

# Actors, Agency and Politics in Sustainability Transitions: Evolution of the solar PV market in East Africa

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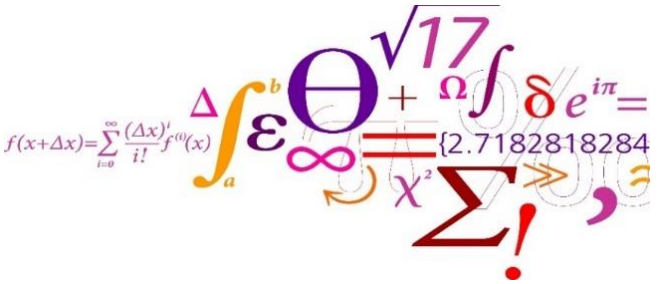


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## List of Abbreviations

| | |
|---|---|
| CDM | Clean Development Mechanism |
| CTCN | Climate Technology Centre and Network |
| DAC | Development Assistance Committee |
| DFI | Development Financial Institutions |
| DfID | Department for International Development |
| DTU | Technical University of Denmark |
| EPC | Engineering Procurement Construction |
| ERA | Electricity Regulatory Authority |
| GETFiT | Global Energy Transfer Feed-in Tariff |
| GIZ | German Development Agency |
| GHG | Greenhouse gas |
| IEA | International Energy Agency |
| IFC | International Finance Corporation |
| IPP | Independent Power Producers |
| KIC | Knowledge and Innovation Community |
| KfW | KfW Development Bank |
| LDC | Least Developed Countries |
| MaP | Multi actor Perspective |
| MLP | Multi-Level Perspective |
| MW | Mega Watt |
| NGO | Non-Governmental Organization |
| OECD | Organization for Economic Co-operation and Development |
| PV | Photovoltaic |
| REA | Rural Electrification Authority |
| SCOT | Social Construction of Technology |
| SDG | Sustainable Development Goals |
| SE4ALL | Sustainable Energy for All |
| SHS | Solar Home Systems |
| SNM | Strategic Niche Management |
| SSA | Sub Saharan Africa |
| STS | Science Technology Studies |
| TIS | Technological Innovation Systems |
| TM | Transitions Management |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNFCCC | United National Framework Convention for Climate Change |
| USAID | United States Agency for International Development |
| USD | US Dollars |
| WB | World Bank |

## Abstract

Access to clean, reliable and affordable energy services is fundamental to economic and social well-being. Yet nearly 600 million people in Sub-Saharan Africa lack access to electricity. International commitments aimed at reducing greenhouse gas emissions and ensuring universal access to energy services, principally the Paris Agreement of the UN Climate Change Convention and the UN SE4ALL Sustainable Development Goal 7, have created a momentum for African countries to transition to more sustainable low-carbon energy pathways.

Such commitments can be attained through targeted policies pursuing systemic changes, which include strategic and deliberate actions on the part of multiple actors to consolidate their efforts, collaborate, develop pragmatic solutions and ensure just and socially inclusive outcomes. Towards this end, transnational actors, such as aid agencies, financial institutions, non-profit organizations and private firms play a crucial role through their involvement in framing agendas, engaging in policy advice and mobilizing resources, both technical and financial.

Against this background, the objective of this thesis is to investigate how these transnational actors operate and influence the transition to solar PV in East Africa, focusing specifically on off-grid and utility-scale solar PV systems in Uganda, Kenya and Rwanda. By investigating the dynamics of transnational linkages, external dependencies and global-local entanglements shaping specific transition pathways, the thesis contributes to an improved understanding of agency and politics in the sustainability transitions literature. The research topic is investigated through multiple case studies presented in the form of four articles that comprise the thesis. Article 1 adopts a 'transnational' perspective to analyze the development of the off-grid solar PV regime in Uganda. It identifies how transnational actors mobilize key resources (finance, technology, knowledge) to enable the PV transition. Article 2 adopts an agency-centric 'policy translation' perspective to analyze the process by which actors modify and localize imported policies, thereby accelerating the transition to utility-scale solar PV in Uganda. Article 3 adopts the actor-centered concept of 'frictional encounters' from the Sino-African literature to study the micro-politics and actor struggles as they unfold between Chinese and Kenyan actors during the development process of a utility-scale solar PV niche project. Article 4 integrates the MLP framework with a 'political economy' perspective to analyze the utility-scale solar PV niche against the background of the niche-regime-landscape dynamics in Rwanda.

The thesis applies qualitative research methods, mainly semi-structured interviews and document analyses in order to provide detailed and context-specific insights. The dynamics of change are analyzed through the multilevel perspective (MLP), as a well-known framework. The thesis contributes to further develop the MLP by establishing a more actor-oriented approach, which is necessary to understand actor interests and strategies in pursuit of particular transition trajectories. The thesis develops a typology of transnational actors and identifies their specific roles and characteristics. It makes use of transition frameworks to explore

agency by nuancing simplified actor categories, assessing the underlying motives, and by explicitly unraveling the micro-politics. The thesis also highlights the interplay of transnational and local agency, which is pertinent in the highly globalized energy regimes, but has received limited attention in the literature. In doing so, the thesis explores strategic and intentional actions, locates the relative position and influence exerted by specific transnational actors, and explores the socio-political processes underpinning sustainability transitions.

The thesis demonstrates that the diffusion of off-grid solar PV systems in East Africa has witnessed a shift in the actor-drivers in recent years, away from international donors and NGOs toward more private-sector engagement. This observed shift has entailed a change in the modus operandi of development actors. While the off-grid PV sector has evolved over many decades in, the utility-scale PV systems have only emerged over the last five years. The thesis finds that cost competitiveness, tailored policy instruments, investor risk guarantees, and improved regulatory procedures have enabled this recent emergence. Such niche developments have occurred against various regime and landscape pressures.

The thesis highlights the important role played by higher levels of leadership (i.e. state and regulatory actors) in prioritizing and accelerating the development of solar PV projects. Further, the thesis explores the nature of the involvement of 'rising powers' in Africa, such as China, acting as technology suppliers, developers, and investors in the development of utility-scale PV projects, reflective of the growing importance of South-South cooperation in shaping energy markets. Finally, the thesis finds that the nature of global-local multi-actor relations and politics is crucial to shaping specific transition outcomes. Transnational actors act as knowledge and funding repositories, whereas national actors provide legitimacy and institutional embeddedness. Accelerating the process of decarbonisation of the energy systems requires political work, negotiations, agency and power to wield influence, strong political commitment, and willingness to adapt to or modify institutional structures. These insights provide useful lessons that could be used for outcomes in support of the Paris Agreement and SDG7.

# 1. Introduction

## 1.1. Transition to low-carbon energy pathways in Africa

Modern energy services are fundamental to economic and social development and well-being. Yet, just over two-fifths of the population (i.e. 600 million) in Sub-Saharan Africa (or SSA hereafter) have access to electricity, the lowest of all regions in the world. Many African countries are at a critical juncture with regard to defining their energy futures. These countries have to navigate two simultaneous transitions within the energy sector: a transition towards universal energy access (Pachauri et al., 2013, IEA, 2017b), and a low-carbon, climate resilient and 'just transition' (Newell and Mulvaney, 2013, Swilling et al., 2016). Currently, there are fifteen countries in SSA (including Uganda and Rwanda) with electrification rates of less than 25%, and rural electrification rates of less than 10% (IEA, 2018). However, the challenges go far beyond these low access rates and inadequate coverage of the electricity grid. The electricity sector in SSA is also characterized by "limited consumption, pervasive reliability challenges, prohibitive prices, and utilities in financial distress" (Blimpo and Cosgrove-Davies, 2019; ch.1).

There have been concerted international efforts and global commitments through various initiatives, such as the United Nations Sustainable Energy for All (SE4ALL), which aims to close the electrification gap in developing economies by 2030. The inclusion of energy in the post-2015 Sustainable Development Goals (SDGs), i.e. SDG 7, underlines the significance of this issue in the wider development agenda (Nerini et al., 2018). The energy sector is central to climate action (SDG 13) as it accounts for the largest share of global anthropogenic greenhouse emissions (IEA, 2017a). The European Environment Agency (EEA, 2015) has stated that "living well within the limits of the planet requires a transition to a green economy", and that it is necessary to respond to *systemic challenges* and integrate *policy approaches* for a long-term, global transition to low-carbon energy systems.

With the rapidly growing energy demands of developing economies, they will likely need to pursue a low-carbon energy development trajectory, in order to meet the global climate goals without hindering their development prospects (Fouquet, 2016). Therefore, the process by which developing countries can transition to low-carbon futures presents a major challenge. In order to promote low-carbon energy transitions in developing countries, facilitating transfer and uptake of low-carbon technologies (Haselip et al., 2015) has been recognized as an imperative in international policy forums, for example, within the United National Framework Convention for Climate Change (UNFCCC). This recognition has resulted in the adoption of various mechanisms to enhance technology transfer, such as Clean Development Mechanism (CDM), and such platforms as Climate Technology Centre and Network (CTCN) and Climate Knowledge & Innovation Community (KIC).

In this context, it is important to note two broader fundamental shifts that are currently ongoing. First, the landscape of international climate change negotiations has changed from the pursuit of *global* targets and timelines, to voluntary contributions and *national* policies for reduced greenhouse gas (GHG) emissions as defined within the Paris Agreement (2015) (Newell and Bulkeley, 2017). Second, these 'bottom up' actions to mitigate climate change are enabled by an emerging set of multiple actors (in particular, private actors, non-state actors, sub-national actors etc.), operating and undertaking decision-making at various levels of governance from the international to the national and sub-national (Hsu et al., 2015, Bäckstrand et al., 2017). This has led to intensified collaborative dialogue, partnerships and cooperation among state and non-state actors within the realm of transnational climate action (Pattberg and Widerberg, 2016, Boezeman and de Coninck, 2018, Westman and Broto, 2018).

In developing countries, the transition to an alternative low-carbon energy sector has been witnessing a similar shift, particularly the influx of private, non-state actors. As renewable technologies (such as solar PV) mature, become competitive and gain ground i.e. in terms of increased diffusion rates, they are changing the traditional dynamics and modus operandi behind power sector development and rural electrification. In SSA, unlike the predominant centralized electricity generation elsewhere, alternative decentralized systems have been rapidly spreading to cater to areas where grid connectivity is lacking, and/or to complement the grid (GOGLA et al., 2018), thereby reshaping 'energy geographies' i.e. changing spatial, material and political dimensions of energy (Alstone et al., 2015, Ahlborg and Hammar, 2014, Ahlborg, 2018).

Particularly in East Africa, decentralized electricity generation systems, such as solar home systems and pico-scale solar, have been rapidly diffusing along with more recent developments in mini-grids and large-scale solar power (Hansen et al., 2015, Pedersen, 2016). They do so in many rural areas by offering a cost-effective and sustainable alternative to fossil-fuel based solutions, such as diesel generators. This has given rise to newer forms of socio-technical configurations, driven by a multiplicity of actors along with complex dynamics and partnerships (Kruckenberg, 2015). Traditionally, development aid agencies played a crucial role but the arena has expanded significantly to involve new business models and many transnational actors including non-governmental organizations (NGOs), private firms, social enterprises, corporate philanthropic foundations and venture capital firms (Hansen et al., 2015, GOGLA et al., 2018). These changes, in combination with the broader turn in development cooperation towards market-based solutions and private sector partnerships, along with newer actors ('rising powers') (Power et al., 2016) assaying to achieve low-carbon development (Nygaard et al., 2016), have opened up new avenues of research. In particular, research has begun to explore how these multiple actors enable and steer energy transitions, how they modify the existing institutions, and how they engage with on-the-ground realities (Ockwell et al., 2019).

The literature on sustainability transitions provides a useful perspective to unravel how these low-carbon energy developments in East Africa are taking place. The transitions perspective brings attention to the evolutionary and socio-technical dimensions of technological change and systems innovation (Markard et al., 2012). It provides frameworks to investigate and understand complex societal systems (linked to societal functions, such as energy, food, water and mobility), asking how these could make a structural qualitative shift from an unsustainable to a more sustainable state (Loorbach et al., 2017). While the transitions field has been developed in the Western context (especially Netherlands), recent research has contributed to the field by adapting it to developing country contexts. The field has been foraying not only into socio-technical aspects but also socio-cultural, and increasingly, political dimensions of energy transitions (Meadowcroft, 2011, Geels, 2014, Baker et al., 2014, Newell and Bulkeley, 2017), which have been neglected in the past (Ockwell et al., 2018). More recently, a number of studies have urged academics to adopt explicit actor-oriented and politically-informed perspectives in analyzing transitions to low-carbon alternatives (Farla et al., 2012, Power et al., 2016, Newell and Phillips, 2016, Avelino and Wittmayer, 2016, Avelino et al., 2016, Kern, 2015).

The primary aim of this thesis is to contribute to advancing this emerging research agenda on the 'agency' and 'politics' of sustainability transitions, and the socio-political dimensions of transitions at large. This ambition involves exploring how agency and politics can be conceptualized in sustainability transitions, and how such conceptualizations may further the understanding and challenges in relation to transitions in the context of developing countries. The theoretical basis of the thesis is thus positioned within the field of sustainability transition studies, which it aims to advance further. Empirically, the thesis analyses the transition to solar photovoltaic (PV) in East Africa, focusing specifically on Uganda, Kenya and Rwanda.

This synopsis is structured as follows. In the following sub-section 1.2., the main research questions guiding the analysis conducted in this thesis are described. This is followed in Section 2 by a description of the conceptual framework used to examine the research questions. Section 3 presents the research methodology, and in Section 4, a description of the individual articles comprising this thesis is presented. Lastly, Section 5 provides the main conclusions and suggests areas of further research.

### 1.2. Research questions

This thesis focuses on the socio-political dimensions of transition to solar PV in East Africa, and is guided by the following main research question:

> *How do transnational actors operate and influence the transition to solar PV in East Africa?*

This main question has been addressed by answering four sub-research questions, broadly corresponding to the four individual – albeit interrelated – articles of the thesis (see Table 1)

The first question investigates the role of transnational actors in the development of off-grid solar PV regime in Uganda since 1980s until the present.

> Sub-question 1: *How do transnational actors exert influence and operate while mobilizing key resources for sustainability transitions in low-income countries (case of Uganda)?*

The second question unfolds the particularities of how global policy ideas are adapted and translated in a local context through actor-networks, focusing on the case of the GETFIT program in Uganda.

> Sub-question 2: *How did the actor constellations translate renewable energy policy and accelerate transitions within the specific political and institutional context of Uganda?*

The third question addresses the nature of Chinese investment in renewable energy in Africa, focusing on the encounters between the actors involved in a large solar power project in Kenya.

> Sub-question 3: *How do micro-politics and negotiations among Chinese and local actors unfold on the ground in the transition to large scale solar power in Africa?*

The fourth question focuses on the actors and institutions that enabled the first utility-scale solar PV project in Rwanda.

> Sub-question 4: *How did the key players and institutions in Rwanda enable and influence the process of developing East Africa's first utility-scale solar PV project?*

All four articles explore the interplay of agency and politics by foregrounding the analysis of transnational and national actors enabling sustainability transitions through case-specific, in-depth studies in East Africa. An overview of the four articles is provided in Table 1.

**Table 1: Overview of articles included in this thesis**

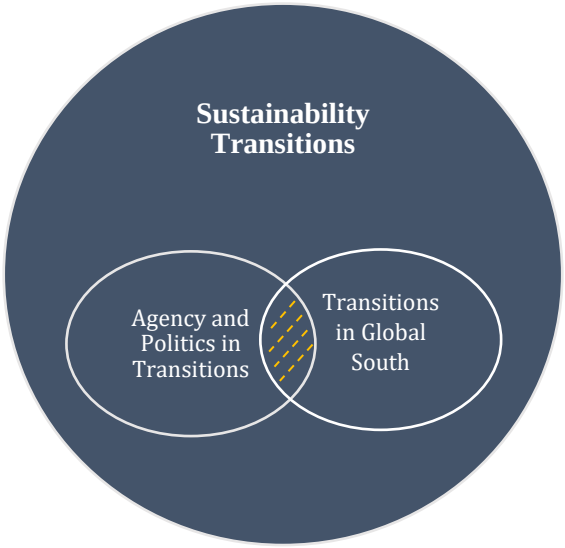
| | Title | Authors | Status |
|---|---|---|---|
| 1 | Agency in Transition: the role of transnational actors in the development of the off-grid solar PV regime in Uganda | Padmasai Lakshmi Bhamidipati, Ulrich Hansen and James Haselip | *Environmental and Societal Innovations* Published in March 2019 |
| 2 | How do energy policies accelerate sustainable transitions: Unpacking the policy transfer process in the case of GETFiT Uganda | Padmasai Lakshmi Bhamidipati, James Haselip, and Ulrich Hansen | *Energy Policy:* Published in July 2019 |
| 3 | China's involvement in the transition to large-scale solar PV in Africa: exploring frictional encounters on the ground in Kenya | Padmasai Lakshmi Bhamidipati, Ulrich Hansen | *Geoforum:* Revise and Resubmit |
| 4 | Getting on the ground: Exploring the determinants of utility-scale solar PV in Rwanda | Judit Rodríguez-Manotas, Padmasai Lakshmi Bhamidipati, James Haselip | *Energy Research & Social Science:* Published in August 2018 |

## 2. Research Fields and Conceptual Framework

This thesis is positioned within the main research field of sustainability transitions. It locates itself at the intersection of the thematic areas of 'agency' and 'politics' in transitions, and research on transitions in the Global South (see Figure 1). It also draws on actor-oriented approaches from related theoretical fields to answer the research questions outlined above.

This section presents the particular strands of literature the thesis draws upon, how the concepts of actors and agency have been employed in the literature, and how such concepts and frameworks have been integrated and applied in the analyses. The analysis in Articles 1 and 4 is guided by concepts explicitly drawing on the Multi-Level Perspective (MLP), although complemented by actor-oriented and political economy perspectives; while Articles 2 and 3 draw on complementary perspectives rooted in policy process theory and Sino-African literature, while ensuring their integration with the sustainability transitions literature.

**Figure 1: Overview of the literature within which the thesis is situated**




## 2.1. Sustainability Transitions Framework

Research on sustainability transitions is concerned with the transformation of socio-technical systems associated with societal domains (such as energy, food, transport and agriculture), towards a more sustainable society (Grin et al., 2010). The literature focuses on the processes and patterns through which new technologies are deployed and diffused for provision of societal services. Technological change is understood to result from both long-term processes and radical shifts. However, technologies are not simply physical artefacts, but artefacts-in-context, which co-evolve with heterogeneous elements in society, and entail power struggles and socio-cultural change (Geels, 2005b). Thereby, innovation systems are about wider and inter-linked changes in technology and societal elements, such as policy, culture, markets and practices. Sustainability transitions are defined as "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (Markard et al., 2012; 956).

Emerging in the late 1990s and early 2000s, from disciplines such as evolutionary economics, science technology studies (STS) and social construction of technology (SCOT), sustainability transitions is a rapidly growing field of transdisciplinary research. A central aim of this field of research is to conceptualize and explain how changes can occur in a way that societal functions are fulfilled (Köhler et al., 2019). Research in this field employs four main conceptual strands – strategic niche management (SNM) (Kemp et al., 1998), transition management (TM) (Kemp and Loorbach, 2006, Coenen and López, 2010), technological innovations systems (TIS) (Geels, 2005b) (Elzen et al., 2004), and multi-level perspective (MLP) (Geels, 2002a, Markard and Truffer, 2008b). A prominent approach in the studies is the MLP (Rip

and Kemp, 1998, Geels, 2002b, Smith and Stirling, 2010), which combines ideas from evolutionary economics, the sociology of innovation, and institutional theory (Köhler et al., 2019). I elaborate this conceptual strand in the next section as the MLP framework is a core element of the research underlying the development of this thesis.

## 2.2. The Multi-Level Perspective

### 2.2.1. The conventional framework

The Multi-Level Perspective is a widely adopted framework in transition studies, the focal concern of which is the structures, actors, and processes that affect socio-technical transitions (Smith et al., 2010, Geels, 2011). MLP offers a heuristic framework for conceptualizing how transitions to sustainability come about through the interplay between three analytical levels: niches (micro), regimes (meso) and landscape (macro). Each level presents a different measure of structuration (Geels, 2011) or degree of institutionalization (Fuenfschilling and Truffer, 2014). The landscape denotes the overarching, exogenous structural context, corresponding to the broad societal trends, such as macro-economic conditions, geopolitical shifts, climate change, demography and deep cultural patterns (Geels, 2002a, Van der Brugge et al., 2005).

The regime forms "the deep structure that accounts for the stability of an existing socio-technical system" (Geels, 2011; 27). It consists of a semi-coherent set of rules that guide actors' behavior such as cognitive routines and shared beliefs, competencies, user practices, regulations, and legally binding contracts (Geels, 2011, Geels et al., 2004). It is highly institutionalized and enjoys certain stability, typically in the form of path-dependency, resistance to change and structural lock-in (Raven, 2006). It stabilizes existing trajectories through cognitive routines, regulations and standards, adaptation of lifestyles to technical systems, sunk investments in infrastructures, and competencies (Geels and Schot, 2007). The MLP framework focuses on these 'meso-level' changes that entail broader institutional conditions for technology diffusion. Sustainability transitions are understood by the MLP as socio-technical changes in the existing regime to reconfigure and sustainably fulfill societal functions.

At the micro-level, the niches act as protective spaces or 'incubation rooms', which allow for experimentation, innovations, and for new technologies to evolve, stabilize, enter small market niches and break through them (Verbong and Geels, 2007). These innovations may be shielded from the selection pressures through support mechanisms such as technology favoring policies, subsidies for demonstration projects, and other regulatory support (Smith and Raven, 2012). Niche development is contingent upon some level of regime instability and tensions that provide 'windows of opportunity' at the regime level (Verbong et al., 2008). The breakthrough and upscaling of niches towards market competition and large-scale societal transitions is supported by 'niche-internal processes', which include the shaping and

alignment of expectations and the formation of a social network and learning processes. These have been elaborated extensively in the literature on strategic niche management (SNM) (Schot and Geels, 2008).

Recent work highlights the need to focus on 'niche-external processes' (as opposed to niche-internal processes), in which actors actively influence the dominant regime structures within which the niche is embedded through "outward-oriented socio-political work" (Raven et al., 2016; 164). Niche innovations may also breakthrough "if landscape developments put pressure on the regime that leads to cracks, tensions, and windows of opportunity" (Köhler et al., 2019; 4). MLP argues that sociotechnical transitions come about through interacting processes within and between the incumbent regime, radical niche-innovations and the pressures exerted by the sociotechnical landscape (Geels et al., 2016a).

### 2.2.2. Recent development of the MLP framework

Conventionally, the main focus of transitions research has been on elucidating socio-technical regime change as a building up or bottom-up process, through experimentation, niche innovation, scale up, and acceleration (Loorbach et al., 2017). This entails focusing on emerging technologies, and nurturing, shielding and managing them against the incumbent structures and technologies at the regime level. Accordingly, the prevailing perspective involves focusing on the stability of the emerging niche and comparing it with the relative instability within an existing regime. In recent years, however, increasing attention has been devoted to so-called breaking down processes, which include issues related to regime destabilization, re-emergence of incumbents and institutional change (Smink et al., 2015c).

Several alternative configurations may not fit into, or entail, simultaneous breaking down-building up processes, such as incumbents developing niche-innovations, alliances between incumbents and new entrants, and niche-involvement of incumbent actors (Bergek et al., 2013, Berggren et al., 2015, Geels et al., 2016b). Niche-innovations do not always necessarily compete with or substitute the incumbent regime. A further alternative configuration may be led by pathways such as regime transformations, transitions and optimizations resulting in improved and upgraded existing regimes (Ghosh and Schot, 2019). All of these point to multi-dimensional interactions, struggles, and alignments between niches and regimes (Rosenbloom et al., 2016, Raven et al., 2016, Smink et al., 2015b), unlike the conventional portrayal of regimes as "monolithic barriers to overcome" (Geels, 2014; 23).

Recent debates in the literature, which focus on sustainability transitions in the Global south, have illustrated the co-existence of niches alongside regimes and the co-evolution of multiple regimes (Hansen et al., 2017, Wieczorek, 2018). While regime instability may typically lead to niche development, in developing country contexts, regime stability "does not necessarily obstruct regime transformations as many systems are nearly absent or dysfunctional" (Wieczorek, 2018; 212). On the contrary, regime instability could act as a barrier for niche development (van Welie and Romijn, 2017, Verbong et al., 2010).

Further, political and economic instability is widespread across various developing countries, resulting from such factors as non-transparent political decision-making, corruption, clientelism and elite capture. These conditions not only exacerbate the challenge of clearly delineating regimes in empirical research, but, more importantly, raise a fundamental question about regime stability as a decisive factor for transitions in the context of developing countries. In such cases, Hansen et al. (2018b) argue that sustainability transitions could be achieved without yielding any social and democratic benefits, and in that sense, it may not be 'just' and 'inclusive' (Swilling et al., 2016). Such transitions may instead reinforce deeply entrenched power structures instead of destabilizing them (Baker et al., 2014, Rodríguez-Manotas et al., 2018).

Other recent conceptualizations of the MLP do not limit themselves to studying singular niche-innovations. Instead, they increasingly pay more attention to diverse inter-linked change mechanisms, including: i) interactions between multiple niche-innovations; ii) adoption of niche-innovations within existing systems triggering further 'innovation-cascades'; and iii) interactions between multiple systems (Geels, 2018). Transitions scholars are increasingly also focusing on empirical research, which expands the notion of singular monolithic regimes to multiple co-existing and heterogeneous regimes (Wieczorek, 2018, van Welie et al., 2018). Indeed, regimes are now established as being far more heterogeneous, complex and fluid than previously assumed, and the conceptualization of socio-technical regimes in developing countries has been attentive to accounting for these particularities. van Welie et al. (2018), for example, distinguish between service and sectoral regimes, and identify multiple heterogeneous regimes, including 'polycentric', 'fragmented' and 'splintered' ones. Similarly, Ghosh and Schot (2019) suggest shifting the focus of change processes from niches to regimes by proposing a novel regime change framework for studying transport in India, comprised of three pathways to regime change: regime optimization, transformation and transition.

These new conceptual developments have led to a broadening of the scope of the MLP framework and strengthened its relations with other disciplines within the social sciences. As a so-called mid-range theory, MLP allows for such fruitful crossovers with other lenses and approaches, thereby offering better insights into specific causal mechanisms (Geels, 2018). Its scope has also expanded further through the concept of 'global socio-technical regimes'. Scholars have criticized the methodological nationalism implicit in transition studies and proposed an alternative 'global regime' perspective as a new research agenda, which accommodates the increasingly multi-scalar actor networks and institutional influences that operate beyond just the national and regional borders (Fuenfschilling and Binz, 2018, Bauer and Fuenfschilling, 2019).

Such a global perspective is pertinent as organizations, industries and markets are increasingly operating internationally and forming global networks in which "ideas, practices and routines are diffused and coordinated" (Bauer and Fuenfschilling, 2019; 173). Accordingly, transitions unfold as a result of the interplay between local sustainability initiatives and global forces and flows. Both niches and regimes may evolve beyond the confines of the local and national scales and embed global features through actor

relations, social networks, and institutions that may enforce or destabilize regimes (Raven et al., 2012, Coenen et al., 2012, Hansen and Nygaard, 2014). As Fuenfschilling and Binz (2018) argue, the dominant rules of the game are indeed global, unlike the previous assumptions in the literature. International actors and networks, embedded within global institutional rationalities, play a critical role in reproducing the rules and routines through their behavior, influencing and transforming them further. Addressing these issues will require closer attention to the spatial and transnational dimensions of niche and regime developments (Hansen and Coenen, 2015, Truffer et al., 2015).

