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A Knowledge Exchange Framework for Supporting African Municipalities in Sustainable Energy Transitions

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Abbreviations

DECC	Department for Energy and Climate Change (UK)
DFID	Department for International Development (UK)
DU	Durham University
EPSR	Engineering and Physical Sciences Research Council
KEF	Knowledge Exchange Framework
SAMSET	Supporting African Municipalities in Sustainable Energy Transitions
SEA	Sustainable Energy Africa

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1. Introduction

1.1 Background

The aim of this working paper is to provide an outline Knowledge Exchange Framework (KEF) as part of wider work being undertaken through the SAMSET project. "Supporting African Municipalities in Sustainable Energy Transitions" is an EPSRC/DFID/DECC-funded project (Grant No. EP/L002620/1) that seeks to develop a series of ways of supporting local and national bodies involved in municipal energy planning in the effective transition to sustainable energy use in urban areas.

Through close partnering with six municipalities in three African countries (Ghana, Uganda and South Africa), the project aims to develop an information base from which to support towns and cities, undertake direct support for these urban areas around strategy development and priority initiatives, and facilitate knowledge exchange and capacity building.

The key aim is to, "**design, test, and evaluate a knowledge exchange framework to facilitate the implementation of an effective sustainable energy transition in Africa's Sub-Saharan urban areas**", and includes a strong action research component which involves close partnering with municipalities (see figure 1) and other key urban energy actors to foster a deeper understanding of the dynamics and constraints that policy and strategy implementation faces in Sub Saharan African towns and cities. As such the purpose of this paper is to act as a base document for the KEF at the end of the first year of the project. It does this through reflecting on the challenges and issues around learning and comparison across energy transition processes and the active partnerships developed across the SAMSET project. It's designed to actively support and integrate the wider team activities whilst also providing a detailed conceptual overview of the wider issues of energy transitions within the urban African context.

1.2 Objectives

The KEF has been designed around the objectives of:

I. Operating as both an analytical and a policy/action framework – it has to combine understanding and action - this means it bridges the worlds of research and practice.

II. To facilitate learning and comparison between the different urban and national contexts of the work – so we are able to say something about the effectiveness and efficiency of the work and its wider potential relevance.

III. Attempting to be 'rigorous' to allow meaningful comparison AND sufficiently 'flexible' to be sensitive to the different contexts – that means that active interpretation is required in context.

Figure 1: Map of municipalities involved in SAMSET project

2 Literature review

The next section provides an overview of the existing literature on energy transitions, helping to explain this term and others (such as intermediaries, landscape pressure, socio-technical, regime) and seeking to contextualise these debates within the particular context of sub-Sahara African towns and cites. The literature review also forms the conceptual basis of the KEF by bringing together a range of these different ways of understanding and conceiving of energy transition as part of the SAMSET project.

2.1 Powering Africa's urban transition

Despite sub-Saharan Africa having the lowest urbanisation levels of all global regions rapid urban growth on the continent is expected to see over 700 million urban dwellers by 2030 (UN-Habitat, 2010) and 1.2 billion by 2050 (UN-DESA, 2011). Population modelling suggests around 37 percent of sub-Saharan Africans were residing in urban areas in 2010 (UN-Habitat 2008) rising to 61 percent in South Africa and 51 percent in Ghana (UN-Habitat, 2007b). Such significant expansion of towns and cities, represented so often by ubiquitous images of mega-cities like Lagos, Kinshasa and Johannesburg is shaping what Pieterse and Parnell (2014) term 'Africa's Urban Revolution' - a dramatic rendering of the complex, shifting geographies of the continent. This rapid urbanization will account for nearly all population growth in Africa over the coming decades, creating multiple policy, financial and challenges for governments. Balancing the necessities of economic growth, the plethora of national policy objectives and the needs of the 40 to 60 percent of urban dwellers living in poverty (Toulmin, 2009: 92) we suggest that urban infrastructure systems will be at the centre of development efforts (Khennas, 2012) and placed under a series of pressures and play a key role in mediating the futures of this 'urban revolution' or as we term it, urban transition.

One of the most crucial of these infrastructural demands is to provide energy services to power the burgeoning towns and cities of the continent. As Madlener and Sunak (2011) suggest “Associated with the process of urbanization is increasing energy consumption due to various effects and mechanisms that influence urban structures and human behavior.” These urban energy networks, consisting of vast conglomerations of lines, wires and cables are vitally important to sustaining and supporting the urban life of sub-Saharan African cities through a series of flows, circulations and systems that provide electricity to homes, businesses and cities whilst sitting at the centre of global infrastructures of energy production and consumption. Energy is thus crucial to this wider urban transition as the recent UN-Habitat (2014:41) State of African Cities makes clear “The growth of Africa’s energy sector is a prerequisite for sustained expansion in all others.” Yet here exists a paradox, as McDonald (2009:xv) has argued “Africa is the most under-supplied region in the world when it comes to electricity, but its economies are utterly dependent on it”. Recognising this crucial role of electricity and wider energy sources in powering African development the UN declared 2012 as the ‘International Year for Sustainable Energy’ showing the global concern for achieving a series of energy policy initiatives and placing energy at the centre of debates about the delivery of the Millennium Development Goals (UN-Energy, 2005) and post 2015 agenda, illustrating how energy mediates all manner of development indicators from poverty, through to heath, education, gender equality and civic participation (Brew-Hammond, 2010).

As numerous policy publications make explicit (Infrastructure Consortium for Africa, 2009; UN-Habitat, 2014) the investment deficit for infrastructure including energy is significant, estimated at $360 billion for Nigeria alone (Simone, 2010) and predicating widespread disruption (Khenna, 2012), shortages in accessing technologies and essential services (UN-Habitat, 2014). This has meant populations in countries such as Malawi, Burundi and Liberia with less that 10 percent able to access modern electricity networks (UNDP-WHO, 2009). Attention is increasingly being focused on such investment. For instance, the ambitious ‘Electrification Roadmap For South Africa, Africa and

Developing Countries' aims to connect 500 million people to energy services in over 50 countries in Africa. Eskom, the South African utility company are facilitating the development of this utility sector partnership, providing technical knowledges and showing the geo-political aspirations of the electricity sector in South Africa to play a central role in the energy arena of the continent (McDonald, 2009). At a national level countries such as Ghana are broadening their ambitions from electrification to engage with wider issues of carbon reduction, climate change mitigation and renewable energy with ambitious targets of 10 percent renewables by 2020 being set (Ghana Energy Commission, 2011).

What these and the plethora of initiatives, projects, financing and emerging institutional arrangements show is that energy has over the last few decades become an important concern to multi-scalar governance actors and the development aspirations of the continent (Kebede et al, 2010; Sokona et al, 2012). And towns and cities, as we have outlined are becoming increasingly important sites in these processes as these global goals around energy are being reframed at multiple scales and across geographical stretched networks. With the lowest global rate of urban electrification located in sub-Saharan Africa at 68.8 percent (IEA, 2008, 2011), together with the fastest rates of global urbanisation outlined above, the demands of economic development and high rates of poverty (UN-Habitat, 2014) the need to think about the specificities of this urban (energy) transition on the continent is pressing.

