to 50W each, the school systems were around 1kW each (and sometimes larger). Multiplying this by the thousands of schools in the programme means that scale has been achieved and that PV, in this context, begins to look serious when compared with small off-grid systems.

As can also been seen in Figure 4.2, there was a significant increase in the number of installations from 2013 onward. The reason for this sudden jump in system installations is explained by the Jubilee Coalition Government's programme to supply laptops to every primary school child. This was a key campaign promise made by Uhuru Kenyatta (NGO 2 2016) and it is clear that his Jubilee Government (which came to power in 2013) has been serious about electrifying all primary schools in order to ensure the success of the laptop programme. But the laptop programme has suffered controversy over whether other educational needs are more important (Kiberenge 2013), its cost (Muindi 2013) and its viability (Ombogo 2013), as well as allegations that the procurement process has sparked battles between business interests politically connected to rival groups within the Jubilee Coalition (Ongiri 2014).

Figure 4.2 Number of Targeted and Installed Institutional Solar PV Systems



Source: Compiled from sectoral reports. See National Treasury (2010-2016)

4.5 Closing Down: Legitimising and Delegitimising Practices

Returning to the interactions of PV actors with the state, in 2008, the KEBS committee on PV and wind began a process of developing PV regulations in response to disappointing results following the introduction of PV standards. There is no space to recount the detail of this process (for this, see Ockwell and Byrne 2016a: 119–22) but there are several points it is worth noting. First, it is interesting that PV actors themselves were supportive of developing regulations considering that they had initially wanted only standards. As Loh (2007) describes the standards making process and development of KEREA's own code of conduct (KEREA 2005), in the early 2000s KEREA members thought it would be 'better that the association has its rules and governs itself before the Government comes in and puts its hand into saying all these things and getting licenses'. But, in spite of some successes in the early 2000s at removing low-quality modules from the market (Jacobson and Kammen 2007), poor products and practices continued to dog the PV niche. The regulations that were eventually agreed (in 2012)

included the requirement that every actor practising in the Kenyan PV market be licensed, and licensing was only possible upon successful completion of nationally approved testing (ERC 2012). Furthermore, there was a payment for a license and it was a requirement that the license be renewed annually (also with a fee). Fees varied depending on the class of license, from no cost (basic level) to US$24.00 (intermediate) to US$37.00 (advanced level) with renewal costing either US$7.00 (intermediate) or US£10.00 (advanced). Fees for accredited training were expected to be about US$146.00. For some aspiring PV technicians these could be serious barriers to entry. But there were also question marks over whether the Energy Regulatory Commission (ERC), the licensing authority, had the capacity to manage the administrative burden that could result from implementation of these regulations (Ockwell and Byrne 2016a: 120), especially considering that the number of technicians already operating in Kenya was estimated to be more than 2000 (Ondraczek 2013: 409).

These barriers to entry to the PV market highlight the second point of note. The PV regulations could be seen as the most codified and institutionalised form of a closing down process that got underway informally in the mid-1980s. At that time, closing-down dynamics were mostly discursive in the sense that Burris, for example, was vocal about those he perceived to be practising poorly. The introduction of standards and then regulations could be seen as increasingly stronger closing down devices, prescribing at a national level what was considered good practice. But notions of good practice are not technically neutral and incontestable. This is the third point of note. The deliberations in the KEBS committee included arguments over certain aspects of the regulations, the details of which had implications for different actors' interests. For example, according to Mboa (2013), there were arguments over how long various product warranties should be, with the government and consumer representatives on one side arguing for lengthy warranties, and private sector representatives on the other arguing that lengthy warranties could put them out of business. Indeed, similar arguments were had during the standards process in the early 2000s (Gisore 2002: 49–50).

The final point of note arising from the implementation of regulations derives from the three preceding observations when these are considered within the wider context of low carbon energy policy dynamics in Kenya. As Newell and Phillips (2016) argue, the dominant low carbon energy actors in Kenya are mainly interested in developing geothermally generated electricity. Grid connected geothermal electricity offers the potential to meet the needs of industrial users at scale and at low cost. As it is a low carbon form of energy, it also aligns with donor interests in promoting climate compatible development. The Kenyan Government is interested because it relieves the pressure they experience from the powerful manufacturing lobby and grid-connected consumers while providing large capacity increases to underpin the government's economic growth ambitions. Off-grid small scale PV systems are of low priority in this context (recall the comments from Private Sector 2 2016 about scale). PV regulations can be seen as a light touch act on the part of the state that is simply setting an enabling-environment for private sector activity rather than acknowledge an emerging niche in need of further nurturing. In a sense, the story of a private sector phenomenon, deployed successfully to attract resources for many years, may backfire on the PV niche. Regulations could reduce the number of local players in the market and, if donor resources and policy support are targeted predominantly at geothermal energy exploitation, strict closing down around what is considered good practice could constrain the kinds of experimentation that enabled so much learning within the niche.