Such debates are particularly pertinent in the context of developing countries where niches and regimes often develop with the support of global resource flows i.e. knowledge, technology and capital (Berkhout et al., 2011, Wieczorek et al., 2015), and within a more transnational context. A global perspective also informs emerging research on the role of foreign donors in stimulating transitions in the Global South (Marquardt et al., 2016, Tigabu et al., 2017, Boodoo, 2018). Wieczorek et al. (2015) and Hansen and Nygaard (2013) term these diverse cross-border relationships and interactions 'transnational linkages'. Wieczorek (2018; 207) notes that such linkages are "the means for actors to complement lacking resources and constitute thereby a major source of socio-technical innovation".

A transnational perspective does not suggest that national, regional or local scales are undermined. Rather the associated "national innovation policies and institutions remain highly significant due to various path dependencies and their key role in harnessing the power of transnational linkages to create new paths" (Wieczorek, 2018; 207). While transition scholars have identified the importance of transnational linkages and global-local relationships (Sengers and Raven, 2015, Manning and Reinecke, 2016), Hansen et al. (2018b; 199) state that "it is less clear how these linkages operate and function with regard to influencing key niche and regime processes". As a way forward, Wieczorek (2018; 212) emphasizes the need to further unpack the 'exogenous' character and impact of landscape factors, focusing in particular on the question of "how and why actors deal with various developments? Do they actively mobilize them [landscape] to support their work on alternative niches? What strategies are deployed and do they differ per context? And how can historical developments be harnessed to motivate shifts to sustainability?"

Moreover, with a basis in earlier calls in the literature (Genus and Coles, 2008, Smith et al., 2010), recent contributions have also begun to devote more attention to improving the understanding of agency and power in transitions (Lawhon and Murphy, 2012, Avelino and Wittmayer, 2016, Wittmayer et al., 2017), as well as the political aspects of transition processes (Meadowcroft, 2011, Avelino et al., 2016). These contributions have raised a question about whether the development of 'benign' niches automatically results in human co-benefits and social equity (Baker, 2012, Swilling et al., 2016). Further, Feola (2019) highlights the elusive nature of the landscape and the failure of the framework to critically engage with analysis of larger forces, such as capitalism, which are often taken for granted. Recent contributions have thus been

aimed at developing an improved understanding of how landscape forces, such as globalization and privatization, are manifested through actors' behavior.

The following section discusses recent theoretical debates in the literature with regard to actors, agency and politics of transitions, which are of specific interest to this thesis.

## 2.3. Actors, agency and politics in sustainability transitions

### 2.3.1. Early conceptualization of actors and agency in the MLP

Early works on socio-technical transitions foregrounded the importance of interactions between multiple levels, characterized by MLP as niche-innovations, regimes, and exogenous landscape. Transitions, defined by regime change, come about through the interplay between dynamics at these three levels (Geels, 2006). Actors play a crucial role across these levels in the transition process since transitions are understood as involving a broad range of actors (Rotmans and Loorbach, 2010). Here, we focus on how agency was conventionally conceptualized across the regime, niche and landscape level.

According to Geels (2002b), socio-technical regimes are characterized by multiple interlinked developments related to technology, regulations, infrastructure, cultural meanings and user preferences. Such a structural perspective, however, does not offer primacy to actors and agency (Geels, 2005b). Actors form the actual linkages, steer developments and play a vital role in regime transformation (Smith et al., 2005). Further, Geels mobilizes ideas from 'structuration theory' (Giddens, 1984) and 'bounded rationality' (Simon, 1972) to explain the role of agency in MLP. As he sees it, actors act in self-interest and in strategic ways to achieve their goals (Geels, 2005c, Geels and Schot, 2007). Furthermore, actors "interact (struggle, have economic transactions, form alliances, exercise power, negotiate) within the constraints and opportunities of existing structures, while simultaneously acting upon and restructuring these systems" (Geels, 2005c; 12).

Regime actors are broadly identified as incumbents, engineers, firms, suppliers, public authorities, research institutes, venture capital firms and advocacy groups. The regime concept is indeed developed around the understanding that actors create, reproduce, and maintain the elements forming a socio-technical system by providing stability. For instance, they do so by exercising influence or by vested interest aimed at maintaining the status quo among incumbent actors (Geels, 2005b). For regime stability, it is important that the multiple actors are aligned and coordinated (Geels, 2005b). To generalize their actions, transitions scholars focused on understanding three types of actor-related patterns, specifically firm-related (market struggles), user and culture related (preferences), and policy-related (regulations) (Geels, 2005b).

Agency is interpreted as the ability to intervene and make a difference over the course of events, including the exercise of political, economic and institutional power (Smith et al., 2005). The socio-technical

perspective, using MLP as a theoretical framework, focuses on the emergence and stabilization of dominant patterns through evolutionary processes, and interactions among heterogeneous actors play a crucial role, in which interpretations and expectations take shape (Grin et al., 2011). According to this perspective, agency influences "whether, how, and how fast a particular transition will develop" (Grin et al., 2011; 79). Whether the economies transition to a more sustainable society or not crucially pivots on the strategic agency involved in "promoting niche experiments, realizing regime changes", shaping innovative policies, and triggering institutional change, among other such intentional activities (Grin et al., 2011).

From a governance perspective (TM), much of the transition dynamics take place between niche and regime levels and multiple agents seek to exert influence on a transition. The governance approach to transitions (Smith et al., 2005) provides insights on agency and power in regime transformations, particularly through an analysis of multi-actor interests (or distributed agency), resource dependency and expectations (Grin et al., 2010). It concerns itself with the questions of whether there is competition for strategic agency and whether such competing agents are able to align. Common to the MLP and the governance perspective is that "actors understand the opportunities and constraints implied by their immediate context, and are able expand their agency by positioning themselves wider in space and time" (Grin et al., 2010; 5).

With regard to actor categories, actors in transitions frameworks were loosely categorized as niche actors, such as innovators, experimenters or hero-entrepreneurs; regime actors, including regulators, policymakers, incumbent firms and strategists; and outsiders, such as community representatives (Brown et al., 2013). At the niche level, the agency of niche actors was seen confined to "improvise, engage in experiments… [and] try to align heterogeneous elements in [niche] construction processes" (Geels, 2006; 1004). Smith et al. (2005), however, argued that niche actors may disagree and struggle with contrasting visions and expectations, and form coalitions to push for their interests. Consequently, niche actors may not only cooperate, but can also actively compete with each other, as pointed out by Romijn and Caniëls (2011).

Also, Geels (2004) adopted an institutional perspective, developed further in later works by Fuenfschilling and Truffer (2014), in which stability and change were conceptualized as different levels of institutionalization (similar to the structural levels of the MLP). According to this perspective, the agency of niche actors was associated with the strengthening and increasing stability of a given niche by their involvement in developing norms, practices and gaining legitimacy. As such, niche actors were considered as 'system builders' that engage in specific institutional work (Lawrence and Suddaby, 2006) to strengthen innovation systems around emerging technologies (Ockwell and Byrne, 2015), such as in the case of the mini-grid niche in Kenya (Pedersen and Nygaard, 2018). These recent studies have contributed to advancing the understanding of agency of niche actors as mainly conceptualized in the form of how protective spaces are created, shielded, nurtured and empowered (Smith and Raven, 2012, Smith and Raven, 2010), and how niches compete and transform incumbent regimes (Smith, 2007).

As mentioned previously, the landscape concept is associated with wider exogenous forces operating outside of regime and niches, although potentially still influencing them. The MLP framework does not identify and define actors at the landscape level (Fischer and Newig, 2016). Thus, while landscape forces contribute to shaping the behavior and actions of niche and regime actors, these actors have little direct influence on the landscape (Geels and Schot, 2007, Geels, 2005a). Actors are seen as embedded within landscape forces, "but at the same time reproduce ... [landscape forces] through their actions" (Geels and Schot, 2007; 403).

In much of the early works in MLP, niche-regime actor interactions were framed in a dichotomous way. Niche actors were conceptualized as enabling transitions while existing regime actors (or incumbents) were conceptualized as resisting or opposing transitions (Geels and Schot, 2007, Geels, 2002a, Geels, 2005c). This understanding led to a 'David versus Goliath' perception with niche actors portrayed as heroes and existing regimes as villains. While being important, such a formulation can become reductionist in understanding actors' behavior. It can also oversimplify the analysis by assigning business and government actors to the regime and equating civil society with niche agency (Avelino et al., 2016). In addition, much of the tacit agency and institutional power gets concentrated in the regime (such as rules and resources) and agency for change is primarily attributed to the 'niche'. Later works in MLP, however, conceptualize actors, agency and power relations beyond this dichotomy of winners vis-à-vis losers.

### 2.3.2. Evolved conceptualization of actors and agency in the MLP

Several scholars have highlighted the weaknesses in conceptualizing agency in the MLP framework, and elaborated on its limited attention to conflicting interests and politics in transitions processes (Farla et al., 2012, Genus and Coles, 2008, Smith et al., 2005). In addition, certain types of agency have been less developed within the literature, such as rational choices, power struggles and cultural-discursive activities (Geels, 2010, Geels, 2011). Further, the MLP framework has been criticized for its lack of attention to micro-level analysis as well as insufficient conceptualization of actor strategies (Markard and Truffer, 2008a).

In exploring these gaps, transition scholars have increasingly engaged with developing an improved understanding of how actors mobilize, employ strategies and make use of resources at different levels. These efforts include research on the role of social movements and civil society actors in their struggle with the incumbent regime actors (Penna and Geels, 2012), the strategic build-up of network-level resources by actors for transition processes (Musiolik, 2012), and the creative role of policymakers and use of structural and relational resources in transition processes (Quitzau et al., 2012). Additionally, recent research has focused in particular on actor expectations in terms of how they guide actor strategies (Budde et al., 2012),

the roles they play in technology selection (Bakker et al., 2012), and collective expectations and their impact on the direction and speed of transition processes (Konrad et al., 2012).

Further, Farla et al. (2012) have shed light on how actors engage with structural changes, i.e. how they create or modify institutional and organizational structures, and develop a supportive environment for niche development. They stress that "if we understand the struggles of actors with competing interests…we will better be able to assess the conditions for sustainability transitions to materialize" (Farla et al., 2012; 996). Hence, while most scholars previously focused explicitly on niche-level actors and processes, recent research has investigated the many defensive strategies employed by powerful regime actors aimed at preventing change (Smink et al., 2015c, Smink et al., 2015a, Geels, 2014). In doing so, various studies have shown how the agency of regime actors plays an important role in transitions, thereby highlighting the need to focus on actor-oriented analysis. Taking this idea further, Späth et al. (2016; 2) has argued in the context of the automobile industry, that incumbent actors have to eventually adapt to the changing circumstances, and they may attempt to "shape and redefine transitions in a way which allows them to retain a central market position". In other words, incumbents can also support specific niche-activities as part of their adaptation strategy (see also Hansen and Coenen, 2017).

Unlike early works in the transitions' literature, which suggested that landscape "provides no room for agency; actors can only respond to it" (Raven et al., 2012; 67), Geels et al. (2016a) find that the influence of landscape developments indeed depends on the interpretation and mobilization of actors. The influence also depends on the extent to which specific actors, such as multilateral institutions and development organizations, instantiate landscape forces in particular localities. Advancing this approach, Sergi et al. (2018) demonstrated that landscape actors, including the United Nations (UN), World Bank, and other multilateral donor agencies, significantly influenced both the off-grid solar PV niche as well as the dominant grid-investments regime in Kenya and Tanzania.

Many early works focused on the "accomplishments and capacities of individual actors – such as 'policymakers', 'consumers', or 'firm owners – to act as levers for transitions" (Avelino and Wittmayer, 2016; 630). They were found to have acted as 'prime movers' (Jacobsson and Johnson, 2000), 'frontrunners' (Rotmans and Loorbach, 2010), 'policy entrepreneurs' (Brown et al., 2013) or 'intermediaries' (Hargreaves et al., 2013). Cautioning against individual valorization of certain actors (e.g. the stereotype of a hero-entrepreneur) which earlier works indulged in, Farla et al. (2012) have argued that there is never only one type of actor involved and highlight the importance of larger actor networks, social movements and collective action. The literature has thus increasingly moved toward an understanding in which agency and power are intimately related topics. In a more recent account, Geels (2014) incorporates political economy perspectives with regime 'resistance', thereby expanding the understanding of power within the MLP framework. On a related note, Avelino and Wittmayer (2016) have also cautioned against

aggregating actors in an arbitrary way (a tendency observed in earlier works) and attributing power to specific actor categories. They have also argued against the tendency to equate power or 'regime dynamics' with particular actors, which overlooked *shifting* power dynamics.

Avelino and Wittmayer (2016) have developed a Multi actor Perspective (MaP) to complement MLP analysis. They have paid close attention to disaggregating the categories of the 'state', the 'market', the 'community' and the 'third sector' (both at an individual and organizational level), unpacking the spectrum of logics with which they operate, and explain the power dynamics among multiple actors. Through a number of works – Avelino and Rotmans (2009), Avelino (2011), Avelino and Wittmayer (2016), Avelino et al. (2016), which in turn have built on a previous body of works (Grin et al., 2010, Kern, 2011, Späth and Rohracher, 2010, Geels, 2014, Meadowcroft, 2011, Smith and Stirling, 2010) – these transition scholars have conceptualized 'power' in transition processes, brought nuance into simplified associations of 'niche' and 'regime' actors, and developed a typology for different kinds of power exercised by actors and its implications thereof. These works have identified sustainability transitions as being inherently political, and some have even theorized the regime as a socio-political constellation embedded in economic structures (Swilling et al., 2016).

While some scholars have drawn on complementary frameworks mainly from political science, such as political economy, social justice, or political coalitions (Baker et al., 2014, Power et al., 2016, Hess, 2014, Geels et al., 2016a), others have based their work on relational approaches, such as practice theory and actor-network theory (Chilvers and Longhurst, 2016, Pel, 2016). There have also been significant overlaps in actor-oriented studies and institutional theories, such as institutional entrepreneurship, institutional work and institutional logics, which are now being incorporated into transitions research (Fuenfschilling and Truffer, 2014, Sergi et al., 2018, Jolly, 2016). Such frameworks highlight that niche actors engage in purposive action in an effort to generate change, both individually and collectively (Brown et al., 2013, Fuenfschilling and Truffer, 2014, Fuenfschilling and Truffer, 2016). As the MLP framework is continuously evolving, more recent publications place less emphasis on structuration theory and more on frameworks such as institutional theory and political economy. Based on the above discussion, Table 2 provides a summary of the conventional and more recent perspectives on actors and agency in the MLP framework.

**Table 2: An overview of the older and newer conceptualizations of agency in the MLP literature**

| MLP levels | Old perspective | New perspective |
|---|---|---|
| Regime | ▪ Regime actors (incumbents) can only resist and prevent change, and have vested interests in doing so<br>▪ Regime actors can provide temporary shielding of niches<br>▪ Regime actors are seen as powerful. They are deeply embedded within - and reinforce existing - institutional structures | ▪ Regime actors can resist, stimulate and engage in niche development<br>▪ Regime actors can bring about radical change<br>▪ Regime actors may rewrite the rules and norms for vested interest |
| Niche | ▪ Niche actors act in a benign, democratic and cooperative manner<br>▪ Niche actors are not powerful. They are experimenters, initiators, and are in the process of mobilizing support<br>▪ Niche actors are hopeful opportunists<br>▪ Niche actors are those that bring about radical novel innovations | ▪ Niche actors may or may not cooperate but they may compete and pursue conflict<br>▪ An individual type of hero niche actor may not exist<br>▪ Niche actors are strong advocates with powerful lobby groups<br>▪ Some niche actors may exert more power than others |
| Landscape | ▪ Landscape is a non-actor concept<br>▪ Landscape is an exogenous environment that is not influenced by actors' behavior | ▪ Landscape actors may refer to multinational firms, donor agencies, and international NGOs<br>▪ Landscape actors instantiate and directly reinforce wider processes e.g. globalization, privatization and neo-liberalization<br>▪ They tend to exercise structural and disciplinary power. |

#Source: based on the above review

### 2.4. Furthering actor-oriented perspectives in MLP

This thesis is embedded within the MLP framework in terms of employing its key concepts, but aims at contributing to furthering this literature with regard to the importance of actors, agency and politics of sustainability transitions. In this section, I highlight the rationale behind employing the MLP framework, and elaborate on how this thesis advances actor-oriented conceptualizations in sustainability transitions.

As highlighted in the previous section, recent research in transition studies has attempted to integrate a number of actor-oriented perspectives into the MLP framework in order to expand its explanatory power of agency in transitions, through frameworks such as institutional entrepreneurship, institutional work and logics, power theories, political economy etc. This thesis is a contribution towards advancing the actor-oriented approaches within the MLP framework, and the sustainability transitions literature more broadly. It analyzes the strategies and activities of multi-actors operating within and modifying the institutional and political structures. Articles 1 and 4 conceptualize the development of solar PV in Uganda (as an off-grid rural electrification regime) and Rwanda (as a utility-scale electrification niche), whereas Articles 2 and 3 focus on the socio-political processes underlying the transitions in Uganda (through policy translation) and Kenya (through encounters and agency struggles).

The heuristic and analytical properties of the MLP framework are well suited to analyze the key actor-drivers and determinants influencing technology diffusion and uptake. The MLP framework is considered appropriate for a number of reasons. First, the MLPs analytical possibilities cater to a better understanding of *how* transitions unfold over time, through narratives describing causal links of niche-regime-landscape interactions (Geels, 2010). Second, due to the meso-level focus, this framework allows for situating various dynamics within broader institutional conditions such as policies, social norms, market dynamics and supporting infrastructures (Geels, 2010, Verbong and Geels, 2010). This multidimensionality entails consideration of a range of actors and processes at the three levels that influence diffusion. Most recently, MLP recognizes that actors have varying motives, interests and agendas, which entail contestations, conflicts and power dynamics (Geels, 2014). Third, the main strength of conceptualizing emerging technologies as a niche development process lies in the explanatory power of analyzing the stability of a niche, in relation to the relative instability of the existing regime (Markard and Truffer, 2008b). Fourth, MLP allows for context-specific layered analysis. MLP is a process theory as its foundation ontology, structuralism, essentially focuses on developments, encounters and activities over time, and it aligns with the interpretivist or constructivist ontologies (Geels, 2010, Grin et al., 2010). The MLP framework allows engagement with the complexities and politics of sustainability transitions, as opposed to a prescriptive orientation of SNM and TM (Loorbach and Rotmans, 2006). Lastly, the framework has been expanded conceptually and analytically, which allows for greater consideration and scope for exploring and advancing actor and agency-oriented perspectives.

This thesis draws inspiration from transnational linkages and multi-scalar dynamics (Sengers and Raven, 2015, Wieczorek et al., 2015) and actors and politics in transitions (Avelino and Wittmayer, 2016, Avelino et al., 2016). It makes use of transition frameworks to explore agency by nuancing simplified actor categories (i.e. niche, regime and landscape), identifying the underlying motives and agendas of multi-actors, and by explicitly unraveling the micro-politics underpinning various kinds of agency in the transition process. In addition, this thesis adds a further dimension by focusing on transnational actors and how they instantiate landscape forces through activities and ideologies on-the-ground. It highlights the interplay of agency of transnational and local actors, which is pertinent in the highly globalized systems and energy regimes, but has received limited attention in the literature. In doing so, the thesis explores strategic and intentional actions, locates the relative position and influence exerted by specific transnational actors, and explores the political implications of sustainability transitions.

Article 1 adopts a 'transnational' perspective (Wieczorek et al., 2015, Wieczorek, 2018) to analyze the development of the off-grid solar PV regime in Uganda. It identifies how transnational actors mobilize key resources (finance, technology, knowledge) to enable the transition. Article 2 adopts an agency-centric 'policy translation' perspective (Mukhtarov, 2014, Mukhtarov et al., 2013) to analyze the process by which actors modify and localize imported policies, thereby accelerating the transition to utility-scale solar PV in

Uganda. Article 3 adopts the actor-centered concept of 'frictional encounters' (Lampert and Mohan, 2014) to study the micro-politics and actor struggles as they unfold between Chinese and Kenyan actors during the development process of a utility-scale solar PV niche project. Article 4 integrates the MLP framework with a 'political economy' perspective (Newell and Phillips, 2016) to analyze the utility-scale solar PV niche against the background of the niche-regime-landscape dynamics.

## 3. Research Methodology

### 3.1. Research Paradigm

This thesis draws inspiration from the interpretative research paradigm (Yanow and Schwartz-Shea, 2006), which assumes that there are multiple realities and that people create and associate their own subjective meanings as they interact with the world. In contrast to the assumptions of positivist science, according to the interpretivists, knowledge acquired is socially constructed and perceived (Hudson and Ozanne, 1988, Carson et al., 2001, Bryman, 2008). Interpretivist research is characterized by a *continually evolving* and *context-specific* research design, thereby allowing the researcher flexibility to capture meanings and human interactions (Hudson and Ozanne, 1988). Furthermore, interpretivist researcher enters the field with a priori understanding and insight, but remains open to new knowledge. For an interpretivist researcher it is important to understand motives, meanings, reasons and other subjective experiences which are time and context bound (Hudson and Ozanne, 1988, Neuman, 2007). This approach views actors as actively creating and shaping their environment, and not merely being acted upon by outside influences (Hudson and Ozanne, 1988).

While the positivistic tradition tends to judge the quality of a scientific study in terms of 'falsifiability', 'internal and external validity', and 'generalizability', the interpretive tradition refers to different scientific evaluation criteria, including notions such as 'thick description', 'reflexivity', and 'triangulation' (Geertz, 1973, Schwartz-Shea, 2006). Thick description refers to "an observer not just describing a particular behavior, but also the social context of that behavior, so that the behavior attains a meaning that can also be understood and interpreted" (Avelino, 2011). Reflexivity, emphasized in both interpretive research and transition studies, is acknowledging the relation between interpretation, the object of observation and the participant (researcher), and reflecting on one's role in the research process. Triangulation is an approach to validate findings through 'trustworthiness' and 'multidimensionality' in a research project, by employing a diversity of means or sources to understand the phenomena under study (Schwartz-Shea, 2006, Meijer et al., 2002). In this thesis, I make use of thick descriptions and reflections, combine multiple methods of data collection and analysis, and draw on different theories and approaches for the articles.

The analysis of actors in this thesis draws broadly on the ontological assumptions based on interpretivism. There are similarities in the ontological assumptions of the MLP framework (structuralism) and the actor-

centered perspectives (interpretivism) employed by the individual articles. Geels (2010) states that both structuralism and interpretivism perceive actors as 'continuously engaged in sense-making'. Interpretivism focuses on the shared meanings of reality as co-constructed and interpreted by people, through conversations, debates, negotiations and learning processes. For instance, Gidden's structuration theory (Giddens, 1984) is also an interpretive approach that considers actors as "knowledgeable agents who actively draw on rules and resources in concrete interactions". According to the interpretivist perspective, sustainability transitions gain pace when actors can share similar values, meanings, develop common agreements and be open to learning, despite disagreements and contestations (Geels, 2010).

### 3.2. Research Design

Proceeding from the interpretivist paradigm, this thesis aims to unravel the actor-dynamics in the transition to solar PV in East Africa by means of qualitative research and case study design. With a basis in context-sensitive and process-related questions, a qualitative case study approach that takes motivations and strategies of heterogenous actors into account is considered appropriate in this thesis (Garud and Karnøe, 2003). The analyzed actors operate in a complex and uncertain political and institutional environment. A qualitative research approach is particularly suitable for studying process-related questions i.e. the *how* questions, and for conducting in-depth analysis of poorly understood phenomena (Eisenhardt and Graebner, 2007, Langley and Abdallah, 2011).

Lund and Nielsen (2014) describe case studies as "an edited chunk of empirical reality where certain features are marked out, emphasized, and privileged while others recede into the background". A case study approach is useful as it allows space for nuance and flexibility in the data collection and in forming contextualized judgements by researchers during the research process, while being open to unanticipated insights (Yin, 2009). Case studies also serve the purpose of testing existing theories and of developing new theoretical insights on the basis of empirical data with regard to particular phenomena (Stake, 1995, Flyvbjerg, 2006).

There are multiple definitions of what constitutes case study research, single case study and multi-case study. According to Stake (2006), the 'case' does not have any objective existence but is, rather, determined by the purpose of the study. For this thesis, I employ Stake's instrumental case approach and identify multi-case studies as investigations of a specific phenomenon at various locales. In this case, the phenomenon under focus is the transition to solar PV in East Africa. This thesis is thus aimed at contributing to an improved understanding of this phenomenon across different socio-political contexts, but does not employ a comparative approach. Instead of identifying the variables which could be used for comparison, and focusing on similarities and differences, the attempt is to illustrate the most important aspects of the multi-cases in specific national contexts. Nonetheless, the research still provides opportunities to explore commonalities and variations across the cases, some of which are discussed in Section 5 of the synopsis.

### 3.3. Case Selection Strategy

The case of solar PV was selected on the basis of its increasing significance in East Africa (REN21, 2016a, GOGLA et al., 2018), and prominence as a theoretically interesting transition phenomenon. The research conducted in this thesis consists of four multi-cases: (i) off-grid solar PV development in Uganda; (ii) policy translation mechanisms for renewable energy in Uganda; (iii) large-scale solar PV in Kenya; and (iv) large-scale solar PV in Rwanda. Methodologically, the thesis focuses on analysis at a national level and the research carried out is aimed at being as context-specific as possible. The selection of these multi-cases was based on specific empirical observations made during the desk-research stage and the pilot field visit. In addition, they were also based on practical considerations, such as adequate archival data, relevant contacts and access to stakeholders for semi-structured interviews. Thus, case selection was made based on the empirical context, relevance for advancing theoretical debates and opportunities for generating new knowledge, and availability and access to data. The following section provides detailed insights into this.

#### 3.3.1. Empirical context

Increasing pressure for change within the energy sector worldwide (SE4ALL, 2018) means that resources are more than ever being directed towards renewable energy systems. In SSA, the need for such an energy transition is critical due to the low electrification rates. The household electrification rate in SSA is reportedly the lowest in the world (Adegoke, 2018). The energy transition in SSA not only means increased diffusion of new renewables (such as solar PV), but also greater investments in decentralized (off-grid and mini-grid) systems to complement grid connections. This is particularly pertinent in East Africa, for despite being one of the economically fastest growing regions in SSA, a majority of its population is rural (nearly 80%) and the electricity access only at around 22%, well below the average electrification rate of 33.5% for SSA as a whole (REN21, 2016a). East African countries, such as Uganda, Kenya and Rwanda, are primarily dependent on hydropower and thermal power for their electricity needs, making them vulnerable, especially to droughts and oil price fluctuations.

Against this background, solar PV has played an increasingly important role in providing basic energy access especially to rural populations, and diversifying the energy mix. Solar PV systems have been diffused across multiple scales including off-grid PV at household and institutional level, mini-grids for households and small-scale enterprises, and utility-scale PV systems connected to the national grid. The increased deployment and uptake of PV systems has been enabled by declining costs of solar equipment, improved technological efficiency, and conducive enabling environment, among others (Hansen et al., 2015). With my research, I contribute to the policy debates surrounding the energy challenge in Kenya, Uganda and Rwanda. I have chosen this geographic focus deliberately, as all three countries are well endowed with solar energy, and have already been adopting and diffusing solar PV at a significant scale.