One pertinent difference lays in the ways that the urban energy demands, infrastructures and plans across sub-Saharan Africa are (re)shaped by the regions distinct geographies, very different to the development of modern urban energy services in the global North (Rutherford and Coutard, 2014). The growing numbers of urban poor (Parnell and Walawege, 2011) demand access to affordable, clean energy from informal settlements that constitute large parts of many cities and a growing middle class[1] are implicated in intensifying usage, requiring generation to facilitate emerging consumption patterns

[1] Need to explain what we mean by middle class

(Karekezi and Majoro, 2002). As Rutherford and Courtard (2014:1356) assert "Urban energy transition in the South thus clearly means something very different from the North, combining issues around governance, access to finance, trade and supply chains with everyday concerns of, amongst other things, very low basic household incomes, availability of cooking fuel and indoor air pollution."

There are also global imperatives and issues that apply in sub-Saharan Africa as elsewhere that will take shape a series of differentiated transition pathways (Bulkeley et al, 2010). For instance the need to reduce GHG emissions globally is also predicating new ways to understand Africa's urban energy transition as a low carbon transition. As Bridge et al (2013:331) comment, "Ensuring the availability and accessibility of energy services in a carbon-constrained world will require developing new ways – and new geographies – of producing, living, and working with energy".

We suggest that the energy transitions that respond to these global-local energy dynamics and imperatives generate a series of strategic pressures on how socio-technical systems are organised and how such system innovation might take place that require more detailed attention and a context specific notion of how, what and why particular transition pathways are being undertaken and how they may be (re)shaped by municipal actors.

2.2 Overview of energy transition literature

As the previous section has shown there is emerging but convincing evidence that African cities are under pressure to strategically respond to generic pressures by developing managed systemic change in the socio-technical organisation of key aspects of their energy infrastructure. In this section we will examine how the multi-level perspective on socio-technical transitions can help us to understand the role of cities, identify the critical gaps that are not addressed and assess where the MLP would benefit from additional development in order to utilize the framework in the sub-Saharan African

urban context. The MLP provides an ambitious attempt to develop understanding of 'system innovation' (Geels, 2002a; 2002b). In doing this it situates technological transformation in relation to wider socio-political-economic 'systems'. Analytic understanding of these processes of 'system innovation' and socio-technical transitions is predicated on an interrelated three-level framework of landscape (macro), regime (meso) and niche (micro).

First, socio-technical regimes, situate existing or incumbent technologies within a 'dynamically stable' (Geels and Schot, 2007) configuration of institutions, practices, regulations and so on, where configurations impose a logic, regularity and varying degrees of path dependencies on technological change. Regimes are seen as socio-technical in that technologies and technological functions co-evolve with social functions and social interests where technological development is seen to be shaped and potentially shaped by a broad constituency of not only technologists and engineers but also policymakers, business interests, NGOs, consumers and so on where the interrelationships of these interests through regulations, policy priorities, consumption patterns, investment decisions, amongst other things, hold together to stabilise socio-technical regimes and their existing trajectories (Geels and Schot, 2007). The emphasis on regimes, therefore, highlights the enablement and constraints on new technologies breaking through where 'reconfiguration processes do not occur easily, because the elements in a socio-technical configuration are linked and aligned to each other. Radically new technologies have a hard time to break through, because regulations, infrastructure, user practices, maintenance networks are aligned to the existing technology' (Geels, 2002a, p.1258).

Second, the concept of 'landscape' is important in the MLP in seeking to understand the broader 'conditions', 'environment' and 'pressures' for transitions. The landscape operates at the macro level, focuses on issues such as political cultures, economic growth, macro economic trends, land use, utility infrastructures and so on (Geels, 2002b, p.369) and applies pressures on existing socio-technical regimes creating windows of opportunities for

responses (Geels and Schot, 2007). Landscapes are characterised as being 'external' pressures that have the potential to impinge upon but do not determine the constitution of regimes and niches. They create a broader context of opportunities and constraints within which actors and coalitions of actors operate.

Third, the idea of socio-technical niches, which operate at a micro level, is one of 'protected' spaces, usually encompassing small networks of actors learning about new and novel technologies and their uses, and seeking to get new technologies on to 'the agenda', where innovation and processes of learning by trying keep alive novel technological developments which otherwise may be 'unsustainable' (Geels, 2002b; Hoogma et al, 2002). The constitution of networks and the expectations of a technology they present are important in the creation of niches.

Adrian Smith and colleagues (Smith et al, 2005; Berkhout et al, 2003), whilst acknowledging the strengths of transitions approaches, make a thoughtful and constructive contribution to this debate. They question the view that regime change begins in niches and works upwards arguing that this underplays the importance of the relationship between landscape pressures and regimes. In particular they characterise regime change as being predicated on the ways in which shifting pressures impinge on a regime and the extent of the coordination of responses to these pressures both from inside and outside the regime. In doing this they open up the issue of the governance (rather than government) of regime transformation in respect of agency and intervention in relation to both landscape and regime. They point out that landscape pressures can be articulated differently both in very general terms or in relation to specific regimes. Highlighting the context of the regime in transitions, the importance of governance processes and the coordination of adaptive capacity opens up the possibilities for understanding a variety of transition pathways and in doing so raises the issue of the extent to which the pressures on the regime are responded to through resources and relationships

incumbent within the regime or co-opted from outside the regime (Smith et al, 2005).

The Urban Context

Despite an impressive breadth of focus on substantive areas as varied as transport, energy, water, waste and food systems (Hoogma et al, 2002; Verbong and Geels, 2007; van der Brugge and Rotmans, 2007; Geels, 2005; Green and Foster, 2005) frequently within a context of wider transitions to sustainability (Elzen et al, 2004) often with a focus on institutional and governance issues in relation to transitions (Voß et al, 2006) it remains less than clear as to the spatial scale that transitions approaches deal with. Spatial scale frequently remains implicit or underdeveloped in the MLP and transitions approaches generally. The consequence of this is that we are often unclear about where transitions take place and, given the mutual shaping of system and social context, the spaces and places where transitions take place. That said, there is often at least an implicit emphasis on national scale transitions which requires understanding particular socio-technical national contexts and their historical, institutional and policy contexts and also the mechanisms, politics and processes through which attempts are made to steer transitions. Within the national view of transitions the role for sub-national scales (regions, cities, localities etc) is not always clear.

Transitions approaches have been somewhat limited in focusing on spatial scales aside from the national level. In particular, transitions approaches have said little about cities and what the multi-level perspective on systemic transitions can contribute to understanding urban social-technical transitions. The role of cities in transitions approaches is consequently uncertain, fragmented and often implicit (see Hodson and Marvin 2010, 2012). This raises the issue of where cities 'fit' within the multi-level perspective and, in particular, where do cities sit within the landscape-regime-niche hierarchy? Indeed can they be encompassed by both regime and niche? That is to explore how innovative activities within cities interrelate with wider national and societal transitions. Initially then, do we conceive of cities as 'receiving' national

transitions that are then ‘implemented’ in their own local context? If this is the case, can different configurations of social interests at the urban scale mediate national transitions – that is ‘accelerate’, ‘reshape’ or even ‘disrupt’ the implementation of national transitions in their local context? If cities can mediate national transitions can they then develop further capacity and capability to envision and enact their own locally developed transitions that are relatively distinct from national transitions? In view of the nestedness of regimes mentioned above - an urban transition can then conceivably form a variety of different types of relationships with national transitions. Central to this potential is the relative positioning of cities in terms of their position in urban hierarchies and governance capacity that means that cities have differential capacity to either be ‘shaping of’ or ‘shaped by’ national transitions.