4.6 Pluralising Pathways: New Services, New Markets and New Capabilities

But these dynamics are not guaranteed. Recent developments have opened new pathways for PV in Kenya (and elsewhere). Advances in lighting and battery technologies, in particular, have enabled the development of markets for SPLs. And the success of mobile banking in Kenya has stimulated experiments with business models for mobile enabled consumer finance for SPLs and SHSs (Rolffs *et al.* 2015). As with the earlier developments in the SHS market, donors have been crucial to the story

and they continue to be involved in various ways. Perhaps the most important in Kenya has been Lighting Africa, a project implemented by the IFC. However, unlike PVMTI, Lighting Africa engaged in activities more akin to niche nurturing than hardware financing. We do not have the space to discuss the detail of Lighting Africa's activities (see Ockwell and Byrne 2016a: 126-9) but they amount to a concentrated and coordinated version of the accumulated efforts we have already discussed in relation to the activities in the Kenyan SHS niche during the 1990s in particular (see Section 4.1). Whether attributable to Lighting Africa or not, the market in Kenya for SPLs grew exponentially from almost nothing prior to the beginning of Lighting Africa's intervention in 2007 to more than 2.3 million accumulated sales of quality assured SPLs in 2015 (Turman-Bryant *et al.* 2015: 6). Interestingly, the Lighting Africa project describes the rise of the SPL market in similar terms to the way Kenyan PV actors describe the rise of the SHS market, as a private sector led process for which Lighting Africa helped to create the enabling-environment. However, Ockwell and Byrne (2016a: 126-9) argue differently, listing the range of interventions Lighting Africa undertook: aggressive country-wide awareness-raising campaigns; development of, and lobbying for, quality-assurance of products; capability-building of technicians, testing facilities, businesses and finance institutions; nurturing of networks of actors; various pieces of market research on user-practices and on national policies; and more. Indeed, the Lighting Africa project got underway by awarding grants for developing SPLs using advances in lighting and battery technologies; something the global lighting industry had not done itself.

Finally, as well as new PV pathways opening up around SPLs, PV module assembly has been established in Kenya. The assembly plant, located in Naivasha and run by Ubbink EA, began production in August 2011 (Oirere 2012). It was a long process to establish the plant (Kimuya 2013) but, as with the rest of the solar history in Kenya, it benefited from donor support. Half of the investment was provided by the Dutch Government and the other half was shared between the two private partners Chloride (a Kenyan battery manufacturer) and Ubbink BV (the Dutch parent company) that constitute this joint venture (Stuart 2011). It seems that the Kenyan Government was also supportive of the investment. It is not clear what support was provided but Mabonga (2013) suggests there may have been some in kind measure in regard to the cost of the land, and the 2011 budget announced, just ahead of the plant's opening, that duties on the raw materials for making solar modules were to be removed (KPMG 2011: 7). Initially, Ubbink invested heavily in establishing its credibility amongst PV actors across East Africa, something it seems to have successfully achieved (Newell *et al.* 2014). And, by 2015, it had expanded its production into assembly of solar lighting kits under license from the German company Fosera (Ockwell and Byrne 2016a: 131). Inspired by the success of this investment, perhaps, there are moves to establish another manufacturing plant in a different county, following the (as yet uncertain) opportunities created by enactment of Kenya's new constitution (County 2 2016, and see below for a discussion of the implications for counties of the new constitution).

So, whilst the introduction of PV regulations may result in closing down around particular practices, with potential for stifling niche development and excluding some actors, there are also new pathways opening up around SPLs and value-adding production capabilities. It is too soon to tell who will benefit from these developments, and in what ways. Although increasing access to lighting services (and mobile phone charging) from SPLs is certainly of direct benefit to many poorer Kenyans, the exponential growth of the market is attracting many international actors. Some of the companies involved are foreign owned and so this could mean much of the value generated in the market is simply being extracted to overseas investors rather than substantially benefiting Kenyans. If the market continues to expand rapidly in Kenya and elsewhere in Africa then other, perhaps more predatory, international finance may find the potential profits attractive. What this could mean for the political economy of PV in Kenya remains to be seen.

4.7 State of Uncertainty: The New Constitution and Open Questions

On 27 August 2010 President Mwai Kibaki promulgated the new constitution of Kenya (ROK 2010). Amongst many changes to Kenyan democratic institutions, the new constitution devolves a significant amount of power from the national government to the 47 county governments. In principle, the constitution devolves power as close to the people as is feasible, and this is expressed explicitly for the county level in Article 176(2) of the constitution: 'Every county government shall decentralise its functions and the provision of its services to the extent that it is efficient and practicable to do so'. Specific governance functions between national and county levels are designated in the Fourth Schedule of the constitution. For the energy sector, the national government has the function of formulating energy policy while energy planning is devolved to the county level. However, this arrangement is not necessarily fixed. The constitution has provision for transfer of functions between levels, either 'up' or 'down' the institutional hierarchy, set out in Articles 187(1) and (2).

Implementation of the constitution was expected to take at least five years (Sihanya 2012: 18) and, certainly, the process is still underway in regard to devolution of powers to county government in the energy sector (MEP 2015: 113). Although the most recent draft energy policy provides some detail for the division of labour between national and county government levels, there is some evidence that the structure of energy governance in Kenya is proving to be contentious. According to our research, there are some officials at the county level who see the Ministry of Energy and Petroleum (MEP) as not necessarily implementing the spirit of the constitution. Rather than devolve powers to the counties, the MEP appears to see the counties' task as implementing national energy policy (County 1 2016; County 3 2016; County 4 2016). Of course, as interviewee Private Sector 2 (2016) notes, it makes sense that some functions of energy policy be coordinated at the national level. But the enactment of the new constitution appears to have created expectations that there will be more control over policy at the local level. And, clearly, this has implications for resource flows and their control, as much as it does for autonomy over energy developments.