East Africa is reported to have "one of the highest potentials for solar power globally" (REN21, 2016a; 36) and it has progressed most rapidly in recent years (Hansen et al., 2015). Over the past five years, the East African countries, especially Kenya, Tanzania and Uganda have risen to be among the top five (5) countries for sales of off-grid solar (OGS) systems in the world (Ren21, 2018, Ren21, 2017, Ren21, 2016b, Ondraczek, 2013). East Africa accounts for nearly half of all sales of OGS in Africa, with Kenya and Tanzania leading the market (REN21, 2016a). Further, countries such as Uganda and Ethiopia have growing markets with substantial progress and high penetration of PV products. For instance, the cumulative off-grid PV sales in Uganda between 2014 and 2016 were 2 million units, an annual growth of 135% (GOGLA et al., 2018). Previously, research has tended to focus on the diffusion of off-grid solar PV systems mainly in Kenya and Tanzania (see e.g. (Byrne, 2011, Ondraczek, 2013, Rolffs et al., 2015, Byrne et al., 2018, Ahlborg and Hammar, 2014). There is limited understanding of how the Ugandan off-grid solar PV market has grown historically as well as in the recent years, which I discuss in Article 1.

Further, in the last five to seven years, a new market for utility-scale grid-connected PV plants has emerged in SSA as PV has moved towards 'grid parity' (Bazilian et al., 2013). Currently, a cumulative total of 83.5 MW capacity of PV-based generation is installed in Rwanda, Uganda and Kenya, with additional projects in the pipeline. However, there is currently a limited understanding of how these new developments in the utility-scale solar PV segment are taking place (Hansen et al., 2014). The first grid-scale solar PV project (8.5 MW capacity) in East Africa was installed in Rwanda in 2014 and it was also the most quickly-built PV plant in SSA, as a result of various exogenous and endogenous pressures, which I discuss in Article 4. Given the unique socio-political context within which the solar PV plant developed, this made for an interesting exploratory case. In a similar way, the first utility-scale solar PV project (55 MW capacity) in Kenya is developed by Chinese state enterprise, using technology supplied by China, and loan provided by the Chinese Exim bank, which I discuss in Article 3. Further, the process by which renewable energy policies were transferred and adapted to Ugandan context, by a coalition of actors is elaborated in Article 2. This policy led to the development of two utility-scale solar PV projects in Uganda (totaling 20 MW).

### 3.3.2. Theoretical relevance

Energy transitions in the global south present an important theoretical avenue to validate general notions about sustainability transitions, and develop newer concepts. The transitions to solar PV in East Africa are enabled and accompanied by development agencies, and a range of other transnational actors, which are typically considered 'exogenous' to the national-level systems innovation in OECD contexts. However, transition scholars have recently highlighted the increasingly important role such external actors play. For instance, Wieczorek (2018) in particular emphasizes the need to further unpack the 'exogenous' character and impact of landscape factors.

In off-grid solar PV in East Africa, there has been a marked shift from government and donor-led growth to an increasingly private-sector led one, catering to both business value and social good (Nygaard et al., 2016, Hansen et al., 2015). And in the large-scale solar segment, multilateral development banks, aid agencies, and private sector interventions from OECD and non-OECD countries (including China and Middle Eastern countries) are being witnessed. These developments point to a multitude of new actors, transnational resource flows (North-South and South-South), newer forms of agency being exercised, shifting roles of the traditional actors, and changing relational and political dynamics. The analytical emphasis of this thesis is therefore on the role of transnational actors and linkages, and the interplay of transnational and local agency and politics in enabling transitions by employing the MLP perspective. Illuminating how exactly these developments are proceeding allows insights into how international development agendas shape sustainability transitions, how actors mobilize landscape forces to support alternative niches, and what strategies are deployed to promote transitions. Furthermore, from a theoretical point of view, exploring how the transitions to solar PV in East Africa are taking place enables insights into the 'shape and size' of developments (Hansen et al., 2018a), and how the emerging political narratives both reflect and direct them. It contributes to furthering existing works on agency, politics, and critical social perspectives within sustainability transitions literature (Newell and Phillips, 2016, Avelino and Wittmayer, 2016, Ockwell et al., 2018, Avelino et al., 2016).

### 3.4. Data Collection, Methods and Analysis

#### 3.4.1. Research methods and data collection process

The research methods and analytical procedures used in the development of individual articles are described briefly in Section 4 and detailed in the articles. Here, I focus on presenting the overall elements of the research process employed in the development of the thesis, including data collection and analytical procedures.

The thesis concerns itself with the main drivers, contextual factors, and influencing mechanisms at play for solar PV transition in Uganda, Kenya and Rwanda. The data collection method consisted of qualitative, in-depth semi-structured interviews combined with observations at field sites and focus group discussions, and document reviews of archival material. In addition, supplementary data were generated from informal discussions, meetings, and insights obtained during conferences in Uganda and Nairobi. Primary data consisted of transcribed interviews and notes from non-recorded interviews, as well as field notes documenting observations, reflections and thoughts.

Overall, the data collection process proceeded as follows. First, the secondary literature was reviewed, including scientific articles, books, doctoral theses, reports published in grey literature, surveys and government documents (see Annex VI). This contributed to developing an overview of the broad trends in terms of market dynamics, nature of developments, the topics which have already been researched and the

issues which have hitherto not been addressed. This was followed by the scoping phase, in which a pilot field visit was undertaken in January 2017, for two weeks in Uganda and one week in Kenya. The visit enabled familiarizing with the case-study countries, establishing contacts, gathering preliminary data, and identifying relevant experts in the field by a snowballing method. The scoping phase also enabled the identification of possibilities for accessing and collecting data and documents.

During the visit, a broad range of relevant stakeholders, including development aid agencies, government authorities and researchers were interviewed in order to determine the relevance of some of the preliminary research ideas and themes. In total, sixteen preliminary interviews or discussions were conducted in Uganda, and seven in Kenya (see Annex I). The objective was also to explore potentially new areas of interest, and test interview guides and techniques. In addition, the visit allowed closer consideration on the timeline and planning of research activities, including practical considerations such as language and access to field sites.

A second phase of literature review was undertaken to incorporate some of the insights gained during the preliminary data collection. A more evolved interview guide was prepared to better suit the contextual specifics. The interview guide prepared prior to the fieldwork aimed at operationalizing the analytical concepts (such as niche, regime, path dependency, institutional barriers, external pressures, etc.), translating them to make the questions less theoretical, and tailoring them further for individual interviewees. The majority of primary fieldwork was conducted over a period of six months between July and December 2017, of which four months were spent in Uganda, one month in Kenya and one month in Rwanda. While clear ideas were developed for the research in Uganda and Kenya, the fieldwork conducted in Rwanda was approached without any structured questions but more as an exploration. In total, sixty-four interviews were conducted in Uganda, fifteen interviews were conducted in Kenya, and nine interviews were conducted in Rwanda (see Annex II).

Specifically, for Article 4, a majority of the data was collected by the first author, including 12 semi-structured interviews conducted in June and July 2016. While I was not involved in this data collection, I conducted fieldwork in Rwanda in November 2017, undertook a visit to the Rwamagana solar plant, and conducted some interviews with the same set of interviewees in order to validate the findings. I also conducted additional interviews for triangulation purposes. Hence, for this article, I was mainly involved in developing the theoretical framework, linking empirical analysis with the analytical themes, strengthening key arguments, and deriving broader findings and conclusions.

The interviews I conducted were designed to be "conversation[s] with a purpose" (Mason, 2002). According to (Yin, 2011; 311), purposive sampling refers to "the selection of participants or sources of data to be used in a study, based on their anticipated richness and relevance of information in relation to the study's research questions". The interviewees were selected by employing stratified sampling, through a

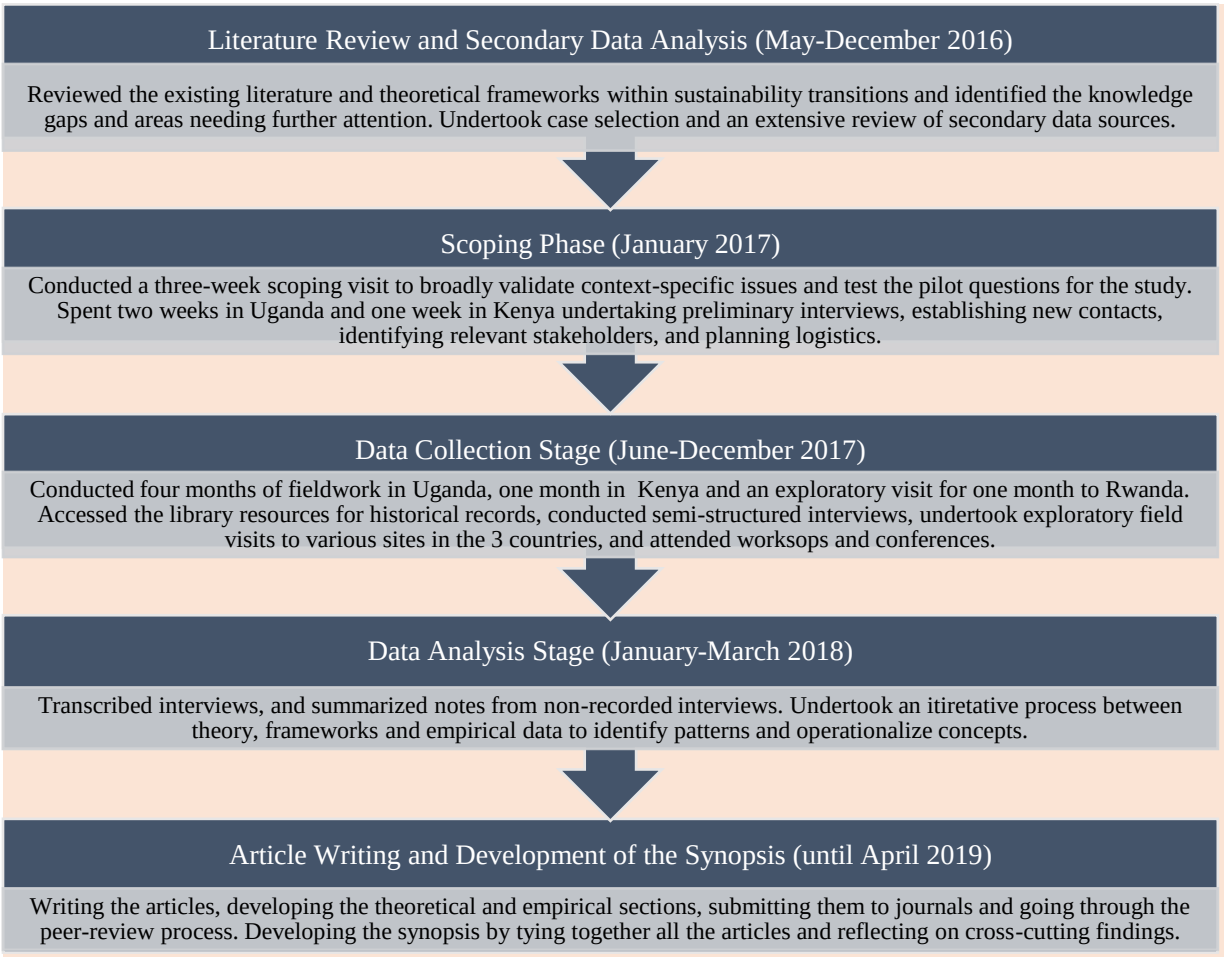
mix of snowball method and purposive sampling (Atkinson and Flint, 2001). The snowball sampling was useful to identify and understand a broad range of actors operating in the field, and the purposive sampling helped to specifically interview those playing critical irreplaceable roles (such as the policy actors in Article 2, and project developers in Article 3 and 4).

The interviews were conducted with representatives from Ministry of Energy, Electricity Regulatory Authority, the Rural Electrification Agency, and representatives from developing aid agencies including GIZ, USAID, KfW and DfID. Additional set of interviews were conducted with private sector representatives, including firm owners, branch managers, marketing managers and staff members from various NGOs, consultancy firms, and research institutes. The interviews lasted from thirty minutes to two hours, and were digitally recorded when permission was granted. Many interviews were captured through notes taken during the interview and elaborated further through extended field notes. In some cases, follow-up interviews were conducted with the interviewees to seek clarification or additional information pertaining to specific topics.

Overall, semi-structured interviews were useful for obtaining nuanced and deep insights into the actions of different actors, while also offering flexibility to explore new insights. Through interviews, it was possible to obtain important accounts with regard to the individual motivations, personalized accounts of historical events, and the rationales behind decision-making processes, which cannot be easily found in archival data. In addition, the focus was also on unraveling points of conflicts, negotiations, and instances of collective action, and the structural factors influencing such behavior.

An overview of the research process has been provided in Figure 2.

**Figure 2: Overview of the Research Process**




The data collection process did entail challenges, many of which are highlighted in the individual articles. Broadly, they pertained to substantial delays in obtaining access to data and interviewees, or not gaining access at all. In some instances, the data did not exist (such as records of PV sales), while in others, changes in the political climate (Kenya's unexpected repeat election) affected the availability of interviewees.

In addition to the interviews, field visits were conducted to solar PV project sites (off-grid, mini-grid and large-scale grid) across the three countries. Further, visits to various private sector companies and their field branches were also undertaken. Also, semi-formal discussions were conducted with a broad range of stakeholders at academic and industry events such as the Green Growth Workshop in Kampala, Future Energy Uganda Conference, and Future Energy East Africa Conference in Kampala and Nairobi. The venues for such events served as field sites (Lampel and Meyer, 2008) where observations could be made on the actor dynamics, networks, the sessions in which stakeholders were participating more actively, and the debates which were being highlighted. These interactions contributed to forming an in-depth

understanding of the empirical context in question, the relevant stakeholders, their interests, and the broader political economy issues.

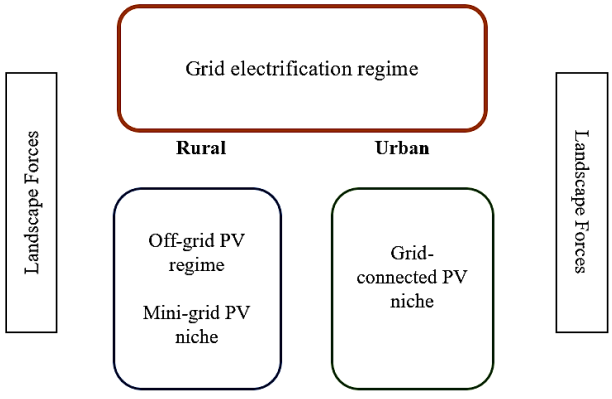
### 3.4.2. Operationalizing key concepts

A crucial process during the interview and data collection was the constant engagement with – and translation of – the analytical concepts of interest into interview guide questions. This process entailed identifying how the literature has defined key concepts, followed by what these concepts meant in relation to the phenomenon under study. Subsequently, the questions were formulated so as to convey the meaning without using theoretical terms.

It was difficult to delineate between 'niche' and 'regime' for Article 1. Only 5% of the rural population in Uganda is connected by grid. The alternative off-grid PV is competitive and equally widespread (catering also to 5% of the rural population), but received tax exemptions. This was neither a protective niche nor a dominant regime. However, off-grid solar PV has gathered significant momentum to become recognized as an important source of energy provision, especially for rural electrification, to address the low levels of energy access. The article identified it as a co-existing regime instead, along with the grid regime.

In Article 4, the niche, regime and landscape concept were operationalized as is, guided by the literature (see Annex III). Utility-scale PV systems (or grid-connected PV) have emerged mainly over the past five years, and hence identified as a niche. However, this niche is comprised of an isolated PV project, driven by private developers, and development financial institutions, rather than the endogenous actors, as is typically the case with most studies in the literature. Figure 3 diagrammatically depicts the co-existence of regimes and niches.

**Figure 3: Hybrid socio-technical configurations with multiple regimes and niches**




*Source:* Authors own elaboration

Across all articles, the niche and regime dynamics were not necessarily framed in a dichotomous way (Geels, 2014). Instead, the regime was seen as hosting the new niche within its ambit, allowing multiple technological niches to co-exist, or for both heterogeneous regimes and niches to co-exist. The questions regarding niches focused on initiatives, projects, expectations, and political motives; while those regarding regimes focused on formal regulations, dominant actors, organizations, infrastructure etc. (Raven, 2007, Konrad et al., 2008). The landscape concept still followed a classical perspective as elaborated in the MLP, albeit attempts were made to pursue a more actor-oriented perspective. The 'landscape' concept was operationalized through the roles, motives, ideologies and practices of the transnational actors. The 'policy translation' concept in Article 2 was operationalized by identifying key actors, activities and strategies, while drawing on relevant literature (Stone, 2012, Mukhtarov, 2014). Interviewees were asked to reflect on the process, their interventions, and the roles of other actors to describe the points of disagreement and the basis on which pacts could be reached between the actors. The 'encounters' concepts in Article 3 was operationalized in line with the Sino-African literature (Lampert and Mohan, 2014, Scoones et al., 2013), by specifically focusing on the quality of interactions between the Chinese and African actors. Towards this end, the perceptions of the multiple actors were also gauged.

### 3.4.3. Analytical procedures

In all the articles, transcripts and notes were subjected to qualitative thematic analyses, which allows for systematic analysis of data using analytically informed coding scheme (Braun and Clarke, 2006, Braun et al., 2019). Thematic analysis allows the researcher to make sense of shared meanings and experiences. For both open coding and analysis, I used a combination of inductive and deductive approaches (starting with an inductive form and drawing on theories), and use themes to find analytical and empirical overlaps.

The broad steps followed for all the articles included familiarizing myself with the data (transcripts, notes and texts, and forming initial observations) and generating preliminary open codes to break-down and synthesize data (such as type of activities, roles played, collaboration, certain opinions, key statements etc.). In some cases, open coding for data was undertaken in smaller chunks. For instance, for Article 1, open coding was performed across and within different actor-categories, and also across three different phases, noting the broader patterns.

For Article 2, open coding was performed for individual key actors, but also at an aggregate level while searching for the themes and identifying overlaps with analytical themes. After generating the first set of open codes, these were repeated by further drilling down and obtaining a set of phrases, or words (such as 'capacity building activities') that also provided some analytical resonance. The first set of open codes across all articles explored the actor's interests or motivations, their roles, and activities (also see Annex IV and V).

Further, data from secondary literature and relevant documents was also used to find overlaps with the analytical categories. This led to a broader understanding of where and how actors were positioned and what they were being guided by. Further, for Article 3, the focus was on analyzing specific aspects such as what strategies were employed by actors, or how conflicts and interdependencies were formed among actors. The suggestion by Adcock and Collier (2001) to iteratively move back and forth between the analytical concepts and empirical data was employed as a means to ensure that the concepts were being captured meaningfully.

### 3.4.4. Reliability of the findings

For scientific quality, thick descriptions, reflexivity, and triangulation were employed as criteria in order to enhance reliability of the findings. Thick description refers to an observer not just describing a particular behavior, but also the *social context* of the behavior (Geertz, 1973). Through various empirical observations, I attempted to capture and convey the *institutional and political context* in which actors were situated, which influenced their behavior. For instance, I analyzed the actors against historical developments and the wider institutional context in which actors were embedded in Articles 1, 2, and 3, and also the political context in Articles 2, 3, and 4. This helped to interpret and analyze actor behavior not just as individual characteristics but as part of the larger socio-political and institutional structures, and study the meanings thereof.

Reflexivity is emphasized in interpretive research methodology but also in transition studies. It requires "an awareness of the researcher's contribution to the construction of meanings throughout the research process" (Nightingale and Cromby, 1999; 228). It is also manifested in the explicit use of 'I', because "researchers cannot expect to hide behind "third-person", omniscient exposition – the so-called view from nowhere" (Schwartz-Shea, 2006). I employed the use of 'first person' account in this thesis. Further, I understand the effects that my identity as an outsider from India and Denmark, and as a woman, may have on the data collection process. Hence, I have used 'reflexivity' as a tool to guide my research. In particular, I was mindful of my identity while informing participants about the research and its aims, and through the course of framing and posing questions. In addition, I have attempted to be as inclusive and transparent as possible about my observations, interpretations, and how I have conducted my data collection and analysis. Furthermore, I have also made an effort to highlight the 'reflexive' side of the actors and not present them as 'flat characters'. For instance, I included examples of reflections of actors and their learnings during policy development (Article 2), and reflections of the government actors in hindsight on how they could have acted differently (Article 3).

The third criterion i.e. triangulation ranges from employing different analytical tools and methods of data collection to making use of multiple theories (Meijer et al., 2002). First, I combined multiple methods of data collection and analysis across all the articles. It involved the use of different sources of qualitative data

in the form of interviews (with key actors, experts, and intermediaries), documentary material (government and consultancy reports, published statistics, material shared by the interviewees, donor evaluation reports, workshop presentations and research articles) and direct observations made at field sites (in Kenya and Rwanda, and during the industry conferences and workshops). Second, I employed different theories across and within each of the articles, while situating them within the transitions field. In addition, to enable the construction of robust narratives, further analyses of the collected data were undertaken through a mapping of chronology of key events within each case study (for an example, see Annex VII).

## 4. Research Article Summaries

The following section provides a short summary of the four articles presented in this thesis. In brief, the article summaries explain the research objectives, analytical concepts and the key findings and contributions.

### Summary of Article 1

Article 1 analyzes the ways in which transnational actors exert influence while mobilizing key resources to enable off-grid solar PV development in Uganda. The article details key solar PV projects initiated during the period from early 1980s to 2017, with a focus on the key actors, their motives, the resources mobilized, and the outcomes. Within sustainability transitions literature, there is a recognition that transnational actors and linkages are crucial for energy transitions in low-income countries. However, there is a limited understanding of *how* such transnational actors operate and exercise their agency. The article situates itself within the MLP framework and carries out an actor-oriented analysis. It develops a typology of transnational actors, explains their characteristics and the resources they mobilize. The transnational actors include multilateral development banks, aid agencies, non-profit organizations, corporate foundations, religious groups, think tanks etc. And the cross-border resource flows are operationalized by way of knowledge, capital and technology. The analysis is undertaken over three distinct phases of solar PV development: Phase I (1983-1996), characterized by non-linear developments, and scattered small-scale initiatives primarily driven by donors and NGOs; Phase II (1997-2008), characterized by deliberate long-term government and donor programs, and the entry of private sector firms (mainly local) in the PV market; and Phase III (2009-2017), characterized by rapid private sector scale-up (mainly multinational companies), fueled by innovative financing and business models, and facilitated by development funding. The roles and agency of transnational actors (particularly, development agencies) shift through these phases, from a broader strategic policy advisory role to becoming brokers and mediators of private-sector led scale up. The article finds that transnational actors gain legitimacy due to their embeddedness within global networks, and enjoy a higher bargaining power. In doing so, they are able to advance their preferred solutions and privilege their agency over national actors. This article contributes towards a better understanding of the

globalized nature of socio-technical regimes, and an actor-oriented perspective illuminates the multi-actor dynamics and agency struggles in the transition to solar PV.

**Summary of Article 2**

Article 2 examines the processes by which actor constellations (transnational and local actors) translate renewable energy policy and accelerate sustainability transitions in low-income country contexts. Within the sustainability transitions literature, previous studies have neglected to examine the specific processes by which policies redirect and accelerate change (through regulations, standards, and incentives.). Article 2 analyzes the ways in which the GETFiT program in Uganda was translated from policy logics developed in Europe and adapted to the local institutional context by the actors involved. The article demonstrates how the program became part of ongoing political negotiations in Uganda, which involved reconfiguration, modification and further development of imported policies in the local context. By modifying the conventional policy transfer framework and integrating it with concepts from policy translation approach, Article 2 foregrounds agency to reveal how the actor constellations operate in reality. It demonstrates how the process entailed maneuvering existing power structures, employing specific strategies, mobilizing resources, negotiating with local stakeholders, and constantly adapting the policy. The strategies operationalized were coalition building, networking, appeasing, gaining legitimacy etc. Findings suggest that the complementary roles played by both transnational and local actors was decisive in shaping the policy outcome. While transnational actors acted as knowledge repositories, advanced specific narratives (i.e. privatization) and influenced the policy process significantly, the local regulatory institution and Ministry of Energy gave the policy legitimacy and territorial embeddedness. The article demonstrates how actors operating at various scales, strategically positioned, draw on global resources (ideas, skills, capital) and networks to steer specific policy pathways and accelerate emerging niche developments (such as grid-scale solar PV). These findings open up an interesting avenue of research into 'co-creation' processes and the study of political aspects of sustainability transitions.

**Summary of Article 3**

Article 3 investigates the role of China as a transnational actor in the evolving transition toward utility-scale solar PV in SSA. China is increasingly being identified as a 'rising power' in Africa and Chinese investments in renewables are escalating. Article 3 examines the unfolding China-Africa relations through the case study of the 55 MW Garissa solar PV plant in Kenya, which was funded, designed and constructed by Chinese technology suppliers and construction companies. The transitions literature has had limited focus on the socio-political dynamics of technological change. In the context of transitions in global south, it is crucial to uncover these dynamics associated with external dependencies and global-local exchanges shaping socio-technical change. Towards this end, the article draws from the Sino-African literature,

specifically the concept of 'encounters', to identify and analyze on-the-ground frictions, conflicts and mutual interdependencies among the Chinese and Kenyan actors. Encounters provide insights into the social backgrounds, beliefs, and interests of these actors. The value of employing this concept is in its ability to engage with the agency of Chinese and African actors simultaneously. The article elaborates on two sets of encounters at the micro-level, 'local employment' and 'local community development', through which interactions between CJIC (contractor), REA (owner), and the local county and community representatives took place. Furthermore, the article operationalizes encounters through various sub-concepts of frictions, benefits, and vulnerabilities. By linking empirical narratives with these analytical concepts, the article reveals how the transnational, national and local actors negotiate and exercise agency to serve varied interests, while aiming for common goals. This article contributes towards a more actor-oriented perspective in the sustainability transitions literature.

**Summary of Article 4**

Article 4 operationalizes the MLP framework to analyze the first utility-scale solar PV project in East Africa, located in Rwanda. The PV project is identified as a process of niche development, which is studied against the background features of regime instability (e.g. vulnerabilities associated with hydropower and thermal) and landscape pressures (e.g. climate change) in Rwanda historically. The article adopts a political economy perspective to complement the MLP framework and focuses on agency and politics in energy transitions, which has been an under-researched area in transition studies. It analyses the collaborative way in which the transnational actors (project developers, investors, financiers) and national actors (regulatory agency, energy board) enable the transition process. The article highlights the power exercised by actors, especially the leadership showcased by the Rwandan state in fast-tracking the project and providing legal guarantees to attract private sector investment. The three important findings of this article are: i) grid solar niche exists without disrupting or challenging the regime, and other technological niches also co-exist, but it is unclear whether this remains as a single niche project (i.e. a single experiment) or whether this might lead to a wider niche; ii) the state in Rwanda (a form of 'developmental authoritarian' government) plays a central role in facilitating low-carbon energy transitions by acting not only as a positive force but also reinstating the existing power structures and state-centered social control; and iii) the 'neoliberal logic' – i.e. public services can be effectively provided by profit-seeking private operators and supported by foreign expertise, technology and capital (development financial institutions) – guides the actors. Political interventions by the State, the neoliberal electricity context and private contract negotiations, combined with transnational resource flows, were key determinants of the emerging grid-scale PV niche.