Understanding the role of cities in a multi-level transitions perspective needs also to take seriously multi-level governance (see Bache and Flinders, 2004) and different scales of action. Agency at the level of the city cannot be reduced to understanding the variety and coalitions of actors (e.g. local authorities, mayors, universities, local economic actors etc) attributed to work at this scale. It also involves, and requires understanding of, the influence of actors at national and supranational scales of action who influence, both intentionally and through unintended consequences, action at a city scale through the production of new state spaces (Brenner, 2004). To put it another way, there are multiple scales of governance action, with differing sets of power relations operating in the relationships between these scales of action and these power relations between different scales of action are variably constituted and organised in respect of different cities. Questioning critically these relationships between scales allows us to conceive of cities not merely as sites for receiving transition initiatives but also potentially as contexts for more purposive contexts for urban transition.

2.3 Urban Africa's energy transition

As we have outlined in relation to energy, ongoing research and debates are revealing a series of emergent dynamics and imperatives across sub-Saharan African towns and cities that suggest very different urban trajectories from the experiences of the global North (Robinson, 2002, 2006). This is particularly important in considering the changing nature of infrastructure systems and notions of socio-technical transition across these urban contexts (Swilling and Annecke, 2012). Importantly, such work prompts us to question the applicability of the MLP as an explanatory framework to these transformations without paying close attention to how these regional dynamics might challenge and reshape this analytical approach to better suit these urban infrastructure conditions (Swilling, 2011).

These accounts of the diverse geographies across sub-Saharan urban Africa challenge notions of socio-technical transition and 'system innovation' (Geels, 2002a) examined in the previous section through the MLP. We also suggest that close attention to the dynamics may provide some important considerations into how such a framework can be specifically configured to focus on how sub-Saharan African towns and cities shape and are shaped by these system innovations, new technologies, shifting networked systems and wider energy transformations, together with how these processes may be understood and interrogated. These dynamics include the forms of urbanization being generated, the place of the 'urban' in understanding energy transitions in the region, the actors involved in innovation and the contested and political nature of energy systems across these towns and cities. We suggest that such a focus on these geographies can help to establish a robust MLP framework that takes accounts of urban conditions in Sub-Saharan Africa and provides a way to analyse and evaluate urban energy transitions.

First, the particular forms of urbanization across sub-Saharan African towns and cities challenge how urban energy networks are conceived, the notion of a socio-technical transition in these contexts and centres the

important challenge of addressing the role of informality (both across energy systems and wider urban conditions) in how transitions are occurring. This growing body of literature explores these particular urbanisation dynamics covering multiple scales from the everyday through to the wider geographies of sub-Saharan Africa (Myers, 2003; Pieterse, 2008, 2010a, 2010b; Simone, 2004a, 2004b, 2010; Swilling, 2011). Taken together this work reveals some important considerations when applied to approaching socio-technical transitions at the urban scale and through the MLP.

These include the historically 'splintered urbanism' of postcolonial cities (Graham and Marvin, 2001; Swilling, 2011) that unlike the global North reveal the historically produced and ongoing fragmentary and divided nature of urban (energy) systems in global South contexts (Bakker, 2003; Furlong, 2014; Jaglin, 2008; Odendaal, 2011) Such historical forms of urban infrastructure development thus shape cities in which the rise of the infrastructural ideal (Graham and Marvin, 2001) offers only a partial understanding of how colonial and post-colonial logics of urban governance mediate such unfolding socio-technical transitions. They ask us to take seriously the legacy of colonial governance and the logics of control, segregation and apartheid. Such histories have produced infrastructural and wider spatial configurations of racialized and class inequality in accessing basic urban resource flows (Demissie, 2007; Myers, 2006) often through widespread processes of privatization and increasing inequality since the 1980s.

Related to these historical dynamics that have shaped cities are the high numbers of informal settlements (Pieterse, 2008; Simone, 2004) across cities of the region that suggest the need to reconsider how cities are understood in socio-technical transitions literatures. Often characterised by the absence of formal energy systems, high levels of energy poverty, reliance on fuels such as charcoal and the ongoing spectre of demolition, removal and eviction these urban spaces clearly create very different conditions (Hill et al, 2014) for the MLP to grapple with. Such urbanisms challenge and stretch global North anchored understandings of what constitutes the energy network in cities. As

such we would suggest that these differentiated forms of urbanisation generate variegated forms of energy geographies that challenge how the MLP considers these urban dynamics and particularly whether any 'linear' transition to modern energy services is possible or even desired. This is particularly relevant for the large and growing number of informal urban settlements across much of sub-Saharan Africa which often remain unelectrified. As Sokona et al (2012:5) argue "The low levels and lack of access to modern energy services for productive activities has also impacted negatively on development and entrenched poverty in the continent." Further issues related to these informal urban spaces include issues about recognition of land (often a precursor to formal electricity connections), the high concentrations of poverty in these areas, high levels of density making interventions difficult to plan, high levels of unauthorised connections and a series of safety issues.

Secondly, drawing on similar and wider limitations of the MLP identified in the previous section concerning the urban context of transitions **the location of the 'urban' in energy transition** in these towns and cities is a pressing concern in considering how we analyse such processes (Hodson and Marvin, 2010). This is particularly important in considering the institutional limitations across sub-Saharan Africa at the urban scale in fostering systemic innovation (Agbemabiese et al, 2012).

There is a growing body of socio-technical literature that is revealing important insights about household scale transitions taking place (Kowsari and Zerriffi, 2011) particularly focused on how poverty mediates energy usage/transition (Kedebe et al, 2002; Visagie, 2008). For instance, Karekezi et al (2008) show that in Kenya, despite urban dwellers requiring access to electricity for modern energy services a range of off-grid fuel sources and technologies including particularly charcoal form a key part of everyday energy usage in cities such as Nairobi. These household scale energy dynamics are predicated both on ongoing poverty and inequality but also the informality of many urban spaces. Van der Horst and Hovorka (2008) challenge how energy transition approaches generate ways of understanding household energy usage through empirical

research in Maun, Botswana. By revealing variegated household energy use patterns the authors challenge notions of linear pathways to modern fuel consumption and the range of structural and everyday factors that shape household energy decisions and assumptions about energy transition, suggesting, “multiple energy sources are employed in complex ways, each for specific purposes, such that modern fuel uptake largely complements fuelwood rather than leading to its abandonment” (Horst and Hovorka, 2008:3342). Such household level transition pathways should of course be a key part of a MLP approach to sub-Saharan Africa’s energy issues.