So whilst the constitution may hold promise for more decentralised energy planning and development, with potential to significantly pluralise energy pathways in Kenya, debate continues as to how the new governance arrangements will work in practice (Johnson *et al.* 2016: 12; Private Sector 2 2016). Part of this debate, at least amongst the county officials we interviewed, arises from the need for greater clarity on the roles of both national and county levels in energy policymaking and implementation as well as a call for a more consultative relationship (County 1 2016; County 4 2016), although some counties seem satisfied with their level of participation (County 2 2016; County 5 2016). There was, however, some ambivalence in regard to the level of participation or consultation (County 3 2016). In this last case it seems that the participation and consultations are largely informal (something expressed by other county officials) and this seemed to be unsatisfactory. Here, the call was for institutionalising the relationships more formally.

Whilst there are emerging struggles between the national and county levels, there is also potential for something similar within each county. Not only has the constitution introduced new institutional arrangements between the national and the county levels, it has also introduced new structures at the county level. This then raises questions about how governance will actually be practiced within counties, especially in regard to how citizens will be included (Johnson *et al.* 2016). Amongst our interviewees working within county administrations, there appear to be several other points of note, especially in terms of our focus on pro-poor solar PV development. These include understanding the electrical needs of the poor, how PV is seen within county energy plans and by county politicians, the constraints on achieving adoption of PV amongst county populations, and working with non-state actors.

In terms of the first of these issues, the electrical needs of the poor, our interviewees were almost unanimous in their responses. Lighting was identified as the priority need for electricity according to four out of the five interviewees. However, when it came to the importance of PV in county energy plans, many respondents said that other needs were greater, at least in the minds of more senior county figures. For these senior figures, it is those issues with political salience that attract their attention. In some cases, the most politically-salient issue was water access rather than energy itself (County 3 2016; County 4 2016). Some of our respondents, who appeared to be keen on the increased use of PV, suggested that one way to raise the profile of PV amongst senior figures would be to connect water and energy issues together. The example given was to promote solar-powered water pumps (County 3 2016; County 4 2016). Whether the profile of PV can be raised or not, and whether it is relevant to poor households or other kinds of users, there was consensus on the constraints to adoption. Unsurprisingly, cost featured strongly here, as did other 'barriers' familiar to the PV niche. Prominent amongst these other barriers were low awareness of the technology and poor quality products in the market.

In terms of strategies to overcome these constraints, working with non-state actors (the final issue discussed in the interviews) was seen as an important way to make progress. One county is already highly active in this regard, or has many ideas for how to proceed. County 2 (2016) has already signed memoranda of understanding with several private companies. It is also designing financing mechanisms for PV, plans to develop its own regulations to foster renewable energy promotion, hopes to provide subsidies for low-income households to get solar, and is in discussions with a private investor to open a solar manufacturing facility. Several interviewees mentioned that there were discussions to open solar power plants in their counties (County 3 2016; County 4 2016; County 5 2016). However, one of the private sector actors we interviewed was cautious about involvement at the county level, citing heavy bureaucracy as an impediment to progress (Private Sector 1 2016). Civil society actors and donors are also focussing attention on county energy planning (Private Sector 2 2016). The World Bank (County 5 2016), GIZ (County 3 2016; County 5 2016) and SNV (County 4 2016) were all named in interviews, and Private Sector 2 (2016) mentioned that DFID and the Kenya Association of Manufacturers are also active at the county level.

As we can see, energy governance in Kenya has become considerably more complex since August 2010. Moreover, even the formal institutions of governance are not yet settled. The Energy Bill of 2015 – the document that would set in law the roles and responsibilities of the national and county levels in respect of energy policy, planning and implementation – had not, at the time of writing, completed its passage through the National Assembly (ROK 2017: 7). This, in itself, is creating confusion and uncertainty. But the spirit of the new constitution has also created expectations that counties may get much more autonomy over their energy futures or, at least, they will become more actively involved in determining their own energy pathways, through consultative relations with the national level. For its part, the national level seems intent on preventing significant decentralisation of energy policymaking power. As Private Sector 2 (2016) comments, these institutions are being formulated by actors at the centre and so it is unlikely that they will give up their powers so easily. However, developments on the ground are starting to move quickly. Some counties have already initiated a number of plans and partnerships, grabbing the opportunities that the new constitution seems to have afforded them. International donors and NGOs are also becoming active, helping some counties to devise their energy strategies, and some international investors are in the process of negotiating county-level deals.

How all this will play out is, of course, open to question and debate. What will be the nature of relations, for example, between powerful donors, NGOs, international investors and capacity-constrained county administrations? Will local people actually get to participate or will county level administrations replicate the notoriously corrupt practices seen for so long at the national level? To what extent will national energy policy begin to reflect the diversity of interests and needs of the

counties[6] rather than treat the nation as relatively homogeneous? If these dynamics play out unfavourably in the eyes of either county or national level interests, what will be the effect on relations between the counties and the centre? These are just some of the many questions that arise as Kenyans struggle with moving to and understanding their new political economy of energy.

4.8 Summary of the Case Study

It should be clear from the historical political economy of Kenya's PV niche-building that the story of a private-sector led phenomenon is highly simplified and that the success of the Kenyan PV niche does not, therefore, provide an exemplar of neoliberal orthodoxy in operation. Instead, it illustrates a much messier and more complex process of energy-pathway construction emerging from the interplay of the ideas and strategies of different actors. PV actors have managed to win resources to afford them the protective space to further their niche development goals, framing their arguments in terms of market-failures and enabling-environments, terms that resonate with neoliberal orthodoxy. State actors have tended to resist active policy promotion of PV but have been able to claim some virtue by also framing their support in terms resonant of neoliberal policy prescriptions, primarily in terms of providing an enabling-environment. However, contrary to this general position, state actors have also engaged in some 'developmentalist' action by spending large amounts of money to fund PV systems in public facilities and by favouring, it would seem, the introduction of module-assembly capabilities. International neoliberal policy makers – donors and others – have, interestingly, continued to espouse neoliberal orthodoxy whilst providing material resources for highly active interventions across many socio-technical fronts.