In addition to the four articles constituting this thesis, additional relevant publications were also prepared alongside, which are listed in the following table.

**Table 3: Additional publications prepared alongside this thesis**

| No. | Title | Authors | Status |
|---|---|---|---|
| 1. | Market for integration of smaller wind turbines in mini-grids in Uganda (2018) | Nygaard, I., Bhamidipati, P.L., Andersen, A., Larsen, T.H., Cronin, T., Davis, N. | Published as a report by UNEP-DTU Partnership in October 2018 |
| 2. | Transfer of policy processes and renewable energy penetration: a comparative analysis of Peru, Thailand and Uganda | Suljada, T., Johnson, F.X., Bruno, A., Rodriguez-Morales, J.E., Hu, M., Bhamidipati, P.L., Bößner, S., Haselip, J. | Article under-review in *Sustainability Earth* |
| 3. | Creating co-benefits or just cashing-in? China's investments in renewable energy in Africa | Lema, R., Bhamidipati, P.L., Gregersen C., Hansen, U.E., Kirchherr, J. | Article under-review, accepted for a Special Issue in *World Development* |

## 5. Conclusions

This thesis set out to explore transitions to solar PV in East Africa by employing an actor-oriented perspective, focusing specifically on the manner in which transnational actors influence transition trajectories and adapt to the existing political and institutional structures. The thesis was guided by the following main research question, which was supplemented by four sub-research questions:

- *How do transnational actors operate and influence the transition to solar PV in East Africa?*

The findings of the four sub-research questions have been detailed and addressed in the individual articles. In this section, the focus is on answering the main research question by presenting the key findings that cut across the four interrelated articles comprising the thesis. Firstly, the main empirical findings on how the transition to solar PV has taken place in East Africa are presented. Secondly, the nature and importance of transnational actors in shaping this transition is discussed. Thirdly, theoretical observations on the appropriateness of adopting actor-oriented perspectives in transition studies are elaborated upon. Finally, reflections on the application of sustainability transition theories in developing country contexts are offered. The section concludes by suggesting possible avenues for further research and policy implications.

### 5.1. The evolving transition pathway to off-grid and utility-scale solar PV in East Africa

In East Africa, off-grid PV systems have gained the most traction for rural electrification, across both institutional and household markets. Kenya and Tanzania were the early adopters in the region, with solar PV market originating in the 1970s (Byrne, 2011, Ondraczek, 2013). This thesis identifies that the origins of the solar PV market in Uganda date back to the 1980s, in ways not too dissimilar to Kenya and Tanzania. The striking similarity in off-grid PV development across these countries is in the importance of NGOs and donor involvement in the early phases of PV diffusion, and the predominance of private sector actors in the

scaling up and acceleration in the later phases. Hence, the diffusion of off-grid PV in East Africa was promoted traditionally through the state, international donors and NGOs; through aid support, technical assistance and funding for rural electrification. Increasingly, however, private firms and investors have emerged in a crucial way to scale up PV diffusion through the application of new business models and private finance (see also Nygaard et al., 2016).

Through an empirical analysis of the development of the off-grid PV regime in Uganda, this thesis finds that such private-sector initiatives are, however, not unsubsidized or without state and donor involvement. Private actors operate in a market, which benefits from tax exemptions provided by the state, and in supplying off-grid PV systems, private firms continue to rely on development funds. Accordingly, international donors promote PV through interventions designed to increase the supply of capital to private firms. This means that they have increasingly moved away from providing direct support, for example via demonstration projects, toward a more indirect role to supporting market development (as also suggested by Nygaard and Hansen, 2015).

The thesis finds that the observed shift from conventional donor and NGO-funded projects to private-sector based transition has also led to a shift in the discourse and the agency of international donors. The dominant narratives have shifted from notions such as 'market failure' and 'enabling environment' to increasingly focusing on 'private upscaling'. Accompanying these narratives are the changing actor roles: from a more mainstream role of market creation, developing incentives, capacity building, regulating and setting product standards to an intermediary role of advocating, facilitating and providing grants and debt funding to private firms.

Through the partnerships with international donors, the private sector firms are able to tap into a wider range of resources while operating in East Africa. This includes networking with members from impact investment funds, benefiting from corporate philanthropy, participating in international industry events and workshops, becoming members in practitioner networks, and securing global awards.

While the off-grid PV sector has evolved over several decades in East Africa, the utility-scale grid-connected solar PV systems have only emerged over the last five years. For long, the development of utility-scale solar PV projects had been constrained by factors such as difficult land acquisition, lengthy project approvals, low tariffs, lack of a conducive policy environment, grid intermittency, investor risks, and high project costs.

However, based on the analyses of the utility-scale PV projects in Rwanda and Kenya, the thesis finds that the recent emergence of utility-scale PV has been enabled by: i) increasing cost competitiveness, ii) tailored policy instruments (such as the GETFiT programme), iii) increased private investments (equity and debt),

iv) risk guarantees (provided by multi-lateral banks or the government), and v) improved regulatory procedures (streamlining the application process and paperwork for power purchase agreements).

The thesis points to the importance of *getting the politics right* at the larger levels of leadership, i.e. state, policy and regulatory actors, in order to prioritize and expedite the implementation of PV projects on-the-ground. In the large-scale PV domain, turnkey projects supported by foreign investments are the trend, delivered and operated by independent power producers. Furthermore, the shift to utility-scale PV has also been accompanied by an increasing involvement of actors from developing countries - especially China - as manufacturers, technology suppliers, developers, and investors; which is reflective of the growing importance of South-South cooperation in shaping energy markets.

### 5.2. The influence of transnational actors in shaping low-carbon transition trajectories

The transnational actors are broadly identified in this thesis as development aid agencies, non-government and non-profit organizations, development banks, private firms, consultancies or think tanks, research institutes, and global industry associations. The thesis finds that these transnational actors play an instrumental role in influencing and steering specific transition trajectories, by complementing national capacities and resources in East Africa. Theoretically, this relates to debates on the development of global niches and regimes (Smith and Raven, 2012, Fuenfschilling and Binz, 2018), and to the role of transnational linkages and the ways in which the development of niches is dependent on wider global technology, markets and networks (Raven et al., 2012, Wieczorek et al., 2015, Sengers and Raven, 2015). Indeed, the thesis argues in line with Kirshner et al., 2019 that we may be observing the emergence of a solar PV regime not only in Africa but at a global scale.

This thesis develops a typology of transnational actors and identifies their specific roles and characteristics, in order to distinguish between the different types of actor-groups. It finds that that transnational actors influence transition processes primarily by mobilizing key material resources such as capital (debt, equity, grants, loans), technology (including technical equipment), and knowledge (including tacit knowledge, skills and ideas). The financial support provided by international donors is particularly critical for developing countries with a paucity of national public funds. By facilitating its inflow, the transnational actors assume higher negotiating power and tend to choose their preferred solutions, and privilege their agency over national actors. For example, development funding is typically tied to conditionality clauses, such as advancing certain policy agendas (including privatization and market-based solutions), negotiating larger political stances, and deepening certain principles of governance (such as democracy, transparency, and accountability).

Transnational actors are also able to exert different kinds of power by way of mobilizing resources. For instance, through sharing knowledge and expertise, certain ideological authority and political power is

exercised. The thesis demonstrates empirically how this takes place through such means as pushing for electricity sector reforms to promote a free-market ideology, preferring alternative technologies, supporting certain policy instruments (feed-in tariffs), and privileging certain program designs and ideas.

The thesis finds that transnational actors have also played an important role in developing effective policies, strengthening regulatory frameworks, and performing advocacy and lobbying functions in conjunction with national actors. It highlights that the core strength of the transnational actors lies in networking, collaborating and forging partnerships with actors across multiple governance scales. Specifically, transnational actors have been instrumental in mobilizing previously loosely connected local actors around solar PV initiatives (such as strengthening industry associations), in order to address sectoral issues in a more coordinated manner. Furthermore, networking also implies leveraging on a diverse set of actors' capacities, experiences, backgrounds, and motives. While this opens up potential conflicts and contestations in some instances, it also leads to fruitful collaborations in others.

The various ways in which transnational actors have enabled the development of solar PV in East Africa have been summarized in Table 4:

**Table 4: Mechanisms by which transnational actors influence and enable transitions in East Africa**

| **How transnational actors enable transitions** | **Description of the activities performed by various transnational actors** | **Empirical evidence found in the articles** |
|---|---|---|
| Mobilizing material resources and knowledge | Mobilizing and providing key resources such as capital (financial resources), technology (technical equipment, products) and knowledge (skills, ideas, concepts, beliefs) to steer change in a preferable or favorable direction | 1, 2, 3, 4 |
| Institutional adaptation and transformation | Designing and experimenting within a protective space, developing workable solutions, coping with socio-political and institutional constraints, improvising deliberate strategies to create change, and strengthening existing institutions and institutional practices. | 1, 2 |
| Networks and collaborations (learning, sharing, building constellations) | Sharing and gaining from the information in the network, benefitting from the embedding of actors in global networks, constructing shared goals and visions, jointly planning, designing, implementing, and evaluating a program, working with local actors to create legitimacy, and leveraging on relative individual capacities and aligning activities for mutual benefit. | 1, 2, 4 |
| Negotiations (compromises, struggles, power dynamics, frictions) | Reaching a middle ground between opposing views, resolving disagreements and conflicts in different social settings, working with local actors to overcome political obstacles, coordinating with policy makers, and creating conditions for the involvement of concerned stakeholders with different access to power | 1, 2, 3 |
| Capacity building (empowering) | Providing technical trainings, skill development workshops, generating awareness, encouraging and facilitating entrepreneurial | 1, 2 |

| | | |
|---|---|---|
| | activities, providing tools and software to enhance skills, and developing information base/library resources etc. | |
| Advocacy (lobbying) | Mobilizing political and regulatory support, involving a broader set of international actors to create pressure on the government, and creating and constructing new rules | 1, 2 |

*Source:* Author's own elaboration drawing from the four empirical articles

While this thesis adopts a transnational perspective, the notion of transnational is inherently linked to the national or the sub-national levels. Indeed, the national and sub-national actors seek support from transnational actors and gain from accessing global resources. The thesis finds that the nature of the global-local multi-actor relations is crucial to understanding how specific transition outcomes unfold. The transnational and national actors can establish a relationship based on dependency or complementarity. Some actor constellations display more dependence on one set of actors than others (e.g. the national government depending on World Bank or China for capital, technology and knowledge), thereby leading to imbalances in power dynamics. Other forms of coalition exhibit a greater degree of inter-dependence, drawing on the actors' relative importance, position, and capabilities. For example, as pointed out in Article 2, international donors worked jointly with the national regulatory agency to strengthen national policies and institutions in Uganda. Another example is provided in Article 4, where the private developers collaborated with the state, and gained from political support and eased regulatory procedures, which resulted in an expedited project implementation in Rwanda.

However, this thesis also finds that in enabling the transition to solar PV, some transnational actors tend to constrict the agency of local actors. First, inherent power imbalances privilege them to assume the role of decision-makers in many instances. Second, development assistance is typically tied to contracts which bind national governments into promoting certain industries, firms, technologies or ideologies. Third, private developers and firms tend to engage with global networks and promote their own country's material and human resources, thereby restricting opportunities for local suppliers, firms or equipment, leading to limited developmental co-benefits. Fourth, some transnational actors provide financial support, design programs and engage with one-off projects without developing local capacities, which in turn may not result in a deeper or longer-term change.

### 5.3. The usefulness of an actor-oriented perspective for studying sustainable transitions

This thesis adopts actor-oriented perspectives in order to study transitions to sustainability, which presuppose that changes in socio-technical configurations are primarily enabled and steered by actors that operate within structures and institutions. Theoretically, this relates to the works on multi-actor perspectives and politics of sustainability transitions (Avelino and Wittmayer, 2016, Avelino et al., 2016).

This thesis posits that transitions to sustainability are framed and determined fundamentally by actors who, in turn, are characterized by competing or complementary agendas and motives. Therefore, it is critical to understand actor agendas and interests, which enable as well as impede transitions. They range from strengthening professional and personal networks (as shown in Articles 1 and 2) and amassing political power and wealth (as shown in Articles 3 and 4), to fulfilling donor stipulations (as shown in Articles 1, 2 and 4) and policy mandates (as shown in Articles 1 and 2). Actors can lead to important consequences for determining transition trajectories. Furthermore, this research also finds that if the larger goals of multiple actors are aligned despite competing motives, the outcomes can still be favorable.

Table 5 provides examples of how the support to promoting the diffusion of solar PV technology is framed by various actors.

**Table 5: Multi-actor narratives supporting the development of off-grid solar PV**

| **Actors** | **Examples** | **Narratives in support of solar PV** |
|---|---|---|
| Development aid organizations | USAID, DFID, GIZ | Solar for energy access<br>"Transforming lives" |
| Inter-governmental organizations | UNEP, UNDP, WHO, IRENA, IEA | Solar as a means to reduce poverty and enable economic development |
| Bi-lateral and multi-lateral development banks | WB, FMO, KfW | "Empowering lives, energizing markets" |
| Charities, NGOs, foundations, faith-based organizations | Solar Light for Africa, Church, Solar Sister, Shell Foundation | "Let there be light"<br>"You can light the way"<br>Solar for rural communities<br>Solar empowers women |
| Private firms | Solar Now, Fenix Int., Barefoot Power | "Power your life"<br>Solar as a profitable and scalable solution |
| Global industry association | GOGLA, ARE | Solar creates jobs |
| Educational Institutes, Universities | Access2 Innovation, MIT | Solar as a technological and social innovation |

*Source:* Author's own elaboration based on Article 1

Further, actor-perspectives provide a lens to better understand multiple interests and strategies. Diversity in opinions does not necessarily lead only to contestations, but may entail negotiating and compromising towards cooperation. Also, these perspectives help explain how certain solutions gain more traction and certain kinds of agency is privileged over others. Further, they also provide useful insights into discerning the nature of power relations i.e. how power is dispersed among multiple actors, and how power dynamics change as transitions unfold. This provides important insights into how multi-actor relational dynamics co-constitute specific outcomes.

Lastly, actor-perspectives provide useful analytical tools to better unravel the 'politics' underlying particular transition trajectories. Politics in transitions are identified and illustrated in many ways in the articles presented in this thesis: i) in terms of the lack of inclusive or top-down decision-making (Article

1), ii) in terms of the political economy of advancing neoliberal narratives hinged on free market orthodoxy (Articles 1,2 and 4), and iii) in terms of encounters between transnational and local actors (Article 3). These varied political dynamics are highly context-specific and contribute towards shaping unique transition trajectories. For instance, the post-genocide context in Rwanda along with the values of a single-rule President has led the country on a high-tech development pathway, which is reflected in the way the PV project in Rwamagana was expedited.

This thesis finds that solar PV (off-grid and utility-scale) offers a new arena for multiple actors to coalesce, negotiate, contest, compromise and defend various stances and interests. The actors leverage their respective positions and display opportunistic tendencies, while also aiming to reach a pragmatic middle ground to achieve some common goals. Accelerating the process of decarbonization of the energy systems requires political work, negotiations, agency and power to wield influence, strong political commitment, and willingness to adapt to or modify institutional structures. The thesis clearly illustrate how politics is pervasive in socio-technical transitions, which goes beyond the prevailing type of conflict in the literature between niche actors and regime incumbents.

### 5.4. The application of sustainability transition theories in developing country contexts

Applying transition theories in developing country contexts enables researchers to envisage alternative operationalization of transition concepts that are specific to non-Western political, economic, cultural and technological settings. This thesis has attempted to revisit the three analytical concepts of MLP – niche, regime and landscape – their interlinkages, and analyze them in the specific socio-political contexts of East Africa.

Unlike the conventional MLP framework, in this case, transitions do not entail replacing one regime with another. The thesis finds that the off-grid, rural electrification regime is not competing directly with the conventional grid-based electrification regime. There is a distinction in the markets, users, policies and infrastructures associated with the two different energy systems. Conceptually, this points to a co-existence and complementarity among multiple regimes.

Further, this thesis identifies that regime instabilities at the grid level may not create an impetus for off-grid regime development, instead they can be inhibiting. Some level of regime stability is required for the off-grid regime to develop and align – in terms of stable regulatory institutions, policy implementation capacities, and stable economic and political situation. On the other hand, grid-scale regime instabilities, along with landscape forces, can enable newer niches to emerge, such as grid-connected solar PV. In this thesis, the instabilities identified were: consecutive droughts, alternation of river flows associated with hydropower, and oil price fluctuations associated with thermal generation. Hence, this thesis unravels how

transitions are occurring through hybrid and dynamic configurations of multiple niches and regimes in combination with landscape forces.

In the literature, landscape has often been treated as a 'residual' category (Geels, 2011), which is exogenous to the socio-technical forces at play. More importantly, agency has been primarily associated with the niche and regime concepts, as the landscape tends to represent overarching meta forces that cannot be altered or influenced by actor's behavior. This thesis conceptualizes landscape as forces, such as climate change, privatization, liberalization, and democracy, which guide the behavior and influence actions of various transnational actors, especially development aid agencies, development banks and UN organizations.

While previous research has recognized that the landscape level may be associated with the actions of development institutions, this thesis advances this argument further by demonstrating the specific manner in which transnational actors instantiate such forces. In doing so, it illustrates how larger ideas and discourses penetrate into practices and behavior, and more importantly, how these contribute to enabling niche environments and the regimes at the same time.

The transition to solar PV in East Africa has been enabled through transnational actors, which were conventionally considered as 'exogenous' to the national systems. In the Global South contexts, transnational actors, directly or indirectly, enable niche development, promote regime-level changes through political and regulatory work, modify the institutional environment, and reinforce select landscape forces. Consequently, it appears that niches and regimes necessitate a transnational perspective to capture the innovation dynamics. This entails shifting the unit of analysis from solely 'national' to 'transnational', involving a focus on transnational actors, relations, and flows beyond the administrative boundaries of nation-states. Therefore, this thesis engages conceptually with a transnational perspective in the process of analyzing agency and politics.

While the MLP framework provides a useful analytical lens for the analysis of long-term socio-technical change, it only provides limited explanatory power and primacy to the role of agency and politics in steering socio-technical change. This thesis takes analytical strides by adopting an explicit transnational view of change processes, advancing actor-oriented perspectives, and unraveling the ensuing politics of transitions.

### 5.5. Further research and policy implications

Based on the main findings presented in this thesis, further research could be pursued in the following areas:

A more elaborated theory on transnational actors in transitions in the Global South is needed, building on this thesis and previous contributions (Wieczorek et al., 2015). Such a theory could engage with different configurations of agency and power exercised by various transnational actors in enabling transitions. Previous studies have developed multi-actor models in Western contexts incorporating state, market, community and the third sector, comprising of national actors (Avelino and Wittmayer, 2016). A newer

conceptual framework could, for example, be developed combining the roles and interactions among state, markets and developmental organizations in the Global South, by incorporating transnational actors. Such a framework could be validated in specific empirical contexts.

The politics in transition processes could be consolidated and conceptualized in a more coherent way. Previous studies have attempted to chart this territory (Avelino et al., 2016). However, such studies are few and fragmented. Additional studies on agency and politics could be conducted to hypothesize, operationalize and evaluate various explanatory factors for politics in transitions. For instance, further research could analyze the key factors that determine the relational dynamics among transnational vs national actors, their relative levels of dependence, why and how these vary from case to case, and how variation along these dimensions influence specific transition outcomes.

There is a need for more research on whether and how transnational actors may constrict national/sub-national agency while enabling transitions. While this thesis highlights preliminary observations in this regard, such insights could be elaborated and unraveled in further detail. Specific limiting factors and the instances or scenarios under which national agency is constrained and marginalized could provide better insights into the modalities of global-local relations. Building on the debates of 'participation' (Chilvers and Longhurst, 2016) and 'just transitions' (Swilling et al., 2016), further research could critically examine power issues, by placing a stronger focus on unheard voices and under-represented actors, and analyze how transnational processes may further entrench inequalities.

The impacts of privately-led energy transitions for pro-poor development in Global South contexts could be examined. For instance, further research could look at the developmental co-benefits like infrastructure, employment, technological capacities etc. derived from utility-scale PV projects mainly involving foreign technology providers, developers, funders, and operators. Previous studies have engaged with community benefits and developments associated with large-scale renewable energy projects (Tait et al., 2013, Wlokas et al., 2012). This could be taken further through a conceptual framework engaging with 'action research' and complementary fields of research, such as political science, in order to unveil how local-level developmental benefits can be improved.

The thesis offers insights and lessons for policymakers and practitioners, particularly related to the different ways of maneuvering complex transition processes in conjunction with multi-scalar actors. It highlights how in some instances (Article 3), the national government missed a critical opportunity to build innovative local capabilities in Kenya. Whereas in other instances (Article 2), the government actors utilized transnational knowledge flows to strengthen institutions and build capacities in Uganda.

These findings demonstrate that policymakers could perhaps focus more strategically on finding opportunities to enhance national learnings and firm competitiveness through capacity building activities. The state actors could deliberately create avenues through which global-local synergies can be achieved.

For instance, local university or research centers could get involved during the implementation of renewable energy projects, knowledge sharing and technical trainings may be stipulated with foreign investment, and priority to local firms/suppliers may be ensured in some instances. While project or program-specific trainings are currently being conducted across East Africa, these can be scaled up and deliberate interventions can be planned to build capacities in strategic areas over the long-term.

In addition, the thesis highlights how in the development of GETFiT program in Uganda (Article 2), the actors came together in a somewhat unplanned way. While in this particular instance, the collaboration was fruitful and it led to positive outcomes, in future, the government actors could perhaps be more tactical and selective, leaving less to chance. For example, the articles presented in this thesis provide a perspective on how transnational actors operate, where do their strengths lie and how they employ strategies to achieve certain outcomes. This information might be of use to government actors when designing programs, formulating policies, drafting guidelines, and applying for grants. They may be able to assess the relative strengths of specific developmental aid agencies or banks, the types of networks they can benefit from, and the ways in which they can develop collaborations. In such ways, local policymakers can be intentional, strategic and purposive in their actions, which would enable them to achieve their envisaged goals more effectively.

**Annex I: Interviews conducted during the pilot phase (January 2017)**

| SN | Position of the interviewee | Type of organization | Location and Type of Interview | Date |
|---|---|---|---|---|
| 1. | Former Deputy Commissioner | Department of Meteorology, Government of Uganda | Uganda / In-person | 05-01-2017 |
| 2. | Manager | Private not-for-profit company, Renewable energy business | Uganda / In-person | 05-01-2017 |
| 3. | Lecturer | Business School, University | Uganda / In-person | 06-01-2017 |
| 4. | Senior Lecturer | University (mechanical engineering) | Uganda / In-person | 06-01-2017 |
| 5. | Project Engineer and Manager (PV) | Research institute (renewable energy and energy conservation) | Uganda / In-person | 09-01-2017 |
| 6. | Senior Project Manager (Energy) | Development aid agency | Uganda / In-person | 09-01-2017 |
| 7. | Off-grid Manager | Rural electrification authority, Semi-government | Uganda /In-person | 10-01-2017 |
| 8. | Head of Department | National council for science and technology | Uganda /In-person | 10-01-2017 |
| 9. | Coordinator (Global Carbon Markets) | Development aid agency | Uganda /In-person | 11-01-2017 |
| 10. | Consultant | Development aid agency | Uganda /In-person | 11-01-2017 |
| 11. | Co-founder Chairman | Industry association (solar & renewable energy) | Uganda /In-person | 11-01-2017 |
| 12. | Program Coordinator | Electricity regulatory authority | Uganda /In-person | 12-01-2017 |
| 13. | Faculty Dean | University (engineering) | Uganda /In-person | 12-01-2017 |
| 14. | Director | Government - Ministry of Energy (renewable energy credit) | Uganda /In-person | 13-01-2017 |
| 15. | Principal Energy Officer | Government energy department (Ministry) | Uganda /In-person | 16-01-2017 |
| 16. | Commissioner | Government energy department (Ministry) | Uganda /In-person | 16-01-2017 |
| 17. | Renewable Energy Advisor | Development aid agency | Kenya / In-person | 18-01-2017 |
| 18. | Senior Research Fellow | Research Institute (energy and environment) | Kenya / In-person | 19-01-2017 |
| 19. | Research Fellow | Research Institute (energy and environment) | Kenya / In-person | 19-01-2017 |
| 20. | Research Associate | Research Institute (energy and environment) | Kenya / In-person | 19-01-2017 |
| 21. | Chairman (Association) and CEO | Renewable energy association and MNC / private company in energy management and automation | Kenya / In-person | 20-01-2017 |
| 22. | Professor | University (energy research) | Kenya / In-person | 23-01-2017 |
| 23. | Executive Director | Network of researchers, policymakers and private actors (technology policy studies) | Kenya / In-person | 23-01-2017 |