At the national scale these socio-technical energy transitions are also interrogated and examined across a number of different countries revealing the diversity of experiences across different contexts (Kemausor et al, 2011; Khennas, 2012; Krupa and Burch, 2011) and cautioning us in making generalisations across the many urban worlds of sub-Saharan Africa. These studies also reflect the perceived importance of national governments, often at the expense of considerations focused on an urban energy regime in unfolding socio-technical transition pathways. This national scale of socio-technical analysis extends to the regional scale and providing often important overviews of shared dynamics across sub-Saharan Africa (Bazilian, 2011; Brew-Hammond, 2010). This research seeks to consider the key drivers, actors, dynamics and outcomes of energy transitions across the continent. Whilst these bodies of work are of course useful in placing and understanding the urban they also shape analytical entry points into how we understand transition that locate the energy regime beyond the boundaries of towns and cities.

Socio-technical accounts of energy transition at the urban scale do of course exist (Gebreegziabher et al 2012), particularly in South Africa (Jaglin, 2013; Swilling, 2013) and including engagement with neighbourhood transitions (Bulkeley et al, 2014; Mdluli and Vogel, 2010). However, we would suggest they remain relatively limited compared to the focus on both household and national scale transition dynamics outlined above and that continue to ignore/ underplay the role of urban regimes in governing energy transitions.Building

on this relative lack of focus on the urban dimension of transitions scholars working in the field (Jaglin and Verdell, 2014) argue that cities in the region have relatively little autonomy to effect energy transitions compared to the national scale regime, As such they argue the focus for researchers, policymakers and activists necessities engagement with this national scale of decision making, associated forms of infrastructure investment and policy orientations. We would challenge such assertions, arguing that the energy regime intersects in a range of ways with urban innovation, technology development and public pressure but suggest that this perhaps provides an articulation of the current state of socio-technical analysis of urban energy transitions as under scrutinized when considering the multi-scalar geographies of these processes.

Thirdly and again drawing on the wider limitations of the MLP established in the previous section necessitate some shifts in **how intermediaries beyond the elite are conceived** and accounted for in these processes and understandings of the socio-technical regime (Geels and Schot, 2007). We can of course draw guidance from debates within the field of socio-technical transitions. As Seyfang and Smith (2007: 584) argue “Innovation and community action are two important strands for sustainable development. Yet they have not hitherto been linked. Community action is a neglected, but potentially important, site of innovative activity”.The focus on elite actors, already outlined, creates an emphasis on processes of technological and infrastructural innovation amongst global IT companies, government agencies and financial institutions. Whilst this is an important area of focus in understanding how technological niches can develop into wider system innovation it also constitutes an inherent limitation in how we analyse socio-technical transition in the sub-Saharan context. As Hodson and Marvin (2010: 278) argue more generally “With (the variable) privatisation and the liberalisation of many infrastructures and the opening up to competition of infrastructure provision – a wide range of distributed stakeholders and social interests are now involved in the functioning of sociotechnical infrastructure systems”. Such observations open up a whole series of actors participating in systemic innovation,

technology development, electrification, policy development and so forth beyond elites.

Crucial, we'd suggest to such a task of expanding the social interests involved in innovation in urban Africa is the agency of slum dwellers and associated social movements and civic organisations in cities with high levels of slum populations. As Silver (2014) suggests infrastructure systems in cities such as Accra have long been associated with incremental and ongoing interventions by urban dwellers seeking to transform conditions of poverty and socio-environmental inequality. These urban, neighbourhood or even household scale transitions, often termed niches in the socio-technical literatures (Geels, 2002b) reveal the need to better consider the role of social movements and civic society in experimentation, innovation and reconfiguration. As Ferguson (2006) so usefully elucidates, this 'civil society' cannot simply be grounded within the context of the 'local'. For as ongoing work by groups such as Slum Dwellers International (McFarlane, 2009) reveal these urban poor movements are intrinsically linked to trans-national networks of solidarity, financing and the co-production of knowledges around essential urban services such as water, sanitation and of course energy.

Finally, the contestations and politics of urban energy in this region require greater attention than afforded by the transitions literature and the MLP. Previous work by Lawhon and Murphy (2012) in this journal has sought to bring socio-technical transitions literature and specifically the MLP into a conversation with conceptual apparatus that more closely examines the contested and political nature of these processes. This could provide a way of expanding urban energy transition analysis that can explicitly centre how power, politics and inequalities across the city come to shape the ways in which transition is planned, operationalised and unfolds. Here Lawhon and Murphy (2012:372) provide a number of important points that suggest, "how political ecology can improve it through a deeper consideration of the role of knowledge, diversity, power, geography, and non-material circumstances in shaping transition dynamics". This useful provocation seeks to build on wider

debates and traditions about contestation over urban infrastructures in African towns and cities (Gandy, 2006; Loftus, 2006, 2012) that have emerged from the urban political ecology literatures and we'd suggest have a key role to play in developing the MLP to address the (urban) politics of energy transitions across the region.

3. Methodology

The production of the KEF consolidated and integrated existing research and debates, literatures (see previous section) and practices to produce integrated insights and reflections on how energy transitions are understood and acted upon. This will be redesigned after seeking to test, evaluate and improve a series of different ways of supporting municipalities across the different contexts and ways of practising around energy issues. The process involved analysing literature on theories of urban energy transition and wider urbanization issues within the sub-Sahara Africa context. This was followed by taking this range of insights to draft an initial KEF that was discussed and debated by the wider SAMSET team including researchers, practitioners, academics and municipal partners. Further testing was undertaken during visits to Ghana, South Africa and Uganda that included undertaking interviews, site visits, workshops and literature reviews. This was followed by a re-drafted paper after the Ghana SAMSET network meeting (May, 2014) and online/phone conversations and feedback. Alongside this working paper the production of a journal article has sought to provide a more detailed examination of academic literatures in order to develop a series of ways of understanding and researching urban energy transitions.The production of the KEF has been ongoing during year one of the SAMSET project. In summary this included

- SAMSET workshop (Dar Es Salem, October 2013)
- Intensive reading/writing/discussion sessions at Durham University (October 2013-June 2014) based on extensive literature review
- Use of previous experience and work in each country
- SAMSET workshop (Cape Coast, May 2014)

- Country visits – Ghana, Uganda and South Africa
- Circulation of draft versions of KEF
- Online and written feedback from SAMSET team

4. The Knowledge Exchange Framework

4.1 Overview

The paper now provides a detailed description of the stages involved in the KEF including purpose, key questions, methods and expected outputs. The KEF has been designed around a number of stages that are addressed around a two part framework. This includes both the need to understand the context and existing energy transition dynamics (see figure 3a) based on debates across and beyond the energy transitions literatures (see section 3) but also, key to the SAMSET project in how to actively support municipalities in creating future energy transition pathways (see figure 3b).

The SAMSET KEF framework is designed to both incorporate the wider team activities during the four year project and the integration of this work (from energy modelling through to working papers, interviewing and active learning) by Durham University (Stages 1-5).

This is then followed by pursuing various different strategies for active learning and comparison with each of the municipal partners and engaging a diversity of different methodologies for these tasks. This forms the central activity of the KEF process into year two of the activities in workstream one.