As a result of this interplay, the still evolving PV niche has benefited from experimentation with technologies (for example, batteries, balance-of-system components, lanterns, ICTs), institutions (for example, practices, micro-finance, standards, regulations), business models, and the establishment of the module-assembly plant. It is unlikely that much, if any, of this niche development would have happened without donor support. Despite this mainly hopeful history of niche building, there are now several uncertainties facing niche actors. As they attempt to enforce closing down around 'best practices' whilst state actors and donors become more supportive of large scale renewable energy options such as geothermal, the niche may see fewer actors and dwindling resources for experimentation. As the PV markets (SHS and SPL) continue to grow, international finance may be increasingly attracted to Kenya with the risk that value adding activities will be located outside the country thereby undermining the evolution of the local niche. And, finally, there is uncertainty around how energy pathways will develop under the new constitution.

In the next section we analyse how the interactions of the different actors at work in the Kenyan PV niche have negotiated the co-production of what we can now describe as a historical political economy of niche building.

[6] Interviewee Private Sector 2 (2016) suggested that energy policy has been traditionally focussed on the 80 per cent of Kenyans who live on 20 per cent of the land area. The remaining 20 per cent of Kenyans living in primarily arid and semi-arid lands have, in effect, been told, 'Sorry, you're on your own'.

5. Analysis: Explaining the Political Economy of Kenya's PV Niche

Having provided a largely descriptive account of the historical political economy of PV niche building in Kenya, we use this Section to try to explain analytically how and why the niche has taken the form that it has. In keeping with a political economy lens based on a discursive institutionalist approach, we analyse the case primarily through narratives but attempt to connect these to the institutional and material changes we observe in the case. Our case study began with an account of narrative construction in the embryonic Kenyan PV niche, and we ended the account of the niche's beginnings with the observation that the narrative was used to win resources from donors for niche building activities. We begin our analysis with this niche-actor narrative, unpacking it in order to try to understand how it worked, why it was so successful and how it evolved. Following this, we examine the official Kenyan State narrative, its evolution and how it affected niche building. This analysis constitutes the second of our main contributions (where the first was our theoretical framework, as discussed in Sections 2 and 3). The two narratives, niche and state, have co-evolved, especially in later years, resulting from what may be understood as strategic actions by both sides in their attempts to negotiate different interests, within the context of neoliberal orthodoxy, as they try to realise their preferred development pathways.

5.1. Evolution of the Narrative Promoted by PV Actors and the Impact on Niche-building

Using the narrative structure of problem-strategy-outcome suggested by Leach *et al*. (2010a: 371), we can discern the generic form of the narrative that PV niche actors used to win resources for their activities. The problem was stated, in general terms, as, 'there is something constraining SHS market growth', and this was identified as a problem by, 'this means those in rural areas will not see their electricity access improve and so they will continue to be hampered in their efforts to meet their development needs'. The strategy to address this was to, 'experiment with a specific way to correct the market failure (or remove the constraint)', with an appeal to donor-involvement by arguing that, 'this is of benefit to all those in the market and so should be funded by a public sector actor'. Following this strategy would then lead to an outcome where, 'the SHS market will grow more quickly and so more people in rural areas will gain access to electricity, thereby enabling them to meet their development needs'. We can refer to this as a 'market-failure' narrative.

As we noted in our brief discussion of ideas earlier (see Section 2.1), for a narrative to make sense to its intended audience (for example, donors), it needs to be contextualised in terms that are readily identifiable to that audience. This can be done through framing the narrative and by infusing it with a moral force. In this case the market-failure narrative is framed by the use of the private sector phenomenon story. Here, we are shown what private sector actors have achieved in PV market development, numbers of unsubsidised SHSs sold, without assistance and in a difficult context. Included explicitly in this framing are individual actors (for example, private sector, actual and potential SHS customers, donors); individual wants and behaviours; individual skills and knowledge; technological hardware; specific policies or instruments (for example, taxes, duties); costs, prices and markets; supply chains; and, occasionally, the biophysical environment. Excluded from this framing – sometimes explicitly, sometimes implicitly – are collectives of various kinds: national electricity grid; collective provision of electrical services; public sector (to some extent); social goals (again, to some extent); and politics and culture. The narrative is infused with moral force by describing the benefits of electricity access and arguing that these benefits are being denied to some people. This sets up the moral dilemma. The normal order of things, increasing electricity access through a private market, is being disrupted by something, a market-failure. On each side of this dilemma there are 'good guys' (private sector PV actors, potential PV users, market forces) and 'bad guys' (a market-failure, a constraint). We are thereby encouraged to make a judgement in favour of supporting private sector actors and PV users by eliminating the market-failure or constraint.

It is uncontroversial to suggest that free-market orthodoxy featured strongly in donor thinking when, in 1992, EAA first began operating and Hankins and colleagues were looking to get projects funded. The narrative deconstructed above married what Hankins and colleagues perceived or diagnosed to be market development needs together with this free-market orthodoxy. Development actors such as the World Bank and others (for example, USAID, GEF, IFC, DFID) could be expected to identify with the moral dilemma represented by a disruption to increasing electricity access – support for increasing electricity access was in some way part of the mission of each of these actors and so we can be secure in suggesting such support furthered their interests – and be sympathetic to the market-failure diagnosis of the disruption. Moreover, the 'system' framing is expressed in neoliberal terms. It is highly atomistic, emphasising (heroic) individuals and their (individual) needs, behaviours, skills, knowledge, agency, need for specific pieces of technological hardware, blaming a specific instrument or barrier for a problem. From this perspective, once a single market-failure can be identified and a single market-correction suggested, a targeted intervention becomes relatively straightforward, attractive and actionable.