**Annex II: Interviews conducted during the main fieldwork phase (July – December, 2017)**

| SN | Position of the interviewee | Type of organization | Location and Type of Interview | Date |
|---|---|---|---|---|
| 1. | Former Commissioner | Government organization | Uganda / In-person | 20-07-2017 |
| 2. | Former Advisor | Government energy department | Uganda / In-person | 21-07-2017 |
| 3. | Project Manager | Government health department | Uganda / In-person | 07-12-2017 |
| 4. | Founder | Solar PV firm | Uganda / In-person | 22-09-2017 |
| 5. | Technical Director | Solar PV firm | Uganda / In-person | 10-08-2017 |
| 6. | Co-founder Chairman | Industry association (solar & renewable energy) | Uganda / In-person | 28-07-2017 |
| 7. | Secretary | Industry association (solar energy) | Uganda / In-person | 16-08-2017 |
| 8. | Marketing Manager | Solar PV firm | Uganda / In-person | 26-07-2017 |
| 9. | Commissioner | Government energy department (Ministry) | Uganda / In-person | 01-08-2017 |
| 10. | Acting Director | Government energy department (Ministry) | Uganda / In-person | 23-08-2017 |
| 11. | Lead Program Coordinator | Government organization | Uganda / In-person | 23-08-2017 |
| 12. | Dean, Faculty of Engineering | University | Uganda / In-person | 13-07-2017 |
| 13. | Executive Director | Semi-government agency (rural electrification) | Uganda / In-person | 01-08-2017 |
| 14. | Off-Grid Manager | Semi-government agency (rural electrification) | Uganda / In-person | 14-09-2017 |
| 15. | Principal Project Engineer-ERT coordinator | Semi-government agency (rural electrification) | Uganda / In-person | 23-08-2017 |
| 16. | Country Head-Uganda | Non-profit organization / International NGO | Uganda / In-person | 22-08-2017 |
| 17. | Senior Standards Officer, Electrical Division | Government organization | Uganda / In-person | 31-08-2017 |
| 18. | Managing Director | Government organization | Uganda / In-person | 11-12-2017 |
| 19. | Energy and Climate Advisor | Development aid agency | Uganda / In-person | 29-08-2017 |
| 20. | Country Head-Uganda | Solar PV firm | Uganda / In-person | 28-07-2017 |
| 21. | Sales Representative | Solar PV firm | Uganda / In-person | 28-07-2017 |
| 22. | Regional Sales Head | Solar PV firm | Uganda / In-person | 31-08-2017 |
| 23. | Chief Executive Officer | Solar PV firm | Uganda / In-person | 15-09-2017 |
| 24. | Product Manager | Solar PV firm | Uganda / In-person | 16-08-2017 |
| 25. | Managing Director | Solar PV firm | Uganda / In-person | 11-12-2017 |
| 26. | Chief Executive Officer | Advocacy organization | Uganda / In-person | 22-08-2017 |
| 27. | Manager (Energy program) | Development aid agency | Uganda / In-person | 18-08-2017 |
| 28. | Director (capacity building and business development) | Government organization | Uganda/ Email | 30-01-2018 |
| 29. | Founder | Non-governmental organization | Uganda/ Email | 21-03-2018 |

| SN | Position of the interviewee | Type of organization | Location and Type of Interview | Date |
|---|---|---|---|---|
| 30. | Project Engineer-Solar | Research institution | Uganda / In-person | 11-07-2017 |
| 31. | Program Coordinator | Development aid agency (Renewable energy promotion) | Uganda / In-person | 21-09-2017 |
| 32. | Former CEO | Regulatory authority | Uganda / In-person | 08-12-2017 |
| 33. | First Executive Director | Regulatory authority | Uganda / In-person | 13-12-2017 |
| 34. | Projects Engineer | Regulatory authority | Uganda / In-person | 29-08-2017 |
| 35. | Manager – Pricing | Regulatory authority | Uganda / In-person | 21-09-2017 |
| 36. | Operations Manager | Solar PV plant (Soroti) | Uganda / In-person | 01-09-2017 |
| 37. | Former Consultant/ Coordinator | Development aid agency | Philippines/ Skype | 15-09-2018 |
| 38. | Project Director | Diversified private sector firm | Uganda/ Phone | 27-03-2018 |
| 39. | Former Vice President | Development Bank | Germany/ Skype | 25-07-2017 |
| 40. | Senior Consultant | Private consultancy firm | Uganda / In-person | 13-07-2017 |
| 41. | Senior Energy Program Manager | Development aid agency | South Africa/ Skype | 11-09-2018 |
| 42. | Managing Director | Research Institute (Energy) | Uganda / In-person | 28-07-2017 |
| 43. | Off-grid Team Member | Semi-government agency (rural electrification) | Uganda / In-person | 10-08-2017 |
| 44. | Public Relations Manager | Regulatory authority | Uganda / In-person | 10-08-2017 |
| 45. | Planning Engineer | Semi-government agency (rural electrification) | Uganda / In-person | 16-08-2017 |
| 46. | Energy Officer | Government energy department (Ministry) | Uganda / In-person | 16-08-2017 |
| 47. | Asset Development and Network Planning Team | Electricity distribution company (private) | Uganda / In-person | 22-08-2017 |
| 48. | Technical Expert | Development aid agency | Uganda / In-person | 29-08-2017 |
| 49. | Director | Solar PV firm | Uganda / In-person | 15-09-2017 |
| 50. | Senior Energy Officer | Government energy department (Ministry) | Uganda / In-person | 20-12-2017 |
| 51. | Programme Management Expert | East African Centre for Excellence (renewable energy) | Uganda / In-person | 15-08-2017 |
| 52. | Energy Officer | Government energy department | Uganda / In-person | 10-12-2017 |
| 53. | Technician (solar) | Research Institute | Uganda / In-person | 14-12-2017 |
| 54. | Technical Service Manager | Consulting firm (electrical and mechanical engineering services) | Uganda/ In-person | 19-08-2017 |
| 55. | Transaction Execution Specialist | Government - Ministry of Energy (credit support for renewable energy) | Uganda/ In-person | 20-08-2017 |
| 56. | Senior Officer (green jobs and private sector) | International organization (green growth) | Uganda/ In-person | 18-08-2017 |
| 57. | Director – Planning & Development | Church of Uganda | Uganda / In-person | 05-09-2017 |
| 58. | Managing Director | Private Company (GIS services) | Uganda / In-person | 13-09-2017 |
| 59. | Chief Technical Services Officer | Utility company (electricity distribution) | Uganda / In-person | 14-09-2017 |

| SN | Position of the interviewee | Type of organization | Location and Type of Interview | Date |
|---|---|---|---|---|
| 60. | Operations Manager (electrical) | Infrastructure company (solar PV) | Uganda/ In-person | 17-07-2017 |
| 61. | Marketing Manager | Infrastructure company (solar PV) | Uganda/ In-person | 18-07-2017 |
| 62. | Operations Head | Solar PV firm | Uganda/ In-person | 18-08-2017 |
| 63. | Chief Executive Officer | Non-governmental organization | Uganda/ In-person | 14-09-2017 |
| 64. | Director | Regulatory Authority | Uganda/ In-person | 29-08-2017 |
| 65. | Managing Director | Solar PV firm | Kenya/ In-person | 21-10-2017 |
| 66. | Senior Technical Officer, Renewable Energy | Regulatory commission | Kenya/ In-person | 11-10-2017 |
| 67. | Assistant Technical Officer, Renewable Energy | Regulatory commission | Kenya/ In-person | 12-10-2017 |
| 68. | Former Chairman | Regulatory commission | Kenya/ In-person | 29-11-2017 |
| 69. | Head of Department, Renewable Energy | Government organization (rural electricity) | Kenya/ In-person | 16-10-2017 |
| 70. | Renewable Energy Manager | Government organization (rural electricity) | Kenya/ In-person | 16-10-2017 |
| 71. | Public Relations Manager | Government organization (rural electricity) | Kenya/ In-person | 18-10-2017 |
| 72. | Senior Wayleaves Officer (land) | Government organization (rural electricity) | Kenya / Email | 21-09-2018 |
| 73. | Engineer | Government organization (rural electricity) | Kenya/ In-person | 16-10-2017 |
| 74. | Project Manager | Construction company (Chinese) | Kenya/ In-person | 19-10-2017 |
| 75. | Head – Renewable Energy | Private Company (renewable energy services) | Kenya / In-person | 14-10-2017 |
| 76. | Director | Consultancy firm | Kenya/ In-person | 29-11-2017 |
| 77. | Senior Energy Specialist | Development organization (multi-lateral bank) | Kenya/ In-person | 30-11-2017 |
| 78. | Business Development Lead | Engineering firm (resources & energy) | Kenya/ In-person | 28-11-2017 |
| 79. | Project Development | Renewable energy company | Kenya/ In-person | 30-11-2017 |
| 80. | Director (electricity and renewable energy) | Utilities and Regulatory Authority | Rwanda/ In-person | 07-11-2017 |
| 81. | Advisor (science, technology, innovation) | Government organization (Ministry of Education) | Rwanda/ In-person | 22-11-2017 |
| 82. | Founder | Solar PV firm | Rwanda/ In-person | 06-11-2017 |
| 83. | Associate Director | University (engineering and public policy) | Rwanda/ In-person | 04-11-2017 |
| 84. | Expert (distribution) | Energy utility | Rwanda/ In-person | 09-11-2017 |
| 85. | Plant manager/supervisor | Solar PV firm | Rwanda/ In-person | 08-11-2017 |
| 86. | Contractor | Solar PV firm | Rwanda/ In-person | 08-11-2017 |
| 87. | Technical and EHS lead | Solar PV firm | Rwanda/ In-person | 08-11-2017 |
| 88. | Consultant (health, labour) | Solar PV firm | Rwanda/ In-person | 09-11-2017 |

**Appendix III: Matrix used to operationalize MLP categories (Example)**

| Analytical category | Sub-category | Examples | Interview data | Data from documents |
|---|---|---|---|---|
| Landscape level | Globalization and privatization | • Global resource flows – capital, technology, knowledge, manpower<br>• Privatization and promotion of market-based solutions<br>• Investment flows / private finance | | |
| | Interventions by developmental organizations | • Donor programs<br>• Agendas, ideologies<br>• Strengthening policies and regulations<br>• Modifying institutions | | |
| | Climate change and Paris agreement | • Electrification goals and energy policies and sector plans (including for rural electrification)<br>• Green growth strategy<br>• Renewable energy targets | | |
| Niche level | Solar PV niche (utility-scale) | • Pilot/Demonstration projects<br>• Feasibility studies<br>• Actor-collaborations | | |
| | Solar PV niche (off-grid) | • Pilot projects<br>• Resource mobilization<br>• Capacity building<br>• Advocacy | | |
| Regime level | Hydropower and thermal regime (utility-scale, centralized) | • Resistance to solar pv developments<br>• Electricity supply shortages and issues of power stability | | |
| Niche - regime – landscape dynamics | Stabilizing and destabilizing mechanisms | • Opening up the electricity market for private investments<br>• Global interest in renewable energy, policy pressures<br>• Emerging technologies gaining traction, cost effectiveness<br>• Political support for increasing power generation capacity | | |

**Appendix IV: Summarizing key points from the interviews and identifying analytical themes (Example)**

| Interviewee | Excerpts from interviews or summary points | First order codes | Second order codes |
|---|---|---|---|
| # 1 | First solar pilot project by Uganda implemented in 1998 to promote the use of solar PV. Project conceived by MEMD and funded by UNDP/GEF. | Pilot project<br>External funding | Experimentation<br>Resource mobilization |
| # 2 | Goal was to develop a market for solar products by involving and incentivizing private sector companies. Project led to positive outcomes. | Incentives to the private sector | Market creation |
| # 3 | The project also led to forming a solar association – an organized body of solar businesses<br>Formation of a new RE department within the Ministry and adding staff and separate budget allocation. | Organizing<br>Forming association<br>New department and staff | Coalition<br>Legitimacy<br>New capacities |
| # 4 | German collaborator and friend worked on a farm-based lab which required electricity and imported solar panels from Netherlands. Initially procured it for self-use and imported additional sets on demand basis. | Actor networks supportive of the new business – international contacts | Networks<br>Transnational ties |
| # 5 | MD of Konserve. Previously worked with ESD Africa in Nairobi under Mark Hankins (2004-06) and joined Konserve in 2006. He also worked with Incafex as Manager in late 90s. Worked closely with several donors and govt. bodies/institutions such as GIZ, World Bank, REA, Makerere University etc. | Relevant contacts in solar PV in the region | Alliances<br>Networks |

**Appendix V: Data structure highlighting the interaction between the mechanisms in the literature and the empirical examples**

| | **Empirical examples from the data** | **Themes in the data** | **Mechanisms in the literature** | **Theoretical dimensions** |
|---|---|---|---|---|
| # 1 | Idea of FiT premium; incentives to support the enabling environment, more importantly the development of GETFiT which was in response to a larger problem of FiTs in developing countries. This was mainly developed by DB in consultation with international experts in energy finance; largely led by an ideology of privatization and market-led investments. | Developing common policy goals, creating political vision and framing imaginaries, increased energy demand, failure of previous FiTs, the idea of premium as a solution | Policy change requires development of an idea; policy innovation, visions, and an agenda | Development of new ideas |
| # 2 | Agreement among the policy actors to work together on the identified problem, setting common goals, and shared beliefs. Meetings with donors and development agencies to pitch new ideas and seek financial support, also to gain legitimacy within the donor network. This strategy was mainly employed by KfW to gain donor support, and by ERA to gain support from within Ministry and other stakeholders. | Forming a coalition, agreeing on common goals, mobilizing support from a larger network, resource mobilization, gaining legitimacy through the involvement of local actors. | Collaboration among policy actors as necessary, coalition building, differences, framing narratives, developing vision, shared agreements | Build coalitions and sell ideas |

**Appendix VI: Overview of the secondary data sources used in this thesis**

| Types of data sources | Relevant examples of sources | Type and relevance of information provided |
|---|---|---|
| Regulatory documents | Reports, policy documents of electricity regulatory authority. Example: https://www.era.or.ug/index.php/resource-centre/regulatory-instruments/policies | Relevant for insights into regulations, feed-in tariff policy instrument, tariff changes, stakeholder engagement records, guidelines and standards etc. |
| Government reports | Policy documents, energy reports, assessments, market studies, survey reports produced by Ministry of Energy and Mineral Development in Uganda, or Rural Electrification Authority in Kenya. Example: https://eaenet.org/wp-content/uploads/2017/02/The-Renewable-Energy-Policy-for-Uganda-2007-2017.pdf | Insights into the key energy policies formulated by the government, rural electrification strategy and goals, government-led household electrification survey reports, strategic plans for developing the renewable energy sector. |
| Industry reports | Reports, market assessments, trend reports by international organizations, global industry associations, and development agencies. Example: https://www.lightingafrica.org/wp-content/uploads/2018/02/2018_Off_ Grid_Solar_Market_Trends_Report_Full.pdf | Informative to gather an overview of the latest market trends pertaining to off-grid solar PV, new business models, installed capacities across countries and regions, financing sources and mechanisms, and challenges faced by firms and industry. |
| Reports by sector-specific inter-governmental organizations | Reports on renewable energy policies, new market trends, feedback on specific policy instruments. Example: reports by IRENA, IEA - https://www.irena.org/documentdownloads/ publications/irena_renewable_energy_ auctions_in_developing_countries.pdf | Information pertaining to the renewable energy policies, renewable energy markets, key data and statistics, cost analysis, latest trends in technological developments, issues and barriers faced. |
| Reports by international donors | Reports of donor assistance programs, evaluation reports, knowledge note series, country-specific fact sheets on electrification, data indicators. | Useful for gaining insights into specific projects and programs, the mode of implementation, their outcomes, key partners and stakeholders involved. |
| Academic articles and Working Papers | Several research articles published in international journals (for example: Energy Policy, Environmental Innovations and Societal Transition, Energy Research for Social Science, Renewable Energy, Research Policy, Renewable Energy and Sustainable Energy Reviews, Sustainability) | Valuable for understanding earlier accounts of solar PV diffusion in Uganda, Kenya and Rwanda; for obtaining theoretical insights, information about relevant actors engaged and the challenges faced. |
| Newspaper articles and magazines | Examples: PV magazine, The East African, Business Daily Africa etc. | Useful for gaining access to recent developments and policy debates and, for capturing quotes and statements made by government authorities |
| Conference proceedings and presentations | Conferences and workshops are useful for documenting narratives and activities of actors in real time. Example: Green growth workshop in Kampala | Notes based on presentations and interactions with speakers and participants in informal settings helped to obtain a more informed perspective on disagreements and issues of concern. |

## Appendix VII: Chronology of key events in the off-grid PV development in Uganda

| Year(s) | Key Developments in Ugandan solar PV sector |
|---|---|
| Prior to 1980s | From late 60s and 70s Uganda underwent political instability, civil unrest, military occupation, and lack of law and order. The economic restructuring and nation re-building process took shape only late 80s onwards. There is no documented/recorded history of solar pv in Uganda prior to 80s. |
| Early 1980s | The Uganda Railways Cooperation, a government parastatal, installed 35kW at 29 locations for communications and signaling. The Uganda Post and Telecommunications Cooperation also installed 30kW at 35 remote telecommunication sites country wide. |
| 1985 | Installation of the first few units of solar under the UNEPI program, procured through UNICEF and WHO and engaged a few private companies for installation of systems. Imported solar equipment mainly from Europe. |
| 1986 | Incafex Ranches imported solar systems to support farm activities, for lab testing of tic control. It is reportedly the first private company with solar as a periphery business. |
| 1987 | Magric Uganda Ltd. was founded by a British Ugandan. Magric was also dealing with commercial farming, agro-products etc. and peripherally ventured into solar PV. |
| 1992 | Wilken Telecommunications Uganda Ltd. engaged with selling solar PV products, to take advantage of emerging opportunities and introduced a global brand Solahart to Uganda. |
| 1993-95 | Solar Energy for Africa was founded by a US based Ugandan. This was the first exclusive solar company in Uganda. He went on to open several branches in Kenya, Tanzania, Rwanda, Burundi etc. Through 90s, he worked closely with church-based organizations. |
| 1994 | Solar Connect Association (SCA) started their solar cooking projects in Uganda in 1994 with the support of several organizations including WWF. |
| 1996 | ESMAP study report published by the World Bank. The WB suggested that Uganda should invest further in exploring alternative renewable technologies for energy sources. |
| 1997 | Solar Light for Africa, an ecumenical non-profit organization, founded in the US by a Bishop for providing light to an orphanage in Hoima, Uganda. Bishop's idea was to build a partnership with Ugandan churches and promote the role of church in helping Ugandans access energy. |
| 1998 | UNDP-GEF UPPPRE Project. First pilot solar project initiated by the Ministry of Energy, Rural Electrification Authority in collaboration with UNDP and World Bank and by accessing funds from the Global Environment Facility. |
| 1999 | UltraTec Ltd., an exclusively renewable power solutions company is started by an Indian Ugandan, along with his wife. UltraTec became the distributor to several big PV brands including Outback Power Systems (US) and Solahart (Australia). |
| 1999 | The Electricity Act was put into motion. With this, the legislative and regulatory foundation for the power sector reforms were set. Uganda Electricity Board was privatized. A new rural electrification agency and an independent regulatory authority was to be set up. |
| 2001 | Rural Electrification Agency, a semi-autonomous body was set up as a secretariat to the Rural Electrification Board which is responsible for rural electrification, as per the Electricity Act 1999. However, it became operational only in 2002-03. |
| 2001 | Bujagali hydropower plant was supposed to start construction but was halted due to several controversies and international allegations. |
| 2002 | Successful completion of the UNDP-GEF UPPPRE Project. The project led to installation of over 2000 solar systems in rural households by 2002. A terminal evaluation report laid out the specifics of its strengths and weaknesses. As part of this, a renewable energy association was formed. |
| 2002 | Konserve Consultancy Ltd. was formed to provide advisory and technical services regarding renewable energy power solutions. They have worked closely with development partners esp. GIZ. They have worked on implementing solar systems at institutional and residential level. |
| 2003 | Solar Division of Davis & Shirtliff is formed. D&S is a Kenyan owned provider of water and clean energy solutions. They opened a subsidiary in Uganda in 1996. However, their solar products were launched in the market in mid 2000s. They opened several branches all over Uganda in late 2000s. |
| 2000-2005 | In early 2000s, cheap solar products manufactured in China were widely made available by Chinese wholesalers and Ugandan retailers. This was also the period of low awareness of these products among the users, lack of standards and legislation to regulate the market. |

| Year(s) | Key Developments in Ugandan solar PV sector |
|---|---|
| 2005-06 | Electricity crisis hits. Power outages lasting 12 hours or more became a norm. Common reasons cited for the power shortage include: i) consecutive droughts and reducing water levels; ii) lack of timely planning for increasing generation capacity; iii) increasing electricity demand. Government immediately reacted by setting up diesel generators upto a capacity of 50 MW and kept adding more to manage the crisis. However, that led to fiscal issues due to high diesel costs and also increasing electricity subsidy burden overall. The construction of Bujagali plant had still not started. |
| 2007 | Renewable energy policy was formed. Introduced feed-in-tariffs. With regard to solar, the policy mentions that it has a high upfront cost, hence suitable for only urban residential and commercial consumers. |
| 2007 | Rural Energy Foundation of Netherlands (grant fund provided by the Dutch Ministry of Foreign Affairs) started working in Uganda to provide solar energy solutions to rural households at a low cost and to remove some of the market barriers which inhibit the uptake of such technologies. |
| 2008-09 | Several media reports/news articles cover that fake solar panels have flooded the market. There were many cases of errors with labelling, wrong sizing etc. such as many 50w panels were labelled as 100w. |
| 2009-10 | The local Ugandan companies lobby with the government to implement stricter standards on imported solar products. They also start organizing and mobilizing themselves to re-start an association. |
| 2009-10 | ERT Phase II starts, PV component implemented through a Photovoltaic Targeted Market Approach (PVTMA) which included provision of consumer subsidies. The target was to connect 20000 new consumers through standalone solar systems and by involving private companies. |
| 2009 | Village Energy (VE) was formed with the goal of providing energy access to rural communities in Uganda. Started by a Ugandan social entrepreneur, an Ashoka Fellow. VE mainly focuses on enhancing the distribution network and capacities by developing a network of technicians all over the country and by running a certified training academy. |
| 2010 | Foundation Rural Energy Services (FRES), a Dutch company opens a subsidiary company in Uganda with a fee-for-service business model. As of 2016, they have 4711 customers and a total of 907 kWp installed. |
| 2009-10 | Fenix International Co. is formed, a US-owned private solar company with its base and operations in Uganda, and a software team based in the Silicon Valley. Fenix partnered with MTN to implement its ReadyPay Solar and primarily targeted solar home systems, catering to rural areas. |
| 2011 | Solar Now, previously Rural Energy Foundation, is formed as a private solar company, Dutch-ownership and its main base in Uganda. Solar Now has the widest reach in the country (over 40 offices) and mainly targets larger solar systems starting with 50Wp panels. |
| 2011 | Barefoot Power Light Up a Village (LUAV) program designed to improve the market penetration of Pico PV. It involved 100 households per community and provided products for lighting and mobile charging, with a payment system based on either upfront or installment basis. |
| 2011 | Govt. started giving a 50 per cent subsidy for every solar water heater bought at a select six outlets. This was as an outcome to the study conducted by the BUDS-ERT Private Sector Foundation that water heaters consume up to 40% of the total electricity consumption in homes and institutions. |
| 2012 | The target for RESP 2001-2010 was to increase the rural electricity connections from 1% to 10%. However, REA had to extend the first plan up to 2012-13. By 2012, the electrification rate in rural was 7%. This was mainly achieved through grid extensions. |
| 2013 | Rural Electrification Strategy Plan 2013-2022. The target is to increase the electrification rate from 7% to 26%. This will be mainly driven by grid but the segments far away from the grid will be connected to mini-grid or off-grid solar. It is understood that achieving 100% rural electrification is not feasible through grid connections solely. |
| 2013 | Village Power, a Swiss-owned private solar company in Uganda is formed. Still in its early stage, it receives support as part of the GIZ EnDev Program to expand their geographical presence and set up offices and sales units in several districts. |
| 2015-16 | Uganda Solar Energy Association, an association for private solar companies gets formed again. Most of the agenda setting is done through the involvement of development partners, global industry PV association, and multinational firms. |

| Year(s) | Key Developments in Ugandan solar PV sector |
|---|---|
| 2016-17 | World Bank/IFC's Lighting Africa Campaign was launched in Uganda for conducting market assessment to identify demand and bottlenecks, creating consumer awareness and supporting enforcement of quality standards for PV products. |
| 2017 | DFID's Energy African Campaign was launched for coordinating with all the stakeholders in the PV market to address challenges in a consolidated way. |
| 2017-18 | Transforming Energy Access program funded by DFID to support testing and scale up of innovative technologies and business models advancing off-grid energy access. |
| 2018 | ERT Phase III starts. The target includes improving access on-grid, off-grid and institutional strengthening through impact monitoring. It also includes disbursing funds to local banks to provide working capital to PAYG operators. |

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# Article 1

# Agency in transition: the role of transnational actors in the development of the off-grid solar PV regime in Uganda

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**Abstract**

While the sustainability transitions literature has highlighted the importance of agency in technological change, there is still limited understanding of the role of transnational actors, such as development agencies, which tend to be key drivers of energy transitions in low-income countries. This paper aims to fill this gap by investigating the role of transnational actors in the development of the off-grid solar PV regime in Uganda, from the early 1980s to 2017. Specifically, we develop a typology of transnational actors and examine their roles in mobilizing the flow of knowledge, capital and technology towards shaping the country's off-grid solar PV rural electrification regime. By discussing the pivotal role of foreign actors, their underlying motives and their shifting importance over time, the paper demonstrates empirically the highly transnational nature of regime development. In the process, we also develop a typology of transnational actors. In doing so, we contribute to the academic literature on actor-oriented determinants in sustainability transitions, as applied to low-income countries.

**Keywords**: *Energy access*; *transnational actors; agency; rural electrification regime; sustainability* transitions

## 1. Introduction

International efforts to provide access to modern, off-grid, clean energy services have intensified in recent years. This includes global initiatives such as Sustainable Energy for All (SE4All), Alliance for Rural Electrification (ARE), and the Global Off-Grid Lighting Association (GOGLA). Such efforts aim at achieving universal energy access (SDG7) while ensuring a reduction of greenhouse gases in line with the Paris Agreement. In most Sub-Saharan African (SSA) countries, improving access to energy is critical as national electrification rates are often below 20%. In this context, solar photovoltaic (PV) has become the principle technology to improve energy access due to its decreasing cost and increasing efficiency. This has been complemented by the widespread use of mobile phones, new flexible mobile payment systems and favorable national policies (Nygaard et al., 2016, Ockwell et al., 2018, Rolffs et al., 2015).

Accordingly, the uptake of off-grid solar PV products, such as solar home systems (SHS), has increased rapidly across SSA. In the period between 2011 and 2015, the number of so-called pico-solar PV products sold in SSA grew from less than half a million to over 11 million per annum (Panel, 2017), with nearly 1.92 million units being sold in SSA in the second half of 2017 alone (GOGLA et al., 2016). East Africa is home to the highest density of solar PV product suppliers worldwide (GOGLA et al., 2018), and in Uganda, the cumulative sale of off-grid solar products between 2014 and 2016 was around 2 million, with an annual growth of 135% (GOGLA et al., 2018). This increase in uptake of solar PV offers a significant means to improve energy access, driving the transition towards sustainable energy systems in East Africa.

It has been argued that sustainability transitions in low-income countries are greatly influenced by various transnational actors (TNA) and cross-border linkages (Marquardt et al., 2016, Wieczorek et al., 2015, Hansen and Nygaard, 2013, Hansen and Nygaard, 2014, Tigabu et al., 2017, Truffer et al., 2015, Sixt et al., 2017). In the case of SSA, scholars have drawn attention to the power of global capital in "disciplining" clean energy transitions in Kenya (Byrne et al., 2018), the influence of "rising powers" in Mozambique and South Africa (Power et al., 2016) and the struggles between local actors and international development actors in Kenya's PV niche development (Byrne et al., 2018).

However, we still know very little about the specifics of *how* TNAs influence such transitions and especially, how they form relationships with local actors and become embedded in transition processes locally. In this paper, we offer an account of these processes by analyzing the role of TNAs in the development of the off-grid solar PV regime in Uganda, from the early 1980s to 2017. We develop a typology of TNAs and examine their influence on regime development through their mobilization of knowledge, capital and technology and their respective strategies and interests in doing so. The research question guiding the paper is: *How do transnational actors exert influence and operate while mobilizing key resources for sustainability transitions in low-income countries?*

In the following section, we elaborate the analytical framework for the article. In section three, we describe the research methodology, followed by section four, which presents our empirical findings. These findings are discussed in section five, followed by the conclusion in section six.

## 2. Analytical framework

The sustainability transitions literature focuses on analyzing how transformative change in socio-technical systems unfold (Geels, 2002, Geels, 2010, Geels and Schot, 2007). A prominent framework in this literature is the Multilevel Perspective (MLP), which offers a structure to assess how transitions unfold as interlinked processes across three analytical levels: landscape, regime, and niche (Geels, 2002, Markard et al., 2012). Niche refers to a protected space that facilitates experimentation and innovation, whereas landscape is seen as "a broad exogenous environment" (Grin et al., 2010). Regimes are conceptualized as "semi-coherent rule sets carried by different social groups, which stabilize a technological trajectory" (Fuenfschilling and Binz, 2018, Geels, 2002). Transitions entail a shift from one socio-technical regime to another, resulting from the interplay between niche developments and landscape pressures.