The KEF will thus undergo further revision, leading up to year four of the project. This will be done through Durham University led work evaluating how these different practices and the models (used by different SAMSET groups)

upon which they are predicated provide important ways of supporting municipalities in sustainable energy transitions.

Figure 3a: Showing outline KEF Stages 1-4, Understanding the energy transition context

Stage	Purpose	Key questions	Methods	Outputs
i) Analysing landscape pressures on urban energy systems (WHY)	Analysis of relevant global pressures and how these touch down in local context and who is doing the translation and understanding of what these mean for the energy system. This includes all existing/future activities undertaken by urban actors	- How are these dynamics understood at urban level? - Is there a shared and collective understanding of key pressure?	- Resource flow analysis - Systemic policy, regulation and institutional review - Stakeholder interviews - Political economic/ ecological analysis Undertaken by Durham University (Incorporating work of wider project team's ongoing research and work activities (Year 2)	Identification of the critical ecological, economic, political and social issues regarded as strategic and requiring action in a particular urban context.
ii) Mapping the landscape of energy transition (WHERE)	Mapping the what and where of energy activities in a particular urban context to build an understanding of the dominant and emerging – (plus missing or absent) transition pathways in that context.	- Where is the key energy activity? - What does it look like? - E.g. experiments, demonstrations, development projects	- Searching on web through primary and secondary documentation, - Using interviews with multiple actors and cascading from these to other contexts, - Interviews with organisations. - Potential for mapping location/territorial extent of energy transition. - Energy future modelling - Participatory methods with municipalities (workshops, active planning etc) Undertaken by Durham University (Incorporating work of wider project team's ongoing research and work activities (Year 2)	Identification of energy projects and other related activities within partner municipalities (and beyond). Sense of the wider landscape of transition

iii) Identifying energy intermediaries (WHO)	Identification of the key intermediary organisations that have the capacity and capability to manage transition projects and learn from these systemically to shape transitions pathways.	- Who are the social interests involved in energy transition? - What is there orientation? (Systemic or project based transition/ External or internally facing	- Netmapping - Develop typology of intermediary capacity - Secure partnerships with key intermediaries Undertaken by Durham University (Incorporating work of wider project team's ongoing research and work activities(Year 2)	Identification and engagement with key intermediary organisations.
iv) Reveal the dynamics of existing energy transition pathways (HOW)	Identify whether there are emerging transitions pathways being constructed by the intermediaries. These can be multiple and co-existing transition pathways. These pathways remain open in relation to potential of SAMSET project/ partners to shape.	- How are these pathways constituted? - What are the social visions and technological expectations? - What capacity, knowledge and resources are utilised? - What are the consequences? - What transitions are missing?	- Integration from across stage 1-3. - Research team developing potential transition pathways. - Testing and developing pathways with stakeholders through workshop. Undertaken by Durham University (Incorporating work of wider project team's ongoing research and work activities(Year 2)	Develop a typology of emerging transitions pathways in the local context e.g. market making, social and community etc. Plus what are the missing elements in these pathways.

Figure 3b: Showing outline KEF Stages 5-7, Assembling transition pathways

Stage	Purpose	Key questions	Methods	Outputs
v) Understanding the gap between existing energyscape and future transition pathways (AFFINITIES)	Reflecting on relationship between the existing contexts and future energyscapes implied by transition pathways and potential interventions by urban intermediaries.	- How does the existing social and material organisation of the energscape shape future possibilities? - Does it conceive of urban context and if so does the regulatory regime support these pathways?	- Case study work of existing projects and interventions - Involvement of national energy policy actors/ institutions in assessing fit with urban transition pathways. - Cross municipality learning and case studies Undertaken by Durham University (Incorporating work of wider project team's ongoing research (Year 2)	Systemic understanding of the current transition pathways and how the fit with the existing institutional context and intermediaries.

vi). Comparative Learning (OPTIONS)	Thinking beyond the immediate context at range of transition pathways that might offer opportunities for learning and transfer?	- What are alternatives? - What could be transferable? - What is possible? - What are the various ways in which such activities can be supported?	- In depth investigation across the six municipalities and wider country contexts - Analyse policy mobilities - Evaluation of team effectiveness using various methods of supporting municipalities (and the models shaping such responses).- Testing of various 'models' of learning and action undertaken by each country team and integrated by Durham University (Year 3)	Provide a range of options and alternatives for municipalities to consider beyond immediate context
vii). Intervention Development (ACTION/ EXPERIMENTATION)	Active partnership development with intermediaries to create conditions and actions for energy transition and including both the unfolding activities of municipalities and evaluation by the Durham University team.	- Which projects and interventions are important for the context? - How do the municipalities develop transition actions? - What are effective strategies for learning (based on different models and approaches)	- Workshops - Capacity development - Ongoing support -Testing of various 'models' of learning and action - Architectural Model (Uganda Martyrs - Municipal Model (SEA) - The Change model (GAMOS) Undertaken by each country team and integrated by Durham University (Year 3/4)	Capacity building of intermediaries. Development of interventions both at project and systemic levels around: Household action, policy, buildings, modelling etc.

4.2 Analysing landscape pressures on cities (WHY) (STEP 1)

Purpose

Analysis of relevant global landscape pressures and how these touch down in local context and who is doing the translation and understanding of what these mean for the urban energy system.

This part of the framework is concerned with seeking to identify and consider inter relationships between wider landscapes pressures and the way they are shaping urban responses to energy issues through infrastructure investment, politics, policy development/directions and so forth. Work is needed to understand how these pressures are identified and contextualised within each of the SAMSET municipalities. For instance who makes decisions, how they are made, responsibilities for policies, relevant policy contexts and so forth. The research needs to consider how these pressures have different histories, impacts and outcomes relating to energy transition whilst seeking to link them to wider global (urban) processes that may present common pressures across the six municipalities. These range of pressures together create, shape and mediate a number of different potential energy transition pathways for cities, which can often be in conflict with each and other resulting in resources being targeted at those pressures deemed important by political regimes at the cost of other energy imperatives, showing how local actors needs to navigate a complex and ever changing landscape of energy transition. This could include (but not limited) to the following -

Climate change

Emerging policy responses to climate change and the bio-physical processes that are prompting the need for adaption/mitigation of urban energy systems. The featured municipalities are (or not) responding to climate change in various ways with key questions about policy development, financing and vulnerability of urban populations creating a series of imperatives to be engaged with. Some have a long history of engagement with urban policy around climate change becoming embedded across a range of different city

functions and international networks of financing, learning and partnerships whist in others such dynamics remain at a national level in relation to policy development and the energy regime.

Urbanization

Estimates suggest that by 2030 African cites will grow by more than 350 million people and account for 50% of the continents population posing multiple imperatives for municipalities and wider urban energy actors in responding to these dramatic dynamics. The need to understand how these urbanization processes are shaping urban areas from the landscapes pressures of energy transition through to the everyday energy practices of different population groups is important in understanding wider landscape pressures on energy transition. As new urban forms, spatial arrangements and the high levels of informality and incrementality in relation to developing infrastructure systems, shape a series of particular urban contexts across Ghana, Uganda and South Africa the need to develop a urban transition understanding through a distinct global South and African lens is vital in supporting sustainable energy imperatives that pay attention to the local energy geographies of these municipalities. Whilst municipalities are responding to urbanization this takes many different forms and based on different understandings of the key challenges.