It is likely that the strength and plausibility of the private sector phenomenon story was assisted by the fact that the market grew quickly in the period from the late 1980s into the early 1990s, providing Hankins with evidence that he deployed in much of what he was writing at the time (see Hankins 1990; 1993; Hankins and Bess 1994 for example). It is not clear whether Hankins and other actors in the PV niche in Kenya who promoted this story and the market-failure narrative believed it to be true or whether they deployed it simply as a political strategy. In a sense, it is not important. The point, for our purposes, is that the narrative worked *in effect* as a political strategy. It persuaded a variety of donors to direct resources into the Kenyan PV niche, and to do so over a long period that enabled building of the niche along several socio-technical dimensions. In so doing, the narrative and interventions became something of a virtuous circle. In other words, the attempts to fix 'market-failures' seemed to be working, making it easier to attract further funding to fix other 'market-failures', and all the while providing the convenient fiction that the market was unsubsidised thereby strengthening the veracity of the market-failure narrative.

The implementation of PVMTI might have challenged the strength of this narrative, given that PVMTI was premised on the assumption that all that was needed was finance to transform the scale of the market – the main market failure that had been discussed for many years – but failed to effect any significant change. However, the private-sector-led story and the market-failure narrative have endured. Explaining this endurance entails examining how the market-failure narrative evolved. In effect, the narrative shifted from 'market-failure' to 'enabling-environment', reflecting what Jacobson (2004: 43) refers to as the neoliberal policymaking embrace in the late 1990s of new institutional economics and Woo (2004: 12-3) calls the 'Washington Consensus Mark 2'. Or, to use Woo's pithier construction in describing the shift from Washington Consensus Mark 1 to Mark 2, the change from a 'market-failure' to an 'enabling-environment' narrative reflects a move from 'get the prices right' to 'get the institutions right'. To some extent, PVMTI embodied this shift in thinking. It was initially about finance deals that would lower PV module prices but became something closer to the 'get the institutions right' approach. Its later focus on capacity building (technical practices as institutions) and support for standards (institutional environment) demonstrates this. Of course, the reality was more complex than this. The initial focus was on establishing suitable finance models for PV (i.e. financial or market institutions), not just getting the prices right. For local PV actors, such as EAA, efforts to get the institutions right had been in play from the beginning. They had, at least, long-lamented poor practices, lack of standards and credit facilities. Before they persuaded PVMTI to restructure, they had already become involved in standards making and had engaged in an alternative policymaking process. It is easy to understand, then, that it would be a short step from the market-failure narrative to one that talks of an enabling-environment, without doing damage to the private-sector-phenomenon story.

5.2. Evolution of the PV Narrative Promoted by the State and Its Effect on Niche-building

As discussed earlier, the focus of Kenya's first energy policy was on improving the efficiency of cooking, of industrial energy use and of electricity distribution. There was only cursory attention given to off-grid PV. However, we can discern something of a narrative around PV, albeit mostly implied. The policy stated that PV 'can be used for water pumping, rural electrification, electric fencing, telecommunication systems, and micro-electronic devices' (ROK 1987: 76) and so its potential for offsetting reliance on wood and petroleum was acknowledged. But, drawing from discussions in other parts of the policy document, we can infer that PV was considered expensive, unfamiliar, immature and risky. The strategy, in relation to PV was therefore that the Ministry would 'undertake rigorous research, design, development and dissemination' of PV (ROK 1987: 103) in addition to installing systems for electricity generation and water pumping. The outcome was unspecified but we might assume the aspiration was that the Ministry would gain better knowledge of PV, as well as succeed in developing the technology so that it was appropriate to Kenya's needs at some indeterminate point in the future. In general, this appears to be a supportive stance but the budget allocation for the plan period (1987 – 2000) was just 0.26 per cent of the total for all energy activities, and this was shared with wind power (ROK 1987: 104).

We could state the problem-definition of the narrative, then, in the form, 'PV has potential but it is expensive and we are largely ignorant of its suitability for Kenyans in off-grid areas', where the strategy is to, 'undertake research, design, development and dissemination'. The immediate outcome would be that the, 'Ministry has better knowledge about PV and so will be able to make decisions about how it should feature in Kenya's energy plans'. We might call this a 'knowledge gap' narrative. But, as with the PV niche narrative, we also need to consider its framing and the source of its moral force. The framing was relevant to actors within the state, as the policy was never made public. As such, the government was certainly included within the frame (at both the national and district levels), as were the off-grid population, PV technologies, the enabling institutional environment (tax incentives, standards, testing facilities, legislation), the market, private sector actors and the biophysical environment. Outside the frame were donors, NGOs and community action. Although perhaps weak, the moral force of the narrative derived from the potential for PV to contribute to socio-economic development in rural areas being hampered by its high cost and the ignorance of its suitability. Here, the normal order of things (socio-economic development for all Kenyans) that could be maintained or enhanced by the 'good guys' (government and, potentially, PV) was being disrupted by the 'bad guys' (high cost, ignorance, poverty, inequality). Considering the primary audience within the state may have been the finance ministry, and the main focus of attention in the policy was cooking, industrial energy use and the efficiency of electricity distribution, the comparative weakness of the knowledge gap narrative helps to explain why the budget for solar was so small. With minimal resources to deploy, and without a compelling case for investing much effort in PV, it is easy to see why the state was indifferent to the technology, its most supportive act being the removal in 1987 of VAT on modules.