Scholars have pointed out that niches and regimes are not limited to specific territorial boundaries and span across multiple spatial scales (Raven et al., 2012, Hansen et al., 2017, Berkhout et al., 2011, Manning and Reinecke, 2016). As Raven et al. (2012) put it, regimes may be "transnational in physical extent, or in the economic and technological base that supports them". Smith et al. (2010) suggest that they may be influenced by global actor networks and institutional arrangements that may either strengthen or weaken them. Wieczorek (2017) and Hansen et al. (2017) note that while regimes may be influenced by transnational linkages, it is less clear how these linkages operate and function, particularly in the context of developing countries. We aim to enhance this understanding by employing the MLP framework in analyzing the process of socio-technical regime development, using a transnational perspective.

Despite MLP's emergence as a key analytical framework, it has increasingly been criticized for a lack of sensitivity to the importance of agency (Geels, 2011, Grin et al., 2011, Farla et al., 2012, Avelino and Wittmayer, 2016, Wittmayer et al., 2017). Grin et al. (2011), for example, highlight a lack of systematic understanding of multiple actors and their agency in transition processes. Similarly, Farla et al. (2012) call for a more explicit conceptualization of actor strategies and resources. Fischer and Newig (2016) suggest that actors supporting transitions can be part of multiple categories, rather than just niches and regimes performing different types of roles (Wittmayer et al., 2017). And Avelino and Wittmayer (2016) note and clarify the ambiguities associated with the conceptualization of actors, and propose a multi-actor perspective to better understand "shifting power relations in transitions". These critical voices have raised renewed interest in improving the understanding of the role of different actors and agency in sustainability transitions.

Following Budde et al. (2012) and de Haan and Rotmans (2018), we adopt a more actor-oriented perspective in transition studies, particularly in understanding the agency of TNA in influencing systems change. We draw inspiration from the "relational perspective" suggested by Raven et al. (2012), which focuses on how specific TNAs become entangled with local networks, institutions and infrastructures through global-local relations (Coenen et al., 2012, Sengers and Raven, 2015). In a similar vein, we draw on Wieczorek et al. (2015) who explores how local niche actors in the solar PV sector in India are embedded in different types of transnational linkages, distinguishing five categories of linkages: actors, knowledge, capital, technology and institutions. Our approach differs slightly from Wieczorek et al. (2015), however, as we understand actors not as an independent category of linkages, but the main node through which various resource flows, specifically knowledge, capital and technology, are mobilized (Wei, 1995). We conceptualize the flow of knowledge as comprised of the exchange of ideas, skills and competences, for example through a process of learning by importing and interacting (Ramanathan, 1994, Lema et al., 2018). The flow of capital refers to the inflow of financial resources from abroad in the form of direct project funding, official development assistance, loans, grants, and equity investments provided by development banks, charities, and commercial investors. The flow of technology refers to the cross-border transfer and diffusion of hardware artefacts, components and equipment, such as solar panels, batteries or inverters (Wieczorek et al., 2015). Further, we do not explore TNAs as niche actors or regime actors, but acknowledge that their roles cut across the analytical levels of the MLP framework.

We understand that landscape is associated with tremendous inertia at a wider ideological, political and economic scale, through such forces as globalization, privatization, neoliberalism and climate change (Geels, 2005, Geels and Schot, 2007). It operates beyond the direct influence of actors (Geels, 2005), but it "can have a major influence on the [actor] behaviours and choices" (Raven and Geels, 2010). In addition, TNAs (such as development agencies) have an influence on how such landscape forces are instantiated in particular contexts at the local level (Sergi et al., 2018, Baker et al., 2014). Instead of treating these as given, our enquiry attempts to make these forces of influence explicit by focusing on the agency of specific actors.

We build on the Multi-actor Perspective (MaP) developed by Avelino and Wittmayer (2016), in which they unpack the actor category of the "third sector" defined as an intermediary between the state, market, and community. The third sector comprises of individuals and organizations that cut across the boundaries between the three axes i.e. profit and non-profit, private and public, formal and informal. In our case, a majority of the TNAs operate in this spectrum of three axes, without strictly adhering to any one notion. Several TNAs operate in a hybrid form, through partnerships that involve a blend of private firms, foundations, NGOs and development banks, among others. Thereby, we develop a typology of "transnational actors" and expand the interpretation of TNAs beyond donor agencies, to include consultancy firms, social enterprises, philanthropic foundations and missionary organizations, among others. This typology of TNAs is presented in Table 1 along with the resources they are likely to mobilize.

**Table 1 - Typology of Transnational Actor-Groups**

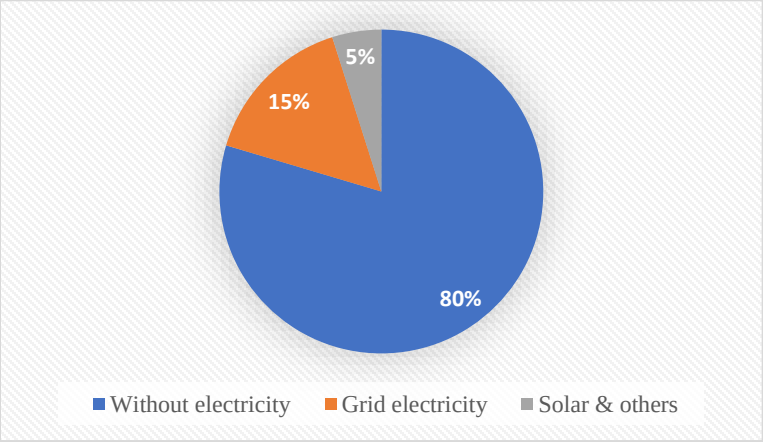
| Actor-Groups | Examples | Characteristics | Resources likely to be mobilized |
|---|---|---|---|
| Development aid organizations | USAID, DFID, GIZ | These agencies have a country of origin and operate with the motive of representing their country´s policies and politics. They exert political power and engage with influencing the politics of nations. | Capital Knowledge |
| Inter-governmental organizations | UNEP, UNDP, WHO, IRENA, IEA | These organizations do not have a specific country of origin but are representative of sovereign member states. They exert economic, social and political power. | Knowledge Capital Technology |
| Bi-lateral, multi-lateral development banks | IFC, FMO, KfW | These are institutions providing capital to developing countries and could be bi-lateral or multi-lateral. They exert certain economic and political power. | Capital |
| Charities, NGOs, foundations | WWF, Shell Foundation, Solar Light for Africa | These are non-profit organizations performing development and/or humanitarian work. These include: i) faith-based organizations; ii) corporate-backed foundations; and iii) charities. They enact, propagate and organize different world-cultural issues. | Knowledge |
| Private firms | Solar Now, Fenix Int., Barefoot Power | These are for-profit firms and social enterprises engaged with business to improve the delivery of electricity goods and service esp. targeting rural areas. They enjoy authority in terms of economic power. | Technology Knowledge |
| Consultancies, Advisory firms | Enclude, Open Capital Advisors | These are organizations engaged with providing consultancy and technical advisory services for rural electrification. They assert expert knowledge. | Knowledge |
| Global industry association | GOGLA, ARE | These are associations targeted to achieve common goals such as promoting off-grid solar. They exert the power of networking, advocacy and international clout. | Knowledge |
| Educational Institutes, Universities | Access2 Innovation, MIT | These are educational institutions, university consortiums engaged with projects as intermediaries or implementers etc. They exert a certain definitional authority and enjoy high social legitimacy. | Knowledge Technology |

*Source:* Developed by the authors

We also identify the actor characteristics, including the authority they may exert for being positioned within global networks. In line with de Haan and Rotmans (2018), we identify an actor as a person operating individually, or as an organization, or a collective of persons including alliances and networks. In this the underlying assumption of the typology is that the actors operate under common logics and modus operandi along the three axes, which allows us to analyze their respective interests and motives in mobilizing resources in regime building. We assess this in detail in Section 4, in order to better understand the solar PV transition process. In so doing, we do not undermine the interests and contributions of the national actors, but illustrate the multi-actor dynamics, and emphasize the influence of TNAs in sustainability transitions.

In Uganda, historically, the government and various development organizations have operated under the assumption that electrification should be achieved through grid connectivity, characterized by large utilities and centralized governance. The policies and related development activities have been aligned to this vision of electrification. This may be seen as corresponding to the dominant electrification regime at a national level. As per the National Population and Housing Census 2014 (UBOS, 2016), the total percentage of the population with access to electricity was 20.4% at the national level, of which 15.5% was connected to the electricity grid, and 4.9% to other sources, as displayed in Figure 1 below. While the main census report does not elaborate on the "other sources", according to the interviews conducted for this paper, they comprise mostly of off-grid solar PV systems. Also, we note that these electrification rates are captured at a household level, which does not include institutions, where off-grid solutions have a wide application (e.g. in rural health centers, schools, telecom towers, churches).

**Figure 1 - National Electrification Rate in Uganda**




*Source:* National Population and Housing Census, 2014

Further, nearly 79% of the total population in Uganda is identified as rural (WorldBank, 2018). Of the rural population, nearly 5.1% of households are connected to the national grid, and 5.2% of households use off-grid solutions (UBOS, 2016). Based on this, we infer that there is no dominant rural electrification regime since a majority of the rural population is unelectrified. Unlike a conventional monolithic understanding of regimes in the transitions literature, we argue – in line with van Welie et al. (2018) – for an understanding that appreciates coexisting and complementary heterogeneous regimes in developing countries. Accordingly, the rural electrification regime in Uganda may refer to both electricity grid extension and the use of off-grid solar PV systems. Mini-grids that make use of solar PV may provide an example of a niche due to their nascent stage of development. Solar PV systems are currently a widely used electrification source in rural areas than its alternatives (such as the expensive diesel generators), whereas the policy focus of grid connections is mainly in urban areas and for productive use. There is a patchwork of different motivations and institutions driving the off-grid solutions rather than a dominant vision typically associated

with a single electrification regime. Hence, we conceptualize the use of solar PV systems in off-grid, rural areas as a rural electrification regime on its own. And this PV regime comprises of semi-coherent rules, policies, infrastructures and discourses, which we analyze unfolding over a period of time.

## 3. Research methodology

Off-grid solar PV is an important technology behind the rural electrification regime in Uganda in terms of diffusion rates. Furthermore, off-grid solar PV has over time been significantly influenced by transnational actors and linkages, which range from small-scale projects by NGOs to sector-based development programs and private firms. The case of off-grid solar PV in Uganda was therefore selected as it provides a suitable empirical context to examine the role of TNA in regime building.

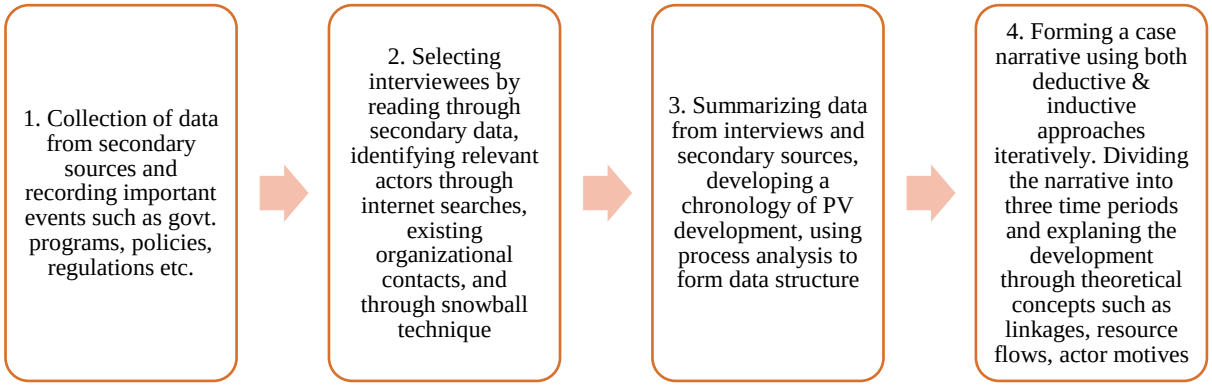
We used a qualitative approach based on case studies to capture historical accounts, narratives, power relationships, actor contestations and negotiations. Case study design is appropriate for process-related *how* questions, and is also sensitive to contextual details (Yin, 2009, Yin, 2003, Eisenhardt and Graebner, 2007). Moreover, a qualitative case study approach allows flexible use of data with an exploratory nature of analysis, which better captures the motives and experiences of actors and provides a deeper understanding of the mechanisms of change (Graebner et al., 2012, Gioia et al., 2013). Figure 2 highlights the approach employed for the study.

Yin (2009) suggests using multiple data sources such as secondary material, archival records, interviews, public records etc. for case study research. For this study, we collected secondary data, reconstructed the timeline of solar PV development, and identified the key organizations, events and developments. Next, we identified the key actors based on the available information and through snow-balling technique and interviewed them. Not all actors identified could be interviewed due to access and availability constraints, especially those involved in the sector in the 1980s and 1990s, but some of the developments in that period were covered in secondary material.

The semi-structured interviews totaling thirty-one were carried out between July and December 2017 with representatives of government, private firms, development agencies, and the solar industry association, among others (see Annex III*).* The questions focused on understanding the involvement of interviewees in the development and diffusion of off-grid solar PV systems. We enquired about their roles in specific projects/programs, and gauged their objectives and motives such as policy goals, sectoral targets, political aspirations and philanthropic interests (see Annex IV). In addition, visits were made to eight private firms operating from Kampala, and discussions were conducted with the staff at five branch offices (points of sale) at district level, and seven independent retailers across Northern and Eastern Uganda. These were aimed at gauging the market demand, pricing, distribution strategies, challenges, user interest and feedback. Subsequently, we developed a detailed chronology of events, and a database of forty-five off-grid solar PV initiatives between 1985 and 2017 involving TNAs, some of which are analyzed in detail in section 4**.** Based

on this compiled data and insights from the interviews, we divided our analysis into three time periods of PV development (see Annex I).

**Figure 2 - An overview of research design**



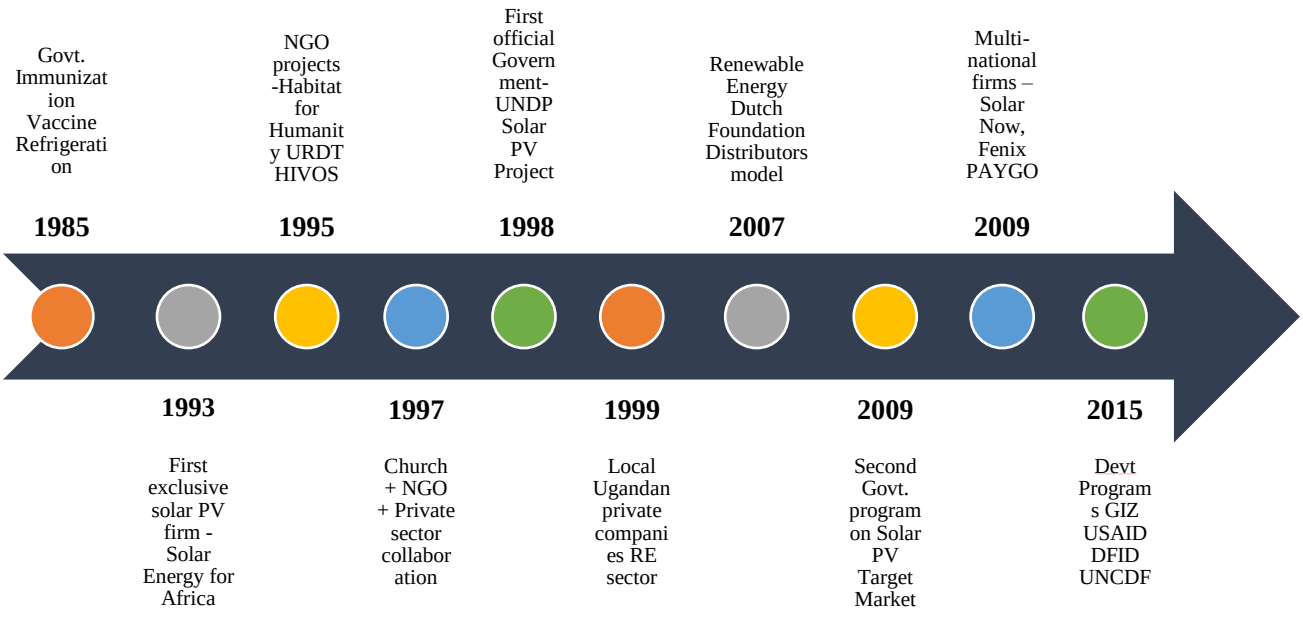

The analysis was carried out by synthesizing and summarizing data from interviews, secondary documents, and field notes. The analytical procedures focused on understanding the role of TNAs, their main motives and their activities related to mobilizing resources. For capturing the resulting outcome of their involvement with PV initiatives, we use the indicator of the total number of solar PV units installed or sold. The ways in which transnational actors influenced and mobilized resources needed to be assessed empirically. We identified the key solar PV initiatives, relevant TNAs, and undertook stages of open coding to indicate the objectives and motives associated with the initiatives. Further, empirical examples of resources mobilized were gathered by operationalizing transnational linkages in line with Wieczorek (Wieczorek, 2017). We looked for specific evidence such as foreign knowledge providers, foreign work experience, references to technical and training assistance, capacity building, references to finance and funding sources including development finance, grants from foundations, and references to technology imports, foreign technology providers etc.

Limitations of the data collected by this methodological approach, as also reflected in other such historical studies (Byrne, 2011), include unreliability (esp. sales figures of PV systems by private firms), fragmentation (e.g. due to the short-term employment of multiple consultants through the project lifecycle), inaccessibility (e.g. available only with retired officials), and sometimes unavailability (e.g. many initiatives were not recorded or documented). For many projects, we relied on the memories of key informants, and wherever possible, triangulated them through other available evidence. It was particularly difficult to gather quantitative information such as units installed or system capacities or the funding amounts based on personal memory.

## 4. The role of transnational actors in the regime building process

We have divided this section into three separate phases that emerged during the research process: Phase I (1983-1996), Phase II (1997-2008) and Phase III (2009-2017). The cut-offs mark disjunctures in the regime building process, characterized by distinct breaks from the nature and pattern of developments preceding them. The narrative only presents a curated sample of initiatives from the database, those that were highlighted by local experts as key milestones, and for which sufficient data could be obtained. A snapshot of the key developments and milestones across the three phases of PV development has been presented in Figure 3. These are detailed further in the following paragraphs.

**Figure 3 - Reconstructing the timeline - key developments and milestones**




### 4.1. Phase I (1983-1996): Small scale, scattered and unintended developments

In the 1980s, a civil war was still being fought in Uganda, following a decade of civil unrest during the 1970s. After an interruption, the Uganda National Expanded Program on Immunization (UNEPI) against diseases like tuberculosis and measles was re-started in 1983, with full operations being resumed in 1986 after the war ended and Yoweri Museveni became the President. The program was hosted by the Ministry of Health (MoH), and external expertise was brought in through two United Nations (UN) agencies: The World Health Organization (WHO) and United Nations Children's Fund (UNICEF). The UN agencies mobilized resources for the program by collaborating with numerous other organizations such as missionary hospitals, development aid agencies (DANIDA, DFID, JICA), Rotary International, the Red Cross and Save the Children Fund (SCF). (Johnstone, 1988) Vaccines, the main tools for immunization, are fragile and

sensitive to temperature changes, requiring refrigeration at 4° C, which needed electricity. Also, while the central cold store was located in Entebbe, the vaccines had to be stored and transported throughout the country. Back then, diesel generators and kerosene were the main fuel sources used in rural areas for electrification. However, their restricted supply in the war zone slowed down the program.

To counter this, the managers at UNEPI and MoH explored solar PV as a possible solution, and SCF undertook a feasibility study on it in 1984, after which they embarked on promoting a unique solar-powered refrigeration system in Uganda. Using solar PV was thus not part of the initial program planning but was incidental and a response to local circumstances. A former manager reported that they installed fifty solar-powered refrigeration units initially[i]. Due to a lack of technical know-how in Uganda, technicians from UNEPI went to Rome for training by Pragma, an Italian company that produced solar PV cells, and a team of Italian engineers travelled to Uganda to help with the first installations in 1987 (Johnstone, 1988). The Italian Government had previously pledged a part of 100 million USD to Uganda in support of the UNEPI program. It was reckoned by program managers that though the solar PV systems were expensive, they needed little maintenance once installed and were a reliable means to store high-value vaccines in remote areas. Subsequent, solar-powered refrigerators were also procured from BP Solar (Spain) by UNICEF. By the late 1980s and early 1990s, in addition to refrigeration, solar PV also started being used for lighting in rural health centers (Eliah and Louineau, 1999). The overall uptake rate of solar PV for vaccine refrigeration within UNEPI program in Phase I was 150, which increased to around 900 systems by Phase III.

The private sector's relationship to solar PV formed during the late 1980s, when a former aircraft maintenance engineer with Kenya Airways returned to his native country Uganda and founded the company Incafex Ranches Ltd., supplying solar PV systems to rural farmers for lighting purposes[ii]. Concurrently, his German friend wanted to set up a farm laboratory in Uganda to conduct experiments on tick-control and tick-borne diseases on cattle. They decided to set up the laboratory on the farm of Incafex, in central Uganda. The laboratory required electricity and a refrigerator, which prompted them to import a solar PV system from Germany, as there was no electricity grid and solar-based refrigerator was a viable option by then. Subsequently, Incafex imported another small kit-sized system comprising of a solar panel, battery and two light bulbs from Neste Advanced Power Systems (NAPS - Netherlands), with the help of a regional agent of NAPS-Kenya based in Nairobi[iii]. Their use of solar PV at the farm lab generated interest among fellow farmers in the region. This in turn motivated other local firms, such as Magric Ltd. (founded by a British-Ugandan), Sun Trade and Consulting International Ltd., Agip Ltd. and Nairo Agro, to venture into importing and supplying solar PV to government projects and households on need-basis. Little is known about these local companies, though, and most have shut down their operations.

Incafex, however, continued to engage in importing and selling PV systems mainly by securing contracts for government projects and for solar lighting systems in rural health centers and schools. Later, Incafex

also imported invertors from Mastervolt, based in the Netherlands. In the 1990s, the focus was on the sale of solar PV systems mainly to NGOs and government agencies. Representing Mastervolt in Uganda, the founder also attended an annual meeting of solar distributors in the Netherlands in the 1990s to connect with the larger network of distributors[iv]. The strategy helped him develop contacts with equipment suppliers in Europe and strengthened ties with Mastervolt, which led to a continued collaboration through the 2000s.

Meanwhile, in the early and mid-1990s, NGOs (local and foreign) played an important role in spreading the use of solar PV in rural areas, some of which is well-documented. One such NGO was Uganda Rural Development and Training (URDT), founded by a US educated Ugandan social entrepreneur, and supported by a few American strategists engaged in creative leadership and systems thinking. URDT was established in 1987 and they started exploring solar PV for powering their office in Western Uganda in 1990, and to operate computers. URDT also offered school leavers a training program in installation of solar PV systems (Eliah and Louineau, 1999). Other NGOs that undertook similar endeavors include World Vision and Concern International. After gaining experience, URDT embarked on a solar lending program in 1995 with support from Hivos, a Dutch NGO, and a loan from the Dutch Bank Triodos. URDT played an intermediary role between the bank and the end-users. Through a cross-subsidy scheme, large system buyers subsidized the small system buyers. Hivos provided technical assistance to install and service PV systems, and funding from the Dutch TOOL Foundation enabled 15 locals to be trained in technical aspects, marketing and user awareness. (Eliah and Louineau, 1999). In addition, URDT also supported four staff members to be trained by specialized PV firms in Tanzania and Kenya. Assistance in the form of capital (loans) and knowledge (technical assistance) helped the project achieve its targets, and URDT developed long-term partnerships with the Triodos Bank and Hivos[v]. Within two years, 130 systems were reportedly installed (Eliah and Louineau, 1999).

In western Uganda, two US NGOs, Habitat for Humanity and Solar Electric Light Fund offered loans to around 1500 new homeowners to purchase solar PV systems. Reportedly, around 100 solar PV systems were installed by the two NGOs between 1995 and 1996. The systems were partly (50%) subsidized by the US Department of Energy (Eliah and Louineau, 1999). The NGOs adopted a coupled approach targeting low-income families for affordable housing and electricity.

While a number of initiatives were driven by NGOs in the early to mid-1990s, the number of private (for profit) firms selling and installing solar PV systems in Uganda rose alongside to nine. Most of these were small enterprises with sales averaging 0.5-3 KWp/year (Da Silva and Kyalimpa, 2001). Many of them were involved with the sale of agricultural equipment and saw the sale of solar PV systems as a growth technology within an existing market. Others were traders marketing a range of commercial products, selling solar PV systems as off-the-shelf items similar to kerosene lanterns and transistor radios. However, only one of the firms dealt with solar PV exclusively.

Solar Energy for Africa (SEFA), founded in 1993 by a US based Ugandan, provides an example of the Ugandan firms that emerged in the 1990s. In the beginning, SEFA had three employees, but by 1994 it had expanded with subsidiaries in Tanzania, Rwanda, DR Congo and Burundi. Initially, all staff members underwent training in solar PV technology in the US. The founder continued to be based in the US, with frequent visits to East Africa. SEFA partnered with NGOs to implement PV projects in the region. One of the first projects SEFA implemented was in partnership with Habitat for Humanity in which 100 solar home systems were installed in the village of Kasese (SELF). In 1994, SEFA installed PV lighting systems in three hotels on the Kalangala island of Lake Victoria. The founder tapped into many high-profile networks in Uganda. The next project reportedly came through Salem Saleh, the brother of President Museveni, to install PV systems in a number of rural health centers. Soon, the word spread and SEFA got a project through a Member of Parliament in Western Uganda who wanted to electrify schools and villages in his constituency[vi]. In this case, the diffusion of PV gained legitimacy due to political currency. SEFA partnered with Solar Light for Africa (SLA), a US non-profit, founded in the late 90s by a Bishop with the initial purpose of providing light to an orphanage in Hoima. The bishop's idea was to build a partnership between Ugandan and US churches, to leverage the church in helping Ugandans access modern and clean energy (Vision, 2003). The agenda went beyond just lighting churches to bringing light to the rural communities, literally and metaphorically. In this model 50% of the financing for the solar system was covered by SLA, and the remaining 50% was borne by the end-users. The Bishop's son was an electrical engineer and provided technical support, and they also partnered with SEFA for installations. While being rooted in the diaspora network, the founder mobilized resources through national and transnational ties, and also linked it with religious agendas. Thus, Phase I evolved in a non-linear manner, through experimentation and need-based interventions. This phase is characterized by small-scale initiatives, short-term projects, and the beginnings of entrepreneurial ventures. A summary of the role of TNAs in phase I is presented in Table 2.