Energyscape

The energy dynamics existing across a series of scales provides a number of different pressures for cities from energy security issues through to widespread poverty and lack of access, through to the need to cut down the carbon emissions of urban areas. Understanding the current energyscape of each urban area including its projected energy demand and generation forecasts, household usage, the potential of efficiency campaigns and large scale transformations forms a key component of understanding the energyscape from which municipal action will develop from.

Green economy

Policy movements from cities embracing attempts to develop sustainable energy systems and new technologies are part of wider discourses and narratives around the green economy that are central to understanding emerging pathways of energy transition. The green economy thus becomes a central part of emerging landscapes of energy transition as cities reorient towards new models for energy production and distribution and emerging discourses around visions of a sustainable future and growing interest/ investment in notions of the SMART city. Work to connect emerging green economy issues to wider economic development imperatives will form a key landscape pressure shaping energy transition as well as posing multiple questions about the role of the green economy across issues such as poverty and inequality, industrial and economic development and ICT rollout.

Resource flows

The flows of energy and other natural resources into and across urban areas not only mediates the but is connected to wider national, regional and global processes that need accounting for in understanding the transition context. From global carbon emission flows through to the interconnections between hydro dynamics and energy production (esp. in Uganda/Ghana) through to the connections with waste generation and processing present a range of different resource flows that are shaping energy dynamics across municipalities and reveal the need to look beyond the urban scale in approaching urban energy transition studies.

Poverty

The requirements of urban poor communities continue to dominate debates around energy infrastructure investment and the need to provide a decent standard of life through electrification programs, subsidised energy tariffs, household level actions, public housing development and so forth. Slum improvement projects provide a long history of attempts by the local and regional state institutions to develop energy improvement in the urban context. Further work is needed to understand how poverty shapes informal and incremental infrastructures that work at the edge or beyond the grid and

how they respond to existing inequalities across energy networks. Such work is rare or non-existent in current energy transition literatures yet provides a crucial consideration in the landscape pressures across the Ghana, South Africa and Uganda contexts.

Politics

The importance of understanding the political drivers of energy transition forms the final landscape pressure to consider how the urban energy landscape is shaped and connected to a series of ongoing multi-scalar processes of contestation/negotiation from different actors around policy, resource flows, urbanization and other imperatives. The work is a crucial element of socio-technical analysis for it allows for an understanding of the political context of urban energy transition, how histories of different governance (such as colonial, post-independence, apartheid, authoritarian, socialist, nationalist and so forth) shape infrastructural configurations and the unequal ways in which energy flows across landscapes. This work must also situate energy transition analysis in the contemporary politics of municipalities, how they inter-relate with national policy/politics and the multiple questions generated from considering these dynamics (from the autonomy of urban areas to shape transition, through to the demands of urban poor settlements to the influence of global actors such as China on shaping transition pathways).

Key questions

How are these dynamics understood at urban level? Is there a shared and collective understanding of key pressures? How is energy transition contested by different actors?

Methods

- Resource flow analysis/Energy Modelling
- Systemic policy, regulation and institutional review
- Stakeholder interviews
- Political economic/ecological analysis

A series of complimentary research methodologies will be used here involving the full range of partners in the SAMSET project. The role of UCT-ERC will be particularly important here in modelling and mapping energy demand, forecasts and other important dynamics across the different urban areas. Alongside such resource flow analysis and modelling work to understand the policy, regulatory and institutional contexts of these dynamics. Such research will be supported by ongoing stakeholder interviews with key actors involved in urban energy in order to develop more detailed and qualitative understandings of the landscape pressures and the politics and policies that shape these orientations. Stakeholder interviews will both support a comprehensive knowledge of the transition context together with outlining some of the potential pathways that SAMSET may support. Finally, a political ecology analysis that analyses power relationships across different social interests, the geography of inequality and the socio-natures of energy on a multi-scalar basis will centre questions of social justice, ongoing urban inequality and the way that energy is produced, distributed and used.

Outputs

Identification of the critical ecological, economic, political and social issues regarded as strategic and requiring action in a particular urban context.

4.3 Mapping the landscape of energy transition (WHERE) (STEP 2)

Purpose

Mapping the what and where of energy activities in a particular urban context to build an understanding of the dominant and emerging – plus missing transition pathways in that context.

This is designed to build a picture of the urban landscape of transition activities in a particular urban area. The aim is to undertake the mapping of the what, where, how and why of energy activities in a particular urban context to build an understanding of the dominant and emerging – plus missing transition pathways in that context. Each urban area will have a series of ongoing

activities that together can suggest a wider range of transition dynamics. These could include for instance wider infrastructural investment (such as electrification) and stand alone projects (such as installation of SWH schemes or retrofitting). Understanding where the key activities are and how the relate to each other will create a sense of the wider landscape of energy transition, how these various activities are linked (or not) and the key drivers in investment, policy development and political action. Furthermore, it is important to identify where activity is not taking place, for considering the reasons for lack of current action and reflecting on potential intersections with other sectors and policy imperatives that may allow for intervention. Finally, it is important to understand past interventions which provide some context on the motivations and actions of various actors to experiment and the particular pathways being travelled by municipalities. As such it is clear that the energy transition landscape is also predicated on the past histories of different energy regimes, intermediaries and interventions.

Key areas to consider include

- Electrification on grid and off grid
- Energy access and technology development (e.g. clean cooking stoves)
- Energy efficiency schemes (e.g. aimed at households)
- Sustainability levels of present transition pathways (e.g. how is electricity being generated?)
- Incremental nature of infrastructures in poor settlements (e.g. how residents navigate energy poverty)
- Large scale infrastructural investment (e.g. investment in new hydroelectric projects)
- Architectural innovation and development patterns (e.g. new middle class ‘green’ housing estates)
- Energy policy development with a territorial focus (e.g. the urban area/ particular neighbourhoods)
- The different investment and financed options being used (e.g. state/ donor/private sector)

Key questions

Where is the key energy activity? What does it look like? What future pathways do these activities envisage?

Methods

- Searching on web through primary and secondary documentation,
- Using interviews with multiple actors and cascading from these to other contexts,
- Interviews with organisations.
- Potential for mapping location/territorial extent of energy transition.
- Energy future modelling
- Participatory methods with municipalities (workshops, active planning etc)

The methodology will aim to create a comprehensive list (and if possible a series of maps) that allows the research team to know the key areas in which urban energy is being framed, understood and acted upon. This is undertaken through a number of methods that allow for key projects and also less visible activities to be recorded with initial activity focused on researching through web related searches, speaking to key intermediaries in each of the urban areas and through interviewing. This activity will thus help to show the territorial extent of energy transition areas that will suggest where the key spaces are, for instance work in informal settlements, development of sustainable technologies and buildings and so forth. This should also investigate the potential for mapping location/territorial extent of energy transition through GIS and the various demand/generation/distribution dynamics that they suggest may be implemented. Finally what this would produce is the mapping of the hotspots and cold spots of energy activity within a particular urban context, understanding of dynamics and trends, locations, social actors and purposes, whilst importantly also providing an understanding of missing or hidden activity and absence.