The second energy policy, published in 2004, saw some evolution of the PV narrative. PV continued to be a minor concern relative to other issues and technologies but, by this time, there was something of a significant level of adoption of SHSs. According to MOE (2004: 31), there were about 200,000 SHSs installed in Kenya at the time. And, as we discussed earlier, PV actors had interacted with parts of the state when they became involved in the process to develop PV standards, as well as during the formulation of the 2004 policy (albeit controversially). These developments do seem to have had an impact on the official PV narrative. It was now more assured in that there was more knowledge about the relevance and suitability of PV. So, the problem-definition became of the form, 'off-grid electricity access using PV is being constrained by the lack of a fiscal and regulatory framework', giving rise to

the strategy of, 'establishing an enabling-environment to incentivise private sector investment in PV'. The outcome could be described as, 'realising wider and deeper off-grid electricity access using PV for more equitable and environmentally-friendly socio-economic development'. So, as with the PV niche actors, the state had adopted a similar form of the 'enabling-environment' narrative.

The audience for this policy was public, in contrast with the 1987 policy. And, it is claimed (Mutimba 2007; Otieno 2007), as there was donor (GTZ) and development-actor (UN Development Programme) pressure to include supportive text on renewables, there may have been a degree of strategic action on the part of the state to create opportunities for increased flows of aid. Included in the frame were the government (only at the national level), private sector actors, PV technologies, the enabling institutional environment, the market, the off-grid rural poor, the biophysical environment and, in an extension of inclusivity from the previous policy, NGOs and community action. Excluded from the frame, once again, were donors, at least in the sense of not being mentioned. The moral force of this narrative was perhaps stronger than in 1987. The 'good guys' had managed to achieve something tangible by this time: the story constructed by PV niche actors of the private sector phenomenon had been adopted in the policy; and the government claimed a small supportive part in this story in terms of removing taxes and duties from PV equipment. This normal order of things was being disrupted by the 'bad guys' of high costs, poor quality equipment and technical practices, theft of modules, low awareness amongst potential PV users, and so on. As we have already discussed, the aim of the established 'Washington Consensus Mark 2' orthodoxy, promoted by many donors, development actors and developing-country governments (at least, rhetorically), was to create enabling environments for private sector investments in free markets. And, as we have seen, PV niche actors themselves supported this approach. So, it is unsurprising that the 2004 energy policy prescribed this as its main strategy for promoting PV, with the addition of some resources for research (in line with statements made in the 1987 policy). It is unclear whether any research has been done by the Ministry but there were indeed efforts to develop and enhance the institutional environment. There was restructuring of the regulatory institutions, including the introduction of PV-specific regulations, and the setting of FITs. PV featured in FITs eventually, suggesting a warmer attitude to PV than had previously been evident. But this official stance was undermined by the, alleged at least, deliberately low level of the FIT for PV.

However, this analysis fails to account for the sudden introduction of the Institutional PV Systems Programme that began with off-grid schools and expanded into other off-grid public facilities. This programme could not be described simply as either establishing an enabling-environment or undertaking research. We have already commented that presidential power played a role in creating the programme. And one interviewee suggested, the programme may have strong support in the Ministry because PV could be implemented at scale, in contrast to SHSs, which for the state appear to be a marginal solution for rural electrification. Both of these may be so but they do not explain the *process* of moving from the President's instructions to the creation of this specific programme. What may explain this process is that the President's instruction forced the Ministry to reframe its narrative around PV for off-grid rural electrification, both geographically and temporally. That is, the President had promised the Northeast Region particularly that it would be electrified (the geographical reframing of the narrative), and that this would happen upon his election (an injection of urgency into the temporal framing of the narrative). Establishing an enabling-environment for attracting private investment into the sparsely populated Northeast Region, where there was little electricity infrastructure, would likely have seemed inadequate for achieving rapid electrification. PV systems may have seemed the most viable when the problem definition was framed in this way. Pilot installations were at least a partial success and so it may have seemed appropriate to then roll out the programme to schools and public facilities in other parts of the country where a grid connection was an unlikely reality in the short to medium term. With the introduction by the Jubilee Government of the laptop programme, there was fresh impetus to achieve PV electrification of all off-grid primary schools, at the very least, in a short timeframe.

The most recent energy policy, published in final draft in 2015, maintains the 2004 PV narrative along with the same strategy of establishing the enabling-environment and undertaking research. But the framing is different in two ways. First, NGOs and community action rejoined donors outside the frame and, second, 'government' includes the national and county levels of government (a similar approach to the 1987 policy with its national and district levels). The only additions are an explicit commitment to complete the Institutional PV Systems Programme and inclusion of a commitment to 'procure and distribute solar lanterns' (MEP 2015: 58). This last inclusion is curious as it is the only place in the policy where solar lanterns are mentioned. There is no prior discussion and no elaboration to indicate what the commitment means. The final point to note is that there is much more confidence about the size of the PV market, with a projection to 2020 of 100MW installed capacity – a huge increase on an estimated 6MW as of the end of 2014 (MEP 2015: 57). The source of this optimism may be the success of the solar lantern market and the positive effect this has had on SHS sales (Rolffs *et al.* 2015). Indeed, one of our interviewees suggested that these successes have caused the Ministry to believe that PV can be implemented at scale, even in the form of SHSs, and spoke of early discussions between the Ministry and the World Bank to develop much more active policy instruments for PV once the current policy has passed through the National Assembly and received Presidential assent (Private Sector 2 2016).