**Table 2 - Role of Transnational Actors in Regime-building process Phase I**

| **Phase I: 1983 - 1996** | | | |
|---|---|---|---|
| **Transnational actors involved** | **Resources mobilized by the transnational actors** | **Main actor motives** | **Off-grid solar PV diffusion rates** |
| WHO, UNICEF, SCF in the UNEPI program | -*Knowledge*: training provided to installers (subsequently users) by the Italian company Pragma, program management and feasibility study by SCF<br>-*Finance*: WHO, UNICEF and a number of development banks and partners, for procuring vaccines<br>-*Technology*: solar-powered refrigeration systems imported from Pragma, Electrolux, and BP Solar. | WHO: improving health by promoting vaccination programs<br>UNICEF: improving the wellbeing of children<br>SCF: equal opportunities to every child | Nearly 150 solar-powered refrigeration units were installed in this phase, and 900 installations in total till date |
| Incafex Ranches Ltd. | -*Knowledge*: The founder´s engineering knowledge from aircrafts, and his German friend's networks with solar PV manufacturers<br>-*Finance*: government project contracts<br>-*Technology*: Solar kits from Neste Advanced Power Systems, and imported invertors from Mastervolt from Netherlands | -Exploring new business opportunities | N.A. |
| Uganda Rural Development and Training | -*Knowledge*: technical assistance and training in installation and service of solar PV systems by HIVOS. Training of URDT staff members by Karagwe Development Association (solar training facility) in Tanzania and Energy Alternatives Africa in Kenya<br>-*Finance*: solar lending program in 1995, with support from a Dutch NGO called HIVOS and a loan from Dutch bank Triodos.<br>-*Technology*: solar panels, batteries and invertors from NEST-Netherlands | -To help rural communities access education and training to become self-sufficient<br>-Altruistic motives of the co-founders | Nearly 300 solar systems were installed (different types of products in terms of Wp) |
| Habitat for Humanity and Solar Electric Light Fund (SELF) | -*Knowledge*: technical assistance to users for installation of PV systems<br>-*Finance*: solar systems were 50% subsidized by the US Department of Energy bringing the local cost down to 400 USD<br>*Technology:* solar PV systems were imported from the US through a private firm - SEFA | -Habitat: affordable housing and electricity; rebuild lives<br>SELF: livelihood empowerment, and reducing energy poverty | Around 100 solar PV systems were installed by the two NGOs between 1995 and 1996. |
| Solar Energy for Africa (SEFA) | -*Knowledge*: all staff members underwent training in solar PV technology in the US; they provided technical assistance to users<br>-*Finance*: 50% of the financing of the solar system was covered by Christian organization (SLA), and the remaining 50% was borne by the end-users.<br>- *Technology:* imported PV systems from a number of manufacturers in China, Germany, India, Spain, US etc. | -To promote the church and Christian ideals in Uganda | N.A. |

### 4.2. Phase II (1997-2008): Gaining Momentum / Commercialization of PV

In 1993, the Govt. of Uganda (GoU) started a program of major market liberalization, financed by the World Bank (WB), which led to the break up and sale of numerous public enterprises, which included power sector reforms. These structural reforms aimed at economic growth were promoted by WB and the International Monetary Fund (IMF) in a number of countries, and were based on earlier experiences of the privatized electricity sectors of Chile, Argentina, UK and Norway. In Uganda, the reforms entailed unbundling of the monopoly of electricity board, privatization and liberalization of the electricity sector (Mawejje et al., 2013), and strengthening the regulatory framework. These measures were enshrined in the Electricity Act, 1999. It is important to understand the process that led to the reforms, and the role played by TNAs (esp. development banks). In the 90s, several study teams from WB visited Uganda conducting an energy sector assessment mission in 1994, followed by a review of the renewable energy sector in 1995. The energy sector management assistance program (ESMAP) produced a sector strategy in 1996 (supported by development aid agencies and UNDP) (Bank, 1999), and another mission in 1998 for implementing the Africa Rural and Renewable Energy Initiative (AFFREI), which aimed to achieve rural electrification through the private sector. Based on these studies, WB heavily influenced the Electricity Bill, which was designed to attract private and foreign investment in the energy sector. In addition, the Norwegian Govt. and the Norwegian Agency for Development Cooperation (NORAD) provided grants (0.6 million USD) (DEMD, 1999) and played a prominent role in institutional restructuring, establishing the de-regulated energy sector, and preparing the Energy Act. WB, NORAD, UNDP, JICA, among others, were the principle architects of the restructured electricity regime.

Meanwhile, MEMD (Ministry of Energy and Mineral Development) embarked on a pilot project in June 1998, the Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE), again aimed at promoting solar PV technology for rural electrification through the private sector. UPPPRE was a precursor to the ERT project, and a number of TNAs were involved in the design process including World Bank and UNDP. Through this project, the government sought to establish the foundation for diffusion of PV technology in rural areas for which there were no plans to extend the national electric grid. The project was selected for funding by the Global Environment Facility (GEF), which is a partnership of governments, development agencies and civil society organizations.

UPPPRE included a 1.8 million USD budget for technical assistance, and it received an additional 500,000 USD from UNDP to finance a PV credit fund and guarantee facility. The project aimed to electrify 2,000 households and several community/institutional facilities. By the end of 2002, 2,389 household PV systems had been installed with support from UPPPRE (Thorne and Mutesasira, 2002). The program trained technicians for system installations and maintenance, and conducted awareness campaigns. It also led to capacity building within the MEMD. UPPPRE was the first government project to initiate planned efforts

to promote the use of solar PV in Uganda. It mobilized private actors and helped them form an association, namely the Uganda Renewable Energy Association (UREA), predominantly comprised of solar firms. The project also provided financial resources to UREA for networking, sensitization, and training.

However, UPPPRE suffered from delays, financial mismanagement, and lack of capacity (MEMD, 2009). There were differences of opinion and contestations among the partners, including about the timeline for payback period of PV loans by end-users. The contestations were mainly over international expertise (claimed by development partners) versus local contextual knowledge (claimed by MEMD)[vii]. This was followed by a period of struggle and negotiations between development donors and the MEMD, resulting in agreements to apply a longer payback period. The new payment system allowed flexibility and inclusion of households engaged in seasonal activities (such as fishing, agriculture), without a steady income source, thereby expanding the market for PV home systems.

UPPPRE was the beginning of a decades-long program called Energy for Rural Transformation (ERT), the first phase of which (ERT-I) commenced in July 2002. Around the same time, a semi-autonomous body - the Rural Electrification Authority (REA), was set up to manage the rural electrification fund, as advised in the Electricity Act, 1999. The ERT was a multi-sectoral collaborative project with a mission to increase energy access. For the energy component in ERT-I, the objectives were to increase PV sales, improve the quality of products being imported, and ensure price reduction. MEMD and REA were responsible for implementation, with support from WB (for funding) and Private Sector Foundation Uganda. ERT-I was designed to be purely commercial, with PV companies undertaking installation, sale and marketing of the systems. Training was provided to 300 solar technicians. This strategy for building up the PV market was based on the assumption that given appropriate grants, private firms would accelerate market growth and deliver on the ERT-I targets (REA, 2010), which was in line with the mainstream privatization ideals, motivating the TNAs and shaping the larger narrative.

However, private sector penetration in rural areas remained low during 2002 to 2005, and several PV firms focused instead on the urban markets, primarily Kampala. Further, the initial phase of ERT was characterized by "uncoordinated and unclear operations and incoherent guidelines from the World Bank" (MEMD, 2009), and there was a lack of unified authority as multiple WB consultants were working over short time periods (MEMD, 2009). ERT-I also suffered delays for several reasons including the disagreements between WB and REA with regard to the project design and delivery models (REA, 2010). Such contestations between MEMD and WB/UNDP in both UPPPRE and ERT programs revealed ideological and intellectual struggles. In both cases, TNAs privileged their knowledge and agency over government insights on the local context and requirements, leading to delayed outcomes.

Meanwhile, the number of private players in the solar market began to rise. During Phase II, at least 30 key private players were operating in the market, the majority of whom were system integrators and hardware

retailers (Kyezira et al., 2009). In addition, a number of small-scale traders, local retailers with over-the-counter sales, and independent distributors scattered country-wide were also responsible for significant PV penetration, for which no aggregated data exists. The market was "in a state of transition where different players were yet to find their optimum servicing levels" (Kyezira et al., 2009). More importantly, some firms had started to carve their niche by partnering with specific manufacturers (such as SolarHart-Australia), and/or by focusing on specific geographical areas (such as Kampala). Such firms developed through diverse distribution networks including partnerships with NGOs, development agencies, microfinance institutions, credit cooperative groups, and local distributors[viii]. They were also instrumental in unifying the previously fragmented voice of solar industry in Uganda.

In 2007, the Rural Energy Foundation (REF), a Dutch non-profit organization, started its SolarNow program in Uganda. REF specializes in establishing and capacity building of retailer networks at the lower end of the supply chain (i.e. local retailers). REF was funded through grants from the DOEN foundation (Netherlands) and the Dutch Ministry of Foreign Affairs, in addition to several individual contributions and foundations. Typically, REF identifies retailers and distributors, trains them in PV technology, sales, and marketing, and helps them start a local business[ix]. Entrepreneurs completing the training sign an agreement with REF and develop solar businesses using the SolarNow brand (Ashden, 2010). Between 2007 and 2010, SolarNow sold over 57,000 solar home systems and 36,000 solar lanterns, a far greater number of units than all previous business models combined.

Distinct from phase I, this second phase was characterized by a number of deliberate and planned solar PV programs focused on for-profit ventures, often with specific sales and distribution targets. It was the beginning of a new privatized era for the electricity sector, with the promotion of private sector investments for rural electrification becoming a government priority. There was an increased momentum and a greater supply-push from stakeholders. Commercial-scale PV operations gained traction and a number of new TNAs entered the market, including development aid agencies, foreign private firms and non-profit organizations. The emphasis was on rural electrification given that nearly 90% of the total population in Uganda was rural, most of which was off-grid. A summary of the role of TNAs in this Phase is presented in Table 3.

**Table 3 - Role of Transnational Actors in Regime-building process Phase II**

| **Phase II: 1997-2008** | | | |
|---|---|---|---|
| **Transnational actors involved** | **Resources mobilized by the transnational actors** | **Main actor motives** | **Off-grid solar PV diffusion rates** |
| UNDP, World Bank, CTA, private companies' involvement in the UPPPRE | -*Knowledge*: technical assistance for installation and maintenance of PV by WB consultants, trainings for cooperatives, 30 seminars/awareness campaigns held for users by private firms, advertisements in newspapers and radio/talk shows for users<br>-*Finance*: Global Environment Facility for technical assistance and UNDP for PV credit fund and guarantee facility<br>-*Technology*: the solar equipment was procured by the World Bank from China | - To improve electricity access by piloting solar technology<br>- To promote privatization in service provision<br>- Capacity building | Installation of 2389 PV systems at the household level in rural Uganda |
| World Bank involvement in the ERT-I program | -*Knowledge*: training of 300 technicians, developing higher solar PV standards, business support to PV firms, installation and maintenance of PV systems, user manuals, capacity building of ministerial staff involved, trainings to microfinance cooperatives, setting up solar PV testing lab<br>-*Finance*: International Development Association, and GEF grant<br>-*Technology*: the solar equipment was procured by the World Bank from China | - Facilitating access to energy for improving services such as health, education, water, sanitation<br>- For promoting solar PV as a viable technology and enhancing the quality of products sold | 512 solar systems installed in 127 health centers, 221 systems in medical buildings, 261 systems in medical staff houses, 20 solar water pumps, schools<br>– nearly 1200 systems in total |
| Rural Energy Foundation | -*Knowledge*: training local retailers with a knack for engineering solutions to become entrepreneurs and developing a competent supply chain<br>-*Finance*: grant fund by the DOEN foundation in Netherlands and the Dutch Ministry of Foreign Affairs for REF; financing for users via retail loans through micro-finance institutions<br>-*Technology:* importing solar products from China, US, and Europe, assembling and installation by local technicians | - To create a network of local technicians in rural Uganda<br>- To test the viability of a unique supply chain focused business model | 57000 solar home systems and 36000 solar lanterns |

### 4.3. Phase III (2009-2017): Scaling up and the dominance of market forces

In continuation to ERT-I program, ERT-II was initiated in 2009 to develop the institutional framework and capacity for delivery of renewable energy services. The PV sub-component of ERT II was implemented by REA through the PV Targeted Market Approach (PVTMA), which included provisions for consumer subsidies, and incentives to suppliers and financial institutions. The target was 20,000 new SHS units by 2013[x]. ERT-II was designed by MEMD and REA, based on the experience of ERT I and UPPPRE. REA supported the firms in establishing a fee-for-service business model. For this, a combination of funds from the International Development Association (IDA, a part of the WB Group) and GEF (REA, 2010) were

used to co-finance sales to households and NGOs. Nearly 20 solar PV firms participated in the PVTMA program.

The subsidy program was not entirely effective. Many PV providers did not pass on subsidies to end-users. Further, an internal audit team at REA identified several discrepancies. In 2015, Uganda's Auditor General highlighted malpractices in the implementation of the solar subsidy program including misreporting and double billing (Muwanga, 2015). Some solar firms claimed payments for non-existent installations, and some invoiced for systems donated by NGOs. The program also failed to meet its target, delivering only 14,000 connections by 2014 (MEMD, 2014). ERT-II was replete with lax bureaucracy, complicated project designs, corruption by private actors and vested interests of some, all of which undermined project success.

Meanwhile, the solar market grew rapidly with a new generation of market players (mostly foreign) – SolarNow, Fenix Int., M-Kopa, Village Power, Azuri Tech etc. New business models based on pay-as-you-go (PAYG) technology were developed, overtaking the local Ugandan companies and forcing strict competition. Capitalizing on its success discussed in Phase II, the SolarNow program was transformed in 2012 from a non-profit foundation to a commercial for-profit entity selling to SMEs and households not only in Uganda but the whole of East Africa.

Around the same time, a US based venture-backed renewable energy company, Fenix International, entered Uganda in 2011, with expertise in power electronics, product design and base-of-the-pyramid (BoP) marketing. They initially partnered with MTN Uganda (telecom stores) to sell solar systems for phone charging and lighting based on upfront cash sales targeting the BoP market[xi]. By 2013, Fenix developed mechanisms for offering credit, and in 2014, launched its commercial-scale ReadyPay products, a mobile pay-enabled solar panel and smart battery system based on a lease-to-own model. ReadyPay, developed by an in-house team, was made available on a PAYG basis using MTN mobile money, a payment platform that allows subscribers to send and receive money via their cell phones. By 2017, Fenix had connected over 100,000 users through their systems[xii]. Unlike SolarNow, Fenix deals with relatively small size systems, targeting low-income rural users.

In Phase III, the sales of just 4 such large solar firms in Uganda had totaled 250,000 units[xiii]. These new generation firms provide quality electricity supply, hardware and services, and also offer coupled credit services. Their solar system distribution branches are predominantly located in high-density areas i.e. central and eastern Uganda, with few in the northern region[xiv]. Some of them have a cloud-based distribution management system, allowing them to monitor real-time customer energy usage data. They have dedicated personnel engaged with training staff through customized in-house trainings. And they have staff that's able to speak dozens of local languages and dialects, allowing for far greater market penetration.

These firms typically have a regional presence and operate across East Africa in order to achieve economies of scale. Several of them rely on external funds in the form of debt financing (e.g. Azuri gets funds from

ElectriFI and TRINE, M-Kopa from CDC, FMO and Norfund) (Reporter, 2018, Maina, 2017), series B financing/crowdfunding (SolarNow from from Novastar Ventures and Shell Technology Ventures Fenix from GDF Suez and Scheider Electric) (Fenix, 2015, Saberi, 2017), second structured asset financing/SAFI (SolarNow from SunFunder) (SolarNow, 2016), UN's capital investment through UN Clean Development Fund (for Village Power) and a range of grant funds from USAID (Power Africa), and GIZ (EnDev). Currently, a hybrid financing structure is being witnessed with a mix of DFIs, impact funds and commercial investments. Further, there is an emergence of commercial investments as the off-grid markets are scaling up (GOGLA et al., 2018).

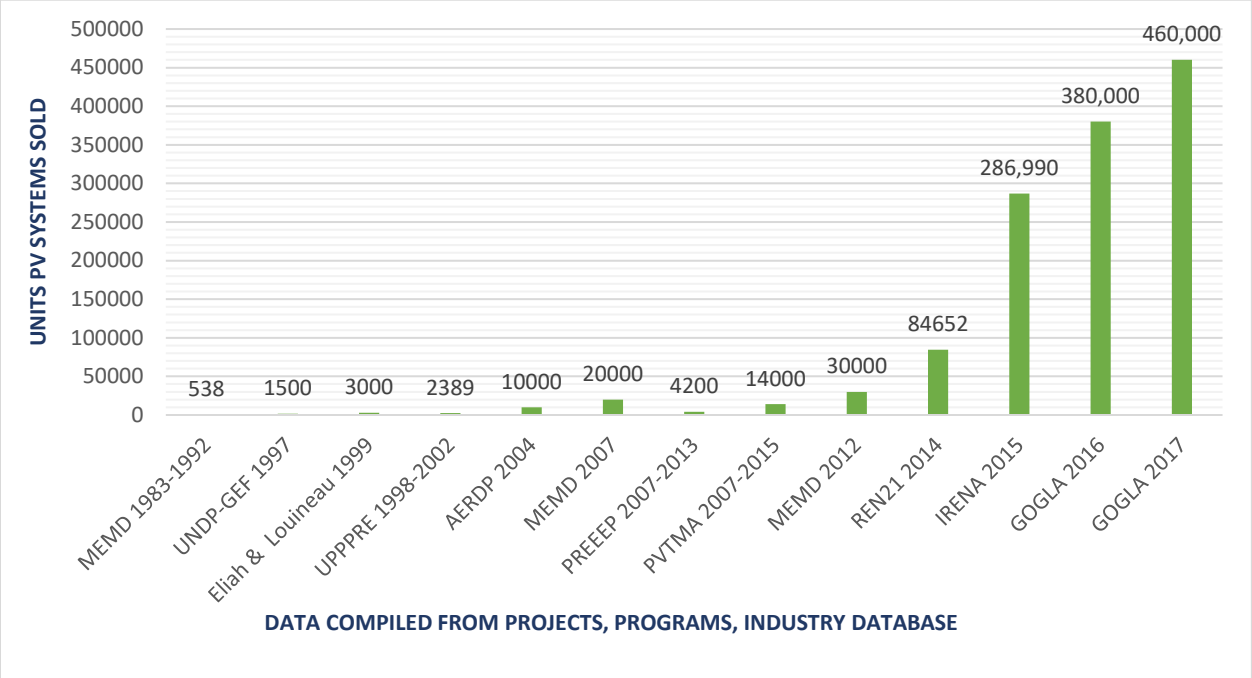
While Phase III has been mainly private-sector driven, a number of initiatives by development partners and multilateral banks are being implemented such as Lighting Africa Program/Campaign (IFC/World Bank), Transforming Energy Access/Energy Africa Campaign (DFID), Energizing Development (EnDev) and Scaling Off-grid Challenge for Development (SOGE). These are multi-country, multi-partner programs, and similar approaches are adopted targeting the whole of SSA and/or beyond as well. Thereby, many key initiatives may not necessarily be driven by adaptation to a local context but they display similarities and patterns with decisions triggered elsewhere, which is reflective of a more regionalized or even internationalized view of the rural electrification regime. Instead of short-term projects/subsidies etc., the development partners and charities such as Shell Foundation are adopting an "enterprise-based model" that is built on market solutions, business support, partnerships and financial sustainability.

Within this rural electrification regime, we also witness the emergence of solar PV mini-grids at a scale (kWp) different from that of solar pico and home systems (Wp). The Rural Electrification Strategy and Plan (RESP 2013-22), developed by REA, prioritizes rural electrification through PV-powered mini-grids (REA, 2013). In phase III, 6 mini-grid projects were implemented in Western Uganda and the islands on Lake Victoria [xv]. These were developed by private actors with support from USAID, Shell Foundation, GIZ and REA etc. While the solar mini-grids form the rural electrification niche, it is likely that in future they may be a co-existing regime, along with grid extensions and off-grid solar PV.

Thus, in this phase, the solar PV market matured and became commercially viable for the private sector to thrive. The total number of private players in 2013 were 85 (Kyezira et al., 2009). However, this doesn't include a number of small-scale traders, dealers, independent distributors, local retailers etc. which may indicate a number of roughly 300 or more. As a result, the uptake of solar PV is relatively high. Foreign firms capture a large share of the market. The presence of foreign technology, capital and skills has been driven by the market and has helped professionalize the sector. Firms that were previously distributors representing specific manufacturers have diversified and now import from a range of manufacturers, and some develop customized designs but get them manufactured in China. Further, there is an increased mobilization and consolidation of several actors, and joint advocacy for a bigger industry voice through the

Solar Association (USEA). Several new partnerships and alliances have been forged, and networks formed, which is an ongoing process. The overall off-grid sales data (representative) is presented in Figure 4 and a summary of the role of TNAs in this phase is in Table 4.

**Figure 4 - Off-grid solar PV sales data (1983-2017)**




*Source:* Author's own compilation. This has been compiled from various sources, and is not exhaustive. Some of them represent govt. programs (UPPPRE, PVTMA), and others represent data from industry association (GOGLA).

**Table 4 - Role of Transnational Actors in Regime-building process Phase III**

| **Phase III: 1997-2008** | | | |
|---|---|---|---|
| **Transnational actors involved** | **Resources mobilized by the transnational actors** | **Main actor motives** | **Off-grid solar PV diffusion rates** |
| World Bank in ERT II program | -*Knowledge*: developing an institutional framework for PV by WB, capacity building of the private firms, trainings for installation and maintenance<br>-*Finance*: by International Development Association, and GEF grant; subsidy scheme for the consumers<br>-*Technology*: procurement of PV systems by private firms from a number of different manufacturers in China, Europe and the US. | - To promote private sector in delivery of rural electricity services<br>- Impetus to private firms engaged with solar PV business | In total, 14000 PV systems installed at household level |
| Solar Now | -*Knowledge*: prior knowhow of Dutch entrepreneur in a renewable energy foundation (based in Netherlands) with domestic market in Uganda, technicians turned local franchises and suppliers for the firm, training of 550 technical staff engaged in sales and marketing by Solar Now<br>-*Finance*: grant support by the Government of Netherlands<br>-*Technology*: from a number of manufacturers, especially in China. | - To capture a business niche through focusing on the lower end of the supply chain | Nearly 30,000 units sold |
| Fenix International | -*Knowledge*: technology company with vast experience, based in San Francisco, with expertise in electronics, product design and marketing, trained hundreds of their staff in technical competence, sales and marketing skills, and trained users in installation and maintenance of systems -*Finance*: Grant support from the Govt. of Netherlands and commercial finance<br>-*Technology:* the technology/ and product designs are developed by in-house engineering team, and manufactured through partnerships with factories in China. | - To develop an innovative, technology-based business model<br>- To integrate the business with data analytics and credit scores to connect users with financial institutions | Over 100,000 systems sold |
| GIZ, multiple donors, and private firms involved in EnDEV program | -*Knowledge*: technical expertise provided in the form of certifying technicians, developing guidance manuals, supporting PV firms in awareness campaigns for users etc.<br>-*Finance*: co-financed by multiple donor partners and governments such as Dutch Ministry of Foreign Affairs, Norwegian Agency for Development Cooperation, UK Department for International Development, Swiss Agency for Development and Cooperation<br>-*Technology:* the solar PV systems are procured and managed by individual private firms with the help of results-based financing scheme by EnDev | - To develop and test a viable business model (RBF) with financial incentives at its core<br>- To promote the delivery of renewable energy services through private sector and remove barriers | 157,800 systems installed at household level, 1100 at institutional level and 1600 for small businesses |

## 5. Discussion

In our description of the evolution of solar PV rural electrification regime in Uganda, we can see a shift from Phase I to Phase III from the traditional donor and government-supported programs to a more market-based diffusion of solar PV, as is also indicated in a report (Nygaard et al., 2016). Similarly, a shift can also be seen from traditional financing to innovative public and private financing mechanisms. After an initial period of incidental explorations in the late 80s, a larger market was deliberately created with concerted efforts by the government through long-term programs in collaboration with development partners, with a focus on rural electrification. The government played a critical role in supporting the consolidation of private actors to encourage and support market penetration, esp. in the late-90s. It invested in generating awareness and increasing the technical knowhow within the nation, with technical and financial support from international development partners and climate funds. It is important to note these background developments which created an enabling environment for the private-sector expansion and intensification of donor activities.

Within the private sector developments in this regard, we can also identify three different phases: First phase – late 80s and early 90s – local Ugandan companies experimenting with the solar sector without it being their main business interest (ex: Incafex, Magric); Second phase – late 90s to mid-2000s – Ugandan companies/traditional business models, dealing primarily in solar pico, SHS and large systems (ex: UltraTec, Energy Systems Ltd., Konserve); Third phase – late 2000s through 2010s – Multinational companies capturing large market shares with bigger investments, business innovation, development assistance and private capital (ex: Solar Now, Fenix). Further research needs to focus on the solar market, particularly private sector experimentation and upscaling.

Our findings also provide inputs for the shifting agency of actors in renewable energy transitions. The specific trajectory of off-grid solar PV is largely a manifestation of the changes and shifts in the development aid and financing mechanisms. Development organizations (esp. WB, NORAD, GIZ) during Phase I were involved in strategic, policymaking and advisory capacities and also provided financial support. In addition, they were closely engaged with shaping the fundamentals of the power sector in line with structural reforms and a push towards privatization and liberalization. The narratives – state failure and neo-liberal reforms – revealed that the rules of the game were soon to be determined by the market. This became the basis for how the electricity sector in Uganda is organized now, within which the multiple actors are located. The activities of the development partners have intensified but their roles have shrunk, to mainly becoming mediators and facilitators of the private-sector driven transition during Phase III, partnering, funding and promoting select private sector firms (ex: Lighting Africa, Transforming Energy Access), and advocating and lobbying for private sector voices and rights. This is also reflective of the shifting paradigms within development assistance for renewable energy (Kruckenberg, 2015). Further

research needs to focus on developing more specific insights on changes in development assistance (comparing DAC vs non-DAC contributions, public vs private finance etc.) in general, and how that manifested in the energy sector, specifically solar PV.

In line with the proposed alternative "global regime" perspective that embraces multi-scalar actor networks, our findings also illustrate that regimes (and niches) are indeed much more globally embedded than previously assumed (Fuenfschilling and Binz, 2018). Our findings reaffirm that the fairly rapid diffusion of solar PV, in a context such as Uganda (and East Africa), can only be understood from an "internationalized perspective" (Binz and Anadon, 2016, Quitzow, 2015). Further, this paper demonstrates the considerable contribution that a relational perspective could make with regard to deconstructing how distinct constellation actors and their relationships can influence socio-technical trajectories.

The paper disaggregates "transnational actors" by developing a typology beyond foreign donors and investors, and assesses the complex diversity of roles played by these actors in advancing the PV transition. The multitude of actors do not act as one unit but rather as a transnational network of independent, heterogeneous organizations driven by different sets of agendas and operating within a negotiated terrain, while exercising power of varying degrees. Agency is thus distributed rather than centrally coordinated (Manning and Reinecke, 2016) and multiple actors operate with a varied set of logics not easily captured by the simplistic notions of "profit" in relation to private companies, and "development" with regard to aid organizations. Our paper also highlights the need for a better framework of agency in transitions.

Further, our analysis indicates that TNAs tend to play a central role in mobilizing resources, exert varying degrees of influence through financing projects and providing expertise, and enjoy a superior position in global networks. This allows them higher bargaining power with the opportunity to advocate and support their preferred solutions. They gain legitimacy due to their embeddedness and siting within the wider global network instead of specific actor characteristics as such. Given this, we also observe distinctions in the definitional authority exerted by the "rational" or "neutral" third sector actors vis-à-vis the state and private sector actors. The trajectory of transition is constantly shaped and framed amidst the negotiations and tensions between the interplay of global and local actors in myriad forms. However, through a number of cases discussed in the empirical section, it is evident that TNAs frequently privilege their knowledge and agency over that of the national actors.