Outputs

Identification of energy projects and other related activities within partner municipalities. Sense of the wider landscape of transition and the main ways that it is being configured and shifted.

4d. Identifying intermediaries (WHO) (STEP 3)

Purpose

Identification of the key intermediary organisations that have the capacity and capability to manage transition projects and learn from these systemically to shape transitions pathways.

Initially the aim is to identify the key intermediary organisations that have the capacity and capability to manage energy transition projects and learn from these systemically to shape transitions pathways. This then enables us to develop a typology of intermediary capacity in relation to transition pathways and map onto the conceptual framework of project/system change and endogenous/external priorities. Such an activity will support us in understanding the dynamics and level of capacity of different organisations as well as missing capacity needed to sustain future activities. Development around this part of the framework recognises that in some contexts the lack of an urban level energy regime will prompt the need to consider actors beyond the municipality and how they might become enrolled in thinking and acting upon energy transition pathways. These might include:

- Municipality (e.g. environment department)
- National actors (e.g. ministry of energy)
- Civil society (e.g. energy related NGOs)
- Utilities (e.g. electricity company)
- Pro-poor organisations/social movements (e.g. slum dwellers groups)
- Private interests (e.g. technology market actors)
- Multi-lateral actors (e.g. donors)

Understanding the key actors involved in energy transitions forms a key step in the framework as it seeks to identify not just the important partners for SAMSET but also the interconnections between different actors and how particular interests may shape and mediate the type of energy transition pathways. Central to this process is identifying the key urban intermediaries who may be able to shape the type of transitions being undertaken and bring together often disparate interests to coalesce around particular actions, visions and plans. Furthermore, mapping the actors involved (or potentially) involved in urban energy transitions opens up important questions about what we consider urban when thinking about actors who may be involved in energy transition across the six case study areas. Furthermore, when we consider this idea of an intermediary we mean those that have the capacity to act between various social interests and faciltate action around energy transition. Finally, it is worth noting that there are a different set of actors for different kinds of interventions (e.g. water, transport, generation etc) and as such detailed sectoral analysis should be considered.

Key questions

Who are the social interests involved in energy transition? What is there orientation? (Systemic or project based transition/External or internally facing etc) What are the politics of these interests? What future energy transitions do they envisage?

Methods

- Netmapping
- Develop typology of intermediary capacity
- Secure partnerships with key intermediaries

The netmapping exercise undertaken by GAMOS provides a key methodology in identifying intermediaries, considering relationships and relative power to effect transition and the potential interests that may be brought together as part of SAMSET. Further work will seek to draw in the key intermediaries as project partners form SAMSET and the municipal teams, predicating

partnerships and shared visions of energy transition pathways. This will be undertaken through ongoing and intensive support of key intermediaries, involvement in range of activities including SAMSET meetings twice annually.

Outputs

Develop a typology of intermediary capacity in relation to transition to help understand the dynamics and level of capacity as well as missing capacity. Sense of unevenness and finding out which organisations/individuals are able to shape transition.

4.4 Reveal the dynamics of existing energy transition pathways (HOW) (STEP 4)

Purpose

Identify whether there are emerging transitions pathways being constructed by the intermediaries. These can be multiple and co-existing transition pathways.

What pathways are currently being travelled and constructed in each municipality is an important part of the framework and it is important that these existing and envisaged pathways are identified and understood to draw out the implications of these particular trajectories and how they might be shaped toward more sustainable orientated objectives. Thus, to shape any type of transition involves building on existing dynamics and also exploring the scope to reshape and transform these pathways. Here we are concerned also with the logics and imperatives through which energy transition pathways are being developed and designed, how they prompt multiple visions of future energy transition, reveal the contested nature of such transitions and the social interests involved with particular energy transition pathways.

Understanding existing transition pathways poses a number of key questions for the SAMSET project, by attempting an analysis of these issues the research and accompanying activities will be better informed by the particular context and current energy dynamics of the six municipalities. Questioning the ways

that the pathways are constituted is important for it reveals how the current trajectories have been established and shows how the landscape pressures have been interpreted by a range of different actors and intermediaries. Furthermore, working with municipalities can help inform how the pathways being developed are formed from particular social visions and technological expectations and provides an opportunity to reflect on the consequences of these actions, drawing in a secondary series of questions? (These include: are these sustainable? how do they address multiple policy imperatives? are the municipalities happy with these envisaged pathways?). Clearly, undertaking such analysis will also reveal the type of transitions that might be missing from current trajectories and provide a way to begin to reshape transition pathways for each municipality.

Key questions

How are these pathways constituted? What are the social visions and technological expectations? What capacity, knowledge and resources are utilised? What are the consequences? What transitions are missing?

Methods

- Integration from across stage 1-3 including modelling and state of energy reports.
- Research teams, municipalities (and other urban intermediaries) jointly developing potential transition pathways.
- Testing and developing pathways with stakeholders through workshop.

The methodology integrates the three stage analysis described above to outline the current and potential transition pathways in each of the urban contexts involving municipalities and the SAMSET team to develop analysis of current trajectories, where they might take the particular municipalities and the implications of these dynamics. This will be achieved through workshop style events that bring together the knowledge and expertise of the team and the wider partners. To realise the objectives of SAMSET in supporting intermediaries in developing transitions this forms the basis from which to

develop options and potential interventions based on building upon current imperatives, bringing in new policies and providing an overall vision for municipal energy futures.

Outputs

Develop a typology of emerging transitions pathways in the local context e.g. market making, social and community. Plus what are the missing elements in these pathways.

4.5 Understanding the gap between existing energyscape and future transition pathways (AFFINITIES) (STEP 5)

Purpose

Reflecting on relationship between the existing energyscapes – institutions, technologies etc and future energy transition pathways.

This part of the framework aims to draw on both the ways in which present energy transition pathways are unfolding and the future energyscapes that may be produced through the SAMSET project and beyond. Key to this activity is understanding whether and how transition pathways can be changed and reconfigured within the institutional context of each of the municipalities and the capacity/capabilities of the institutional context each of the urban areas is situated within. This will be influenced by issues such as existing national priorities, sensitivity to urban issues in national plans and strategies, institutional inertia, financing of current energy activities and the shifting context, policies, and priorities of different partners will all be important in mapping how alternative transition pathways may be produced and upscaled across a series of contexts.

Key questions

How does existing energscape shape – that is open and close - future possibilities? Does it conceive of urban context and if so does the regulatory

regime support these pathways? If not what needs to change in the energy policy or other regimes?

Methods

- Analysis of existing projects and interventions
- Cross municipality learning (workshops/SAMSET activities)
- Development of in depth case studies
- Involvement of national energy policy actors/institutions in assessing fit with urban transition pathways.