5.3 Summary of our Political Economy Analysis

We see that the narratives at play in both the PV niche and amongst state actors have evolved, as have their system-framings, as both sets of actors have negotiated with each other and with international neoliberal policymakers and development actors. Niche actors developed and employed for many years a market-failure narrative; state actors began with a somewhat implicit narrative framed as a knowledge gap. Both sets of actors have converged on a narrative that privileges an enabling-environment, although it is not clear the extent to which either set of actors believes the narrative to be true or whether they are deploying it strategically, each with their own understanding of what it means and how its realisation would promote their respective interests. In any case, there have been more or less successful material and institutional changes, some of which have been clearly beneficial to niche building whilst the implications of others remain uncertain. It would appear, however, that state actors have moved the furthest in accommodating, if not adopting wholesale, the thrust of the niche narrative. Whether this turns out to be indicative of a general trajectory of change in government policy – increasingly supportive of niche-building – or whether this is a short term strategic move remains to be seen. But we do see that certain kinds of alternative framing can have a significant effect on action, especially if married with the power to act. The government's sudden embrace of PV for electrifying off-grid schools and other public service facilities demonstrates this. Under the new constitution, where counties may increase their powers to act, the changed spatial framing of energy plans, to the county level rather than the national level, could open up many new energy development narratives and associated pathways. Of course, the enactment of the new constitution could, instead, create a multitude of new confrontations as international, national, county-level and PV niche actors all engage in promoting their particular narratives in an increasingly complex and crowded energy development discourse.

In the final section, we reflect on what our history of the political economy of PV niche-building in Kenya can tell us, what it could mean for the future of the Kenyan niche, and what it could mean for the ways in which global and local forces will interact in the process of implementing policy ambitions such as sustainable energy for all and climate change mitigation.

6. Discussion and Conclusions

Our case alerts us to the need to consider niches as embedded in a web of relations through which some actors deploy their material power to shape what development pathways are possible, rather than see niches only as self-contained protected spaces of experimentation. Whilst protection of the Kenyan PV niche has certainly been given, and has been crucial to nurturing the development of a wide array of its socio-technical dimensions, the winning of resources to afford that protection during its embryonic period necessitated what we could interpret as strategic compromise on the part of its pioneering actors. The market failure narrative, constructed in the early 1990s, can be seen as an attempt to attract resources for highly active niche-building by strategically framing niche-building needs in terms favoured by what Jacobson (2004: 43) calls 'neo-liberal policy makers'. Actors such as the World Bank and GEF were sympathetic to market development approaches in which 'soft subsidies' could be used for 'limited interventions' to 'overcome barriers' to the effective operation of free market institutions. For the niche, this strategy seemed to work well, allowing niche actors to avoid dependence on an indifferent state or to make use of these neoliberal policymakers for pressuring the Kenyan state into adjusting specific policies (such as unfavourable taxes and duties on PV equipment). However, over time, the story of a private sector phenomenon – the founding myth of the niche, perhaps, and central to the market-failure narrative – seemed to become established fact, at least for neoliberal policymakers, new market actors and many analysts. This uncritical adoption of the niche's 'founding myth' led to reconstructing the market failure narrative into one of an enabling environment, where the rules of the game are privileged above wide ranging active interventions. Niche and state actors seemed to converge on this narrative, perhaps because of close interactions between them during the standards making process but also because of pressure (on the state, at least) from powerful development actors during the process of formulating Kenya's second energy policy. In any case, the resulting 'enabling-environment' of increasingly stringent rules legitimises some practices and actors, and marginalises others, with implications for which development pathways are realisable.

Such technocratic processes may give rise to some beneficial outcomes – SHSs that perform in accordance with technical claims, for example – but they also raise classic questions about who is in control, whose interests are served and whose are marginalised. With both the PV standards and the regulations making processes, for example, we saw that deliberations included weighing local business interests against technical performance requirements that may serve the interests of SHS owners. Negotiating these trade-offs may be entirely sensible but they are not purely technical choices amongst which there is a calculable optimal outcome; rather, these are political choices. Deliberating them within opaque technical procedures raises other questions of transparency and accountability, and brings us back to the point about a web of power relations. We could argue that free market orthodoxy (of the Washington Consensus Mark 2 variety, see Woo 2004) has been, in effect, gradually forced on actors in Kenya, both niche and state, by 'neoliberal policymakers' wielding their material power. At the national scale, for example, this has taken the form of electricity sector reform (World Bank pressure for privatisation, liberalisation, for example), while for the PV niche it has taken the form of finance and funding for what such policymakers have deemed appropriate 'market development' interventions (many different development actors have converged on supporting 'enabling-environment' policies). Accompanying the use of this material power, narratives have played a role in the process of what Newell and Phillips (2016) call 'disciplinary neoliberalism'. The market-failure and the enabling-environment narratives obscure the importance of the collective, relational and systemic phenomena that are crucial to innovation processes and to nurturing social change. Celebrated, instead, are atomistic notions of heroic individuals and deterministic technologies. The complexities of politics, culture, social practice, and so on, are reduced to barriers that must be overcome so that (heroic) entrepreneurs can harness free-market forces to deliver technical fixes for

social injustices. But, it has not only been the disciplinary action of neoliberal policymakers that has worked through the web of power relations, examples such as the standards committee hint at ways in which these power relations can operate amongst actors ostensibly working for shared goals.