The case of Uganda also reveals similarities to the Kenyan and Tanzanian cases (Byrne, 2011) and we observe several linkages between Ugandan actors and those in Kenya and Tanzania (such as SELF, WB, UN organizations and many private sector firms). A striking similarity among these East African countries is in the pattern of involvement of donors, charities and NGOs in the early period and increasing private sector activity over time, with foreign firms building the momentum and continued involvement of donor agencies. This suggests that solar PV development in the broader East African region may be considered

as essentially a transnational phenomenon i.e. shaped by mainly transnational actors and cross-border resource flows. Perhaps this warrants a wider study about the roles of transnational actors in energy transitions across the national borders of East African nations.

## 6. Conclusion

This paper had set out to answer the following research question: How do transnational actors exert influence and operate while mobilizing key resources for sustainability transitions in low-income countries? So far, theoretical frameworks and empirical analyses have had a limited focus on the role of TNA, and their respective motives and agendas. This exploratory paper develops a typology of transnational actors, expands the heuristic framework of Multi-actor Perspective (MaP), and demonstrates the workings of it in an under-researched empirical context. It breaks away from the simplified aggregations of niche, regime and landscape actors, and identifies a number of actors that intervene at each of the levels. Thereby, it illustrates how specific actor groups and constellations of TAs influence the PV-based rural electrification regime, while being positioned and operating at multiple scales. This paper complements existing research work on global socio-technical regimes (Fuenfschilling and Binz, 2017) and contributes to the existing discourse on agency and power in transition studies (Avelino and Wittmayer, 2016, Wittmayer et al., 2017).

**Annex I: Off-grid Solar PV Initiatives in Uganda**

| **Phase I (1985-1996) - 10** | **Phase II (1997-2008) - 12** | **Phase III (2009-2017) - 23** |
|---|---|---|
| UNEPI Program/solar refrigeration | UNDP-GEF UPPPRE Project | ERT II Project (PVTMA) |
| Commonwealth Science Council Project on Solar Drying | ERT I Project supported by the World Bank | FRES, Dutch: Fee for service business model |
| URDT– Dutch HIVOS Project | UltraTec Pvt. Ltd. | Solar Now Uganda: PAYG firm |
| Habitat for Humanity and Solar Electric Light Fund (US) | Davis & Shirtliff Water-Solar Nexus | Village Energy (Network of Technicians and Academy) |
| Incafex and Magric – Private firms | Rural Energy Foundation (Dutch) Solar Now Program | Barefoot Power Light Up a Village Program |
| Solar Energy Uganda/Solar Energy for Africa – First PV firm | Shell Foundation - Uganda Energy Fund | EnDeV Project GIZ Uganda – Solar SHS and Pico PV |
| SEFA in partnership with Solar Light Churches for Africa | PREEEP GIZ Project: promoting renewable energy projects | Fenix International/ Ready Pay (PAYG) |
| Uganda Railway Corporation – EU Project on Telecommunications | JEEP-Nordic Folk center: Solar project | Solar Sisters Inc.: empowering women as entrepreneurs |
| Uganda Posts and Telecommunication – WB Project | Solar Energy Uganda Ltd. / Hire purchase business model | Village Power "Lighting Lwango Project" |
| Wilken Telecommunications Ltd. - Introduced solar water heaters | Energy Advisory Project – GIZ, MEMD | CREEC Presidential Initiative Project: solar lamps initiative |
| | Promotion of solar water heating-MEMD and Govt. of Ireland | CREEC Solar Energy Kiosk Project |
| | Greenlight Planet, Sunking, d.light – manufacturers of PV | Let There Be Light International collaboration with KACCAD |
| | | Scaling-up rural electrification: EU funded and supported by WWF-Uganda / FRES |
| | | Africa-EU Renewable Energy Cooperation Program (RECP) |
| | | Let There Be Light International Collaborated with KACCAD |
| | | ERT III Project: collaborating with Lighting Africa |
| | | Transforming Energy Access (TEA): Shell Foundation, Innovate UK, DFID |
| | | Providing Access to Energy in Northern Uganda – EU funding & Church of Sweden |
| | | UNCDF Clean Start Program: – NORAD, SIDA, Austrian Agency etc. |
| | | Milking the Sun and Harvesting the Sun, Solar Now, Barefoot Power, funded by the Dutch Government |
| | | Scaling off-grid energy (SAGE) – USAID/Power Africa, DFID/Energy Africa and The Shell Foundation |
| | | UNICEF MobiStation Initiative – 'Digital school in a box' |
| | | Solar Suitcases Project – We Care Solar |

**Annex II: Donor programs of relevance to the Off-grid Solar PV sector**

| Project Title | Main Donor | Time Period Covered | Focus Area | Budget (USD) |
|---|---|---|---|---|
| Uganda Photovoltaic Pilot Project (UPPPRE) | GEF/UNDP | 1997 – 2002 | Pilot solar PV for rural electrification | 1.3 million |
| Electricity for Rural Transformation-I | UNDP, World Bank, GEF | 2002 – 2006 | Provision of energy services for improving access to health, education, water and sanitation services | 4.5 million |
| Electricity for Rural Transformation-II Photovoltaic Target Market Approach | UNDP, World Bank | 2007 – 2016 | Facilitated PV systems based rural electrification through private sector enterprises | 46 million (includes financing for grid and off-grid services) |
| Promotion of Renewable Energy and Energy Efficiency Program (PREEEP) | BMZ / GIZ | 2006 – 2011 | Technical assistance to MEMD in the improvement of policy and markets, capacity building and awareness campaigns | N.A. |
| Energizing Development program (EnDev) | GIZ, DFID, SIDA, SDC, MFA, DGIS | 2009 – ongoing | Providing energy for lighting/electrical appliances to households, institutions and SMEs, supporting solar companies in end-user financing | 14 million (including off-grid, grid extensions and cookstoves) |
| Providing Access to Energy in Northern Uganda (PAMENU) | GIZ | 2008 – 2011 | Providing training to local technicians and supporting local PV suppliers | N.A. |
| Milking the Sun & Harvesting the Sun | Government of Netherlands | 2015 – Ongoing | Provision of solar lighting systems and solar powered agricultural appliances targeting dairy and crop farmers | N.A. |
| Lighting Africa Program | World Bank / IFC | 2017 – ongoing | Catalyzing the market through market intelligence, quality assurance, access to finance, business support and policies | N.A. |
| Energy Africa | DFID-UK | 2017 – Ongoing | Campaigning to improve the policy and support conditions to accelerate market based solar PV systems delivery | 4 million |
| Energy for Rural Transformation – III | World Bank | 2018 – Ongoing | Installation of PV systems in rural areas, business development support, provision of credit and quality standards enforcement support. | N.A. |
| The Scaling Off-Grid Energy (SOGE) Grand Challenge for Development | USAID / Power Africa, DFID, AfDB, Shell Foundation | 2017 - Ongoing | Providing seed funding to solar start-ups to support PV expansion, testing of new business models and tap into public and private finance; accelerate growth in off-grid market | 3.7 million |

| Project Title | Main Donor | Time Period Covered | Focus Area | Budget (USD) |
|---|---|---|---|---|
| UNCDF Clean Start Program | United Nations Clean Development Fund, Embassy of Sweden in Uganda, Austrian Development Agency, NORAD, SIDA | 2017 – Ongoing | Providing risk capital to incubate scalable financing models with clean energy service providers, technical assistance to scale up, leaning and sharing, advocacy and partnerships | 10 million |
| Promotion of Mini-Grids for Rural Electrification | EU / BMZ, Government of Germany | 2016 – 2020 | Technical assistance on the mini-grid sector in Uganda. Activities: Mini-grid policy support, Tender framework, 40 Mini-grids, Productive use | 9.7 million |

## Annex III: Interviews Conducted

| Sr. No. | Role | Organizational Affiliation | Interview Type |
|---|---|---|---|
| 1. | Former Commissioner | Ministry of Energy and Mineral Development (MEMD) | Personal |
| 2. | Former Advisor | MEMD | Personal |
| 3. | Project Manager | UNEPI, Ministry of Health | Personal |
| 4. | Founder | Incafex Ltd. | Personal |
| 5. | Technical Director | Solar Energy for Africa | Personal |
| 6. | Co-founder<br>Managing Director<br>Chairman | Uganda Solar Energy Association<br>Konserve Consult Ltd.<br>Uganda National Renewable Energy and Energy Efficiency Alliance | Personal |
| 7. | Secretary | Uganda Solar Energy Association | Personal |
| 8. | Marketing Manager | UltraTec Ltd. | Personal |
| 9. | Commissioner | Renewable Energy Department, MEMD | Personal |
| 10. | Acting Director | Energy Resources Development, MEMD | Personal |
| 11. | ERT Lead Coordinator | MEMD | Personal |
| 12. | Former ERT Consultant | MEMD | Personal |
| 13. | Executive Director | Rural Electrification Authority (REA) | Personal |
| 14. | Off-Grid Manager | REA | Personal |
| 15. | Principal Project Engineer-ERT coordinator | REA | Personal |
| 16. | Country Head-Uganda | E4Impact | Personal |
| 17. | Senior Standards Officer, Electrical Division | Uganda National Bureau of Standards | Personal |
| 18. | Managing Director | Uganda Energy Credit Capitalization Company | Personal |
| 19. | Energy and Climate Advisor | Energy Compact, DFID-UK | Personal |
| 20. | Country Head-Uganda | Village Power | Personal |
| 21. | Sales Representative | Village Power | Personal |
| 22. | Regional Sales Head | Solar Now | Personal |
| 23. | Chief Executive Officer | Village Energy | Personal |
| 24. | Product Manager | Fenix International | Personal |
| 25. | Managing Director | All in Trade | Personal |
| 26. | Civil Society Representative | AFIEGO | Personal |
| 27. | Manager | Solar Mini-Grid Program, GIZ | Personal |
| 28. | Director | Business Uganda Development Scheme - ERT | Email |

| Sr. No. | Role | Organizational Affiliation | Interview Type |
|---|---|---|---|
| 29. | Founder | Uganda Rural Development and Training Program | Email |
| 30. | Project Engineer-Solar | Centre for Research in Energy and Energy Conservation (CREEC) | Personal |
| 31. | PREEEP Coordinator | GIZ | Personal |

## Annex IV: Interview Guide

D.1 Key Guiding Questions for Government Actors

1. What was the motivation, need, and purpose for the solar programs?
2. Who were the stakeholders involved in these programs (including external consultants etc.)?
3. What were the roles and responsibilities of all the stakeholders involved?
4. What resources did each of these stakeholders bring to the process?
5. What were the targets, anticipated outcomes and actual outcomes?
6. What and how did the interests and motives of the various partners differ?
7. What were the key debates, and disagreements among the program partners? Why?
8. What were the learnings, achievements, and challenges during this process?

D.2 Key Guiding Questions for the Private Firms

1. What was the vision and motivations of the entrepreneurs/founders?
2. Elaborate on: the organizational setup, business model, distribution strategies, sales trends etc.
3. What is innovative about your business model/operations?
4. How competitive is the market? Clear niches or overlapping market share?
5. Information on collaborations, partnerships, and funding sources.
6. Information on the type of users, user preferences and their feedback.
7. What is your opinion on the new solar tax and your efforts on advocacy/lobbying?
8. How did you coordinate with GOGLA? And how do they represent private interests?

D.3 Key Guiding Questions for Development Organizations

1. What are the objectives, motives, and the design of the development projects in solar PV?
2. What resources did each of these stakeholders bring to the process?
3. How have the investment and financing trends shifted/evolved? What are the current areas of focus within rural electrification and solar PV? What is the current model/ethos of investment?
4. Who are the key development partners/organizations/banks with the biggest investments in PV? Which segment of PV were and are they most interested in?
5. What are the changes and challenges associated with funding? (ex: funding cuts)
6. Share your project specific inputs (PREEEP, ERT) on working with MEMD and REA. How receptive and cooperative have they been to the project designs, execution? Were there any challenges?
7. Information on the funding sources, and the total amount utilized for different components of the project.
8. Did the government have adequate skill-set and capacities to implement UPPPRE and how did that change by the time ERT was implemented?

D.4 Key Guiding Questions for NGOs, Research Institutes

1. Information on the past and current projects and project partners with regard to off-grid solar PV.
2. Specifics on each of the project – who designed it? How many target households or institutions? What was the purpose/need identified for the project?
3. What were the outcomes vis-à-vis the targets set?
4. What was your role and involvement? How did you engage with capacity building?
5. Could you share your research reports, and any available data sources on solar market?

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[i] Personal interview # 3
[ii] Personal interview # 4
[iii] Personal interview # 4
[iv] Personal interview # 4
[v] Email interview # 29
[vi] Personal interview # 5
[vii] Personal interview # 1, # 12
[viii] Personal interview # 6
[ix] Personal interview # 22
[x] Personal interview # 15
[xi] Personal interview # 24
[xii] Personal interview # 24
[xiii] Personal interview # 24, # 22, # 20
[xiv] Personal interview # 20, # 24
[xv] Personal interview # 14

# Article 2

# How do energy policies accelerate sustainable transitions? Unpacking the policy transfer process in the case of GETFiT Uganda

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**Abstract**

Energy policies play an important role in accelerating 'sustainable transitions' by enabling and incentivizing investment in electricity generation from renewable sources. Key policies such as feed-in tariffs, tradable permits and auctions were pioneered in OECD nations, notably within the European Union, and in recent years have been the subject of donor-funded projects to transfer such policies to lower-income countries. However, within the wider transition studies literature, there is a lack of detailed understanding regarding the process of *how* this policy transfer takes place in the renewable energy sector. Our research addresses this gap by analyzing the micro-politics and actor-strategies by which the GETFiT program was implemented in Uganda. In particular, we focus on the interplay of transnational and national actors in pursuit of specific policy objectives. Informed by case study method and qualitative research, we employ theoretical perspectives, archival data sources and semi-structured interviews to adapt the policy transfer framework to the agency perspective of policy translation. We find that transnational influences, resource flows, local embeddedness, and institutional resilience are all necessary prerequisites for a coherent policy outcome. Moreover, this study opens up an avenue of research into co-creation processes and relational perspectives in sustainability transitions.

**Keywords:** *actor coalitions, actor strategies, policy transfer, policy translation, energy transitions*

## 1. Introduction

International efforts to mitigate climate change have primarily been led by industrialized frontrunner countries, such as Germany and Denmark. The United Nations Framework Convention on Climate Change (UNFCCC) mandates that such mitigation measures must also be pursued by the less-industrialized, low-income countries (Popp, 2011, Wei, 1995), such as through technology transfer (Desgain and Haselip, 2015). The Paris Agreement (2015) adopts a more *bottom-up* approach, within the UNFCCC structures, allowing for voluntary pledges and contributions by both developed and developing countries (Clémençon, 2016, Dimitrov, 2016). Non-OECD countries, such as India and China, contribute an increasingly high share to global greenhouse gas (GHG) emissions and are also leading manufacturers of low-carbon technologies (Zhang and He, 2013, Gosens and Lu, 2014, Sahoo, 2016). Unlike normal market processes, the uptake of low-carbon technologies must happen at a faster pace if the world is to close the emissions gap (Kalkuhl et al., 2018). Low-income African countries have an increased potential to industrialize on the basis of renewable energy (RE) technologies as opposed to the conventional sources. While there has been a significant preoccupation with technology transfer (De Coninck et al., 2007, Murphy et al., 2015, Schneider et al., 2008), such transfer processes are enabled through factors such as incentive frameworks, supportive policies and market creation, among other state-led interventions.

The field of sustainability transitions is relevant here as it analyses how the complex interplay of technology, policy, institutions, markets, and society co-evolve and influence each other while being enmeshed within political economy (Ockwell and Mallett, 2012). Such interlinked processes are fundamental to catalyzing low-carbon development (Geels, 2010, Raven et al., 2012, Verbong and Geels, 2010). A key requirement for sustainable transition is the *redirection and acceleration of technological change* for which policies play an important role (Rogge and Reichardt, 2016). Within transition studies, reaching a better understanding of the policies and politics presents an emerging research agenda (Markard et al., 2012, Rogge and Reichardt, 2016). Much of the thinking in this field builds on the acknowledgment that policies are key to shaping transition trajectories through regulations, subsidies, incentives etc. As a result, scholars have undertaken systematic studies to analyze the politics of policy-making processes, such as the role of political coalitions in energy transitions in the US (Hess, 2014), advocacy coalitions in Swiss energy policy (Markard et al., 2016), and policy networks in Norwegian energy transitions (Normann, 2017). They have employed prominent and classical frameworks such as advocacy coalition framework, multiple streams approach, punctuated equilibrium theory, discourse coalition framework and policy networks approach. Further, it has been increasingly recognized that a multiplicity of instruments, unlike the focus on single instruments previously, are needed to foster low-carbon transitions. As a result, scholars have developed analytical conceptualizations of 'policy mixes' and applied them empirically in various Western contexts (Kivimaa and Virkamäki, 2014, Rogge and Reichardt, 2016, Kivimaa and Kern, 2016,

Rogge et al., 2017, Edmondson et al., 2018, Reichardt et al., 2016). Markard et al. (2016) note that transition studies are just beginning to pay more attention to the "political circumstances that make the adoption of such policies likely". Kern and Rogge (2018) argue that transition scholars have so far made limited use of policy process theories and have limited understanding of the politics in policy processes. Based on a review of the studies employing policy frameworks in sustainability transitions, Kern and Rogge (2018) identify two shortcomings, which include the continued focus on single policy instruments, and the neglect of the linkage between policy outcome and socio-technical change.

We contribute to this emerging research agenda by focusing on *how* policies lead to socio-technical change by analyzing policy process and employing a 'policy translation' approach. Policies in the context of sustainability transitions are unique, as they are geared towards speeding up the deployment of low-carbon technologies and mitigating climate change. However, a significant element of the policy processes is the international movement and adaptation of policies (Oberthür and Tänzler, 2007, Paterson et al., 2014, McCann and Ward, 2013, McCann and Ward, 2012, Stone, 2017), specifically in the context of developing countries. This has received limited attention within transition studies. In this paper, we focus in particular on how policies are transferred in specific developing country contexts, and the political dynamics it entails. This also links to the transition processes in the global south, which typically pose unique challenges and complexities that are different from their counterparts in the global north. These include weak institutional arrangements, less efficient bureaucracies, higher economic and political instability, and socio-economic inequality (Hansen et al., 2018, Ramos-Mejía et al., 2018). There is limited evidence on the dynamics of how renewable energy policies are transferred to developing countries, such as Sub-Saharan Africa (SSA), and how that triggers further socio-technical change.

Since the early 1990s, the European Union (EU) has positioned itself as a pioneer in climate change mitigation policies (Oberthür and Tänzler, 2007). Germany was the first European country to adopt a Feed in Tariff (FiT) program in 1991, followed by Denmark and Spain (Jacobs, 2016). FiTs have been structured in a number of ways and since early 2000s, there has been a shift from value-based to cost-based FiT programs, and from variable to fixed-rates, with long-term certainty (Jacobs, 2016). This served as a catalyst for RE growth not only in Europe but also worldwide. Lately, however, renewable energy auctions (RAs) have become popular, being adopted by 9 countries in 2009 to 44 countries by early 2013. RAs are market-based competitive bidding schemes, where typically a certain amount of power (megawatts-MW) of renewables are offered for bidding to project developers, with the assumption that competition will lead to reduced tariffs (Eberhard and Kåberger, 2016, Alvarez et al., 2017). This significant interest in RAs is driven by increasing maturity of technologies (such as wind and solar) and a rapid decline in the costs (IRENA, 2018). The number of countries adopting FiTs and RAs were 80 and 67 in 2017 (IRENA, 2013, IRENA, 2018). In Africa, there has been a growing interest to deploy policies that enable investment in renewables. Illustrative examples include adoption of FiTs by South Africa, Kenya, Uganda, Tanzania, and

Rwanda (Eberhard, 2013, Mendonça, 2009, Nganga et al., 2013) and RA schemes in South Africa, Uganda and Zambia (Eberhard and Kåberger, 2016, Meyer et al., 2015, Winkler et al., 2018).

This article examines how market-oriented policy instruments (FiTs and RAs) were transferred in Uganda in the period between 2010 and 2015, by employing the framework developed/proposed by Dolowitz and Marsh (Dolowitz and Marsh, 2000), and linking it with a 'policy translation' agency perspective (Stone, 2012, Mukhtarov, 2014) to study socio-technical change. We are interested in "action-oriented intentional activity" (Evans and Davies, 1999), and how knowledge about policies and administrative arrangements in one context are used to develop policies elsewhere. For this, we focus on analyzing the specific actor constellations through which the process was facilitated, and highlight their roles and strategies in mediating and shaping the resulting outcomes. In addition, we describe how policy transfer became part of ongoing political negotiation processes, which involved significant re-configuration, modification and further development of the *imported* policies within the national context. This article is informed by primary research and aims to illuminate the policy processes by employing the case of RE policies in an under-researched empirical context, while illustrating the roles and agency of national and transnational actors. The research question guiding this article is: *How did the actor constellations translate RE policy (case of GETFiT) and accelerate transitions within the specific political and institutional context of Uganda?*

In the following section, we elaborate the analytical framework. In section three, we classify the approach and strategies of policy entrepreneurs, drawing on theoretical concepts, in-depth interviews and archival data. Section four presents a background of the electricity sector and the history of FiT, followed by section five, which presents the main empirical and analytical findings. The final section reflects on the policy process and what it implies for sustainability transitions, followed by concluding remarks.

## 2. Policy Transfer and Translation

### 2.1. The Conventional Policy Transfer Approach

This article draws on the literature on policy transfer, which emerged in the 1980s from the field of comparative policy studies. The concept of policy transfer is understood in the literature as "a process by which knowledge of policies, administrative arrangements, institutions and ideas in one political system is used in the development of similar features in another" (Benson and Jordan, 2011). The literature on policy diffusion is considered to be complementary to policy transfer. Both transfer and diffusion processes share the assumption that "governments do not learn about policy practices randomly, but through common affiliations, and institutional membership" (Simmons and Elkins, 2004). The mechanisms for policy transfer have been recognized to be either 'voluntary' or 'coercive' (Dolowitz and Marsh, 2000). Voluntary policy transfer implies that countries or policymakers willingly adopt policies by way of learning, emulation (Bennett, 1991, Simmons and Elkins, 2004), 'hybridization', 'synthesis', 'inspiration' (Rose, 2005) and/or

'lesson-drawing' (Haas, 1992, Common, 2004, Stone, 2001, Rose, 1993, Rose, 2005). On the contrary, coercive transfer implies pressured adoption of policies, imposition of norms or standards by direct means or indirectly through conditionality obligations resulting from transnational policy externalities (Stone, 2017, Benson and Jordan, 2011, Stone, 2001).

A major preoccupation of this field has been the question of whether and why different countries develop similar policies over time. While diffusion and transfer are concerned with process patterns, policy convergence is associated with outcomes (Knill, 2005). Since the 1990s, policy convergence has mostly been associated with the phenomenon of liberalization (Simmons and Elkins, 2004) and opening up economies to global market forces. Among transnational organizations and global financial institutions such as World Bank (WB) and the International Monetary Fund (IMF) (Stone, 2004), this can be linked to the structural adjustment reforms introduced in developing countries, with conditions of privatization and market-oriented policies (Pauly, 2018, Haggard and Kaufman, 2018). It is important to note these macro-level ideas and global processes that have steered sector-specific policy and governance regimes in various national contexts, leading to diverse outcomes (Haselip and Hilson, 2005, Haselip and Potter, 2010).

The literature on policy transfer has evolved from being state-centric to encompassing transnational and non-state actors (Benson and Jordan, 2011), from being used to study social welfare policies (education, health) to encompassing a wide range of issues such as environmental (Betsill and Bulkeley, 2004), and also from being empirically situated in the US and Europe to Australia and Asia. A conceptual framework which gained the most traction for analyzing policy transfer was developed by Dolowitz and Marsh (Dolowitz and Marsh, 2000), hereby referred to as the DM model. It was envisioned as a heuristic framework. The DM model is based on six key analytical questions that support the systematic assessment of the policy transfer process, which are: *Why do actors engage in policy transfer? Who are the key actors involved in the policy transfer process? What is transferred? From where are lessons drawn? What are the different degrees of transfer? What restricts or facilitates the transfer process? How is the policy process related to policy success or failure?*

### 2.2. A Newer Understanding of Policy Transfer

The DM model has subsequently been reworked, mainly by sociologists and geographers (Benson and Jordan, 2011, Evans, 2009, Peck and Theodore, 2010, Stone 2004). The conventional model has been questioned for its assumptions of being a straightforward, linear and apolitical process (Temenos and McCann, 2013, Benson and Jordan, 2011). The model has also been questioned for treating policy ideas like artefacts that remain unaltered in the process of being transferred from one polity to another (Temenos and McCann, 2013). In contrast, the newer approach understands policy transfer processes as inherently political in nature, and deeply embedded within the institutional fabric of economy and society, subject to interpretation and selective uptake (Radosevic, 1999, Shin, 2013, Mathews, 2002). The concept of 'policy

translation' captures this understanding (Jones et al., 2014, Mukhtarov, 2014, Stone, 2012, Stone, 2017), and is also an umbrella term for a set of new concepts such as 'policy assemblages', 'bricolage', 'mutations', 'mobilities' (McCann and Ward, 2012, Peck and Theodore, 2010, McCann and Ward, 2013, De Jong, 2013) and 'localization' (McCann and Ward, 2012). These concepts identify policy processes as uncertain and complex, involving multiple iterations of problem framing, and multi-scalar actor networks (McCann and Ward, 2012, McCann and Ward, 2013). The emphasis is on agency and scale, drawing on the relational and constructivist approaches (Evans, 2009).

Policy translation takes an agency-centric approach, paying explicit attention to actors and strategies in the process of the travel of policy ideas (Mukhtarov, 2014, Mukhtarov et al., 2013). Similar to Stone (2008), Mukhtarov (2014), and drawing on McCann and Ward (2013), we *follow* the actors as they engage in *situations* with specific policy ideas and objects by framing and modifying their embedded texts, meanings and constructions. In doing so, we draw inspiration from research adopting an actor-oriented approach to policy transfer, including those focusing on specific actor roles such as policy entrepreneurs (Huitema and Meijerink, 2010), transnational corporations (Stone, 2004), and policy networks (Stone, 2008). Particular attention has been paid to 'policy entrepreneurs' (Huitema and Meijerink, 2010, Baumgartner and Jones, 2010) as they play a significant role through the policy-change process (Brouwer and Biermann, 2011, Mintrom, 2000). Similar parallels can be drawn to the notion of 'frontrunners' in transition studies (Rotmans and Loorbach, 2009). We refer to key policy actors as *policy entrepreneurs* because of their agency and leadership in steering the process. These 'policy entrepreneurs' share a common willingness to invest their resources (time, knowledge etc.) in policy change and possess good networking skills (Kingdon and Thurber, 1984). Thereby, policy entrepreneurs can be distinguished through their desire to significantly change the established ways of doing things (Mintrom and Norman, 2009). In this paper, while we identify the individual policy entrepreneurs, we also discuss the collective policy entrepreneurship as they draw on respective knowledge, skills, networks and strategies (Meijerink and Huitema