A range of methods can be used to assess current projects and interventions that allow for learning across different contexts. These include in-depth research of important energy projects emerging from each of the municipalities and urban Africa more generally. Whilst hesitant to term this work as focused on case studies there is some utility in drawing on key activities across the energy network and policy environment. These issues include thinking about the role of civil society/social movements in energy transitions to widen the focus beyond municipalities, the role of carbon and climate financing as potential opportunities for investment and the ways in which experiments can be upscaled to effect action at a municipal scale (as opposed to more isolated projects). Yet this only provides a partial understanding of transition pathways with work being needed to involve a range of different partners from a wider institutional context and thus requiring ongoing learning and involvement from each of the municipalities participates in active learning through a series of workshops and ongoing SAMSET activities.

Outputs

Systemic understanding of the energy transition pathways and how they fit with the existing institutional context and intermediaries.

4.6 Comparative learning (OPTIONS) (STEP 6)

Purpose

Thinking beyond the immediate context at range of transition pathways that might offer opportunities for learning and transfer and the different models and approaches through which such knowledge brokerage activities are best undertaken.

The purpose of the SAMSET project is not simply to analyse current transition pathways but to work and support municipalities in effecting sustainable trajectories across the energy systems of these urban areas. As such the importance of learning within place but also from across the municipal and other partners involved in SAMSET is a key imperative of the framework. An in-depth investigation is being developed across the SAMSET team with a significant evidence base being built to draw lessons, ideas and debates across different contexts both within and beyond Ghana, South Africa and Uganda. A clear part of the purpose of this stage of the framework is to facilitate knowledge exchange across a range of different audiences including the municipalities, wider national actors including civil society, international networks and institutions, academic and research partners and so forth.

At this stage of the SAMSET project a range of models and approaches emerging from a range of different perspectives and ways of understanding energy transitions and reflecting the range of skills, perspectives, practices and knowledges of the multidisciplinary team and as such revealing the rich diversity of ways of approaching energy transitions. These have included a number of proposed models including;

- Architectural Model (Uganda Martyrs)
- Municipal Model (SEA)
- The Change model (GAMOS)

Comparative learning provides the opportunity to reflect on the alternative transition pathways that may be undertaken that can substantially shift current trajectories toward a more sustainable basis. This involves asking not just what the possible alternatives are, that draw on wider best practice but how these might travel and be transferable across a range of different contexts, sensitive to the practical possibilities that will shape the ability to effect change at the municipal level.

Key questions

What are alternatives? What could be transferable? What is possible?

Methods

- In depth investigation across the six municipalities and wider country contexts to provide series of case studies and background material for learning.
- Analyse policy mobilities of energy interventions
- Evaluation of team effectiveness using various methods of supporting municipalities (and the models shaping such responses).
- Network meetings (involving participatory methodologies and active learning)

Comparative learning can take a number of forms and will be manifested in the SAMSET project through activities such as workshops with partner municipalities, postgraduate education opportunities, detailed modelling and sharing of successes and struggles in various contexts. Methods include a range of different ways of understanding how current energy transition pathways might be transformed and include policy mapping, stakeholder interviews, and ongoing debate across the different municipalities and exploration of particular energy projects. As such the research will seek to look at:

- Individual projects and the material changes they bring about in energy dynamics
- The ways that sustainable energy transitions are navigated and negotiated by municipal actors

- Household level transformations
- The broader ways in which innovation is being supported through systemic change
- New policy directions and intersections with other imperatives (e.g. poverty/climate change/eco develop)

Furthermore, this work will draw in thinking about the current role of these urban areas in wider networks of learning within and beyond African circuits of knowledge production concerning urban energy transition. These include for instance; Jinja/ICLEI[2], Kasese/WWF[3], and MISTRA/Cape Town[4] which all provide earlier (and in many cases) ongoing work that seeks to connect these municipalities to wider international learning, best practice and knowledge dissemination. As such important lessons can be learnt from these existing projects in relation to comparative learning and also help to understand how the mobile nature of policies around energy transition, how they travel to different contexts and the main drivers of such dynamics (e.g. key intermediary organisations).

Outputs

Provide a range of options and alternatives for municipalities to consider beyond immediate context

4.7 Intervention development (ACTION/EXPERIMENTATION) (STEP 7)

Purpose

Active partnership development with intermediaries to create conditions and actions for energy transition

This might mean assembling a broad range of intermediaries that are somehow engaged or have capacity to engage in urban scale in order to

[2] More info: http://archive.iclei.org/index.php?id=1217

[3] More info: http://wwfuganda.wordpress.com/2012/10/11/kasese-for-clean-energy/

[4] More info: http://www.mistraurbanfutures.org/en/node/13

develop a range of actions that together might shape particular energy transition pathways into the future. As a clear part of the objectives of SAMSET to not only understand but also effect current energy dynamics in the selected municipalities the need to establish and deliver the previous steps of the framework will form a clear imperative and foundation for generating interventions in each of the urban areas.

Key questions

- Which projects and interventions are important for the context?
- How do the municipalities develop transition actions?
- What are the various ways in which such activities can be supported?

Methods

- Workshops
- Capacity development/Ongoing support
- Survey of partners/SAMSET team

Much of the methodology will be developed and reconfigured during the SAMSET process and the need to develop tools, knowledges and frameworks that can effectively disseminate and broker knowledge exchange across the contexts. Here we will draw on the SEA methodology, existing channels, new opportunities such as postgraduate courses and close attention to the development of municipal and other intermediary capacity during the course of the SAMSET project. Furthermore, there is a need to evaluate throughout the process the ways in which intermediaries are being influenced by the process, how their views, opinions and capacities are being influenced and importantly the learning of the SAMSET team itself.

Outputs

Provide capacity building of intermediaries and development of interventions both at project and systemic levels around household action, policy, buildings, modelling etc. This will include the evaluation and potential integration of a series of different models for supporting energy transitions developed by

different teams. Reflective evaluation of SAMSET project (externally and internally).

5. Conclusion and next steps

5.1 Producing the KEF

This document has sought to provide a comprehensive overview of the production of a Knowledge Exchange Framework as part of the SAMSET project. It has provided an extensive review of literatures on energy transition as the foundation for the development of a seven stage framework. An outline of the KEF was then presented that sought to firstly, understand the context of energy transitions in each of the six municipal contexts in which the project is operating and secondly to test, develop and evaluate a series of ways to actively support these municipalities and facilitate, through cross-context learning a series of sustainable energy transition pathways

5.2 Next steps

One of the key challenges (yet also strengths) of the development of the KEF has been the multi-discipline background of the SAMSET team incorporating multi ways of researching, engaging and practicing energy transitions across Ghana, Uganda and South Africa. This includes architects, social scientists, municipalities and municipal support, NGO sector and more. The active learning opportunities present in reflecting on these various backgrounds and forms of practice will form a key part of the overall outputs of the SAMSET project and will help to produce the finalised version of the KEF in year four that provides a key output for the wider project. Drawing on best practice, reflective evaluation and extensive debate within the project team, with partner municipalities and wider stakeholders, this work will thus be guided by this document as a key way to understand and intervene across these processes. The KEF will now be used to guide the work of Durham University in years two and three of the SAMSET project in integrating the various knowledges,

methodologies, practices and data outputs of the project with year four providing an opportunity to think about synthesizing these diverse approaches into a wider framework for action.

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