Returning to the Kenyan PV narratives, the convergence of the niche and state narratives around an enabling-environment may be somewhat illusory. Niche actors may have been co-opted into neoliberal ideals or they may (still) be using the narrative strategically. Perhaps it is their calculation that it is the best they can achieve and they are hoping they can usher in more active niche building activities under its cover. State actors may also be acting strategically, using the enabling-environment narrative as a way to display their virtue in supporting PV markets while avoiding public funding commitments to a technology they do not take seriously. Moreover, the rent-seeking opportunities afforded by small scale SHSs are insignificant compared with those afforded by large scale centralised power plants. Geothermal power does seem to be the favoured low carbon option amongst state energy elites. Here, the state is willing to bear serious risk, providing resource exploration and mapping support through the state owned Geothermal Development Company (Newell and Phillips 2016: 45), while nothing approaching this kind of support has been forthcoming for SHSs. Whilst we are not alleging that rent seeking is happening with respect to geothermal power, the contrast in opportunities between it and the off-grid PV market is obvious. Where the state has provided generous support for PV, in the Institutional PV Systems Programme, there have been allegations of rent seeking behaviour. This was a centrally managed programme involving large procurements of equipment, not as significant as a power station but in which it was certainly easier to engage in corrupt behaviour than in the decentralised SHS market. But, aside from the potential for corruption, the preference amongst state elites for geothermal is important to niche actors because it highlights that they are in a somewhat precarious position, despite their apparent proximity to policymakers. Donors are also interested in supporting geothermal power and so there is a danger that the hard won gains in the PV niche could wither if the resources necessary for its further nurturing are directed to other interests. Again, this raises questions about whose priorities matter, who is in control, whose interests are served and whose are marginalised.

Having highlighted the risk to the PV niche, we want to draw a distinction between it and the PV market, as we noted in Section 3.3. We conceive of the niche as a network of actors, mainly local, who are building increasingly sophisticated socio-technical capabilities relevant to PV in Kenya, such that they can increasingly indigenise these capabilities. In the process, they can expand and extend the economic and human development benefits of a flourishing PV market contributing to Kenya's development needs and goals. We conceive the PV market as the exchange of money for PV equipment and services. The two conceptions are not mutually exclusive but the niche could wither in important ways while the market flourishes. And the market is flourishing. This is attracting a growing number of international actors, including those in international finance. The risk here for the niche is that the narrow focus on an enabling-environment simply means this kind of international engagement will become increasingly extractive, leaving only the least valuable parts of the supply chain in the hands of local actors. In such a scenario, while many Kenyans would benefit directly from the artefacts sold in the market (SHSs and SPLs, for example), a withering niche could yield more and more control to international finance and technology players, risking further disciplinary neoliberalism.

But we should also be cautious in assuming that disciplinary neoliberalism will triumph without problems. The actions of neoliberal development actors have been somewhat contradictory in Kenya. Although they have been espousing a focus on 'getting the institutions right' they have also been providing resources for more active nurturing of the Kenyan PV niche. Looking at the activities of Lighting Africa, for example, we see them promoting a neoliberal narrative while actively engaging in niche development. Likewise, returning to the international architecture for mitigating climate change, there are elements of the UNFCCC Technology Mechanism that could be used for active niche-

building (Ockwell and Byrne 2016b) although it is far from certain that these elements will be fully developed. But even the cheer leaders of neoliberal orthodoxy, the World Bank, are supporting what may be much more activist approaches. Together with DFID and others, the World Bank was instrumental in setting up a Climate Innovation Centre (CIC) in Kenya (and is doing so in several other developing countries). Once again, the narrative promoting CICs is neoliberal but there is potential for the practice to be actively supportive of niche-building. Perhaps, therefore, Kenyan PV niche actors are right to believe that they can adopt the rhetoric of enabling-environments whilst continuing to find ways of attracting donor resources for further nurturing of the niche.

Interestingly, as the Institutional PV Systems Programme demonstrates, when developing-country governments are able to direct their own resources rather than rely on assistance from international development actors, there is the possibility to ignore many of the tenets of neoliberal policy prescriptions. In the Kenyan case, notwithstanding the various problems and controversies it created, the programme could be seen as an example of reaching the poor most directly with electricity services. Kenya is not the poorest of developing countries, of course, but even so the programme illustrates that there may still be space for the developmental state.

Finally, and constituting the third of our main contributions, the approach we have taken in this paper has enabled us to observe how global and local forces interact in relational terms to co-produce specific development strategies and outcomes, rather than to assume that powerful global forces are deterministic of development pathways. Treating the state and development regime in terms of 'a dispersed ensemble of institutional practices and techniques of governance' (Hansen and Stepputat 2001: 14), rather than monolithic entities, has allowed us to examine the messy realities of policymaking and implementation in which actors from different groups co-produce development pathways through negotiation of complex socio-political relations (Scoones 2016: 307). The resulting development pathways cannot easily be characterised as led by any particular group or thing: technology, market, state or citizen. Instead, in the Kenyan case at least, all have been involved in different ways at different times in what might be described as a dynamic alliance, albeit sometimes an uneasy one. Over time, there have been increasing benefits accruing to the poor – in terms of access to useful socio-technical artefacts – but there are now uncertainties over which direction of development will dominate. Pessimistically, the continued promotion of neoliberal rhetoric, espoused in this period of financial constraints and increasingly isolationist states, may result in dwindling resources for niche-construction while promoting the expansion of the most predatory forms of neoliberal capitalism. Optimistically, despite neoliberal rhetoric, we see even the centres of neoliberal orthodoxy practising in ways that could strengthen niches of pro-poor energy access and, potentially, transformations.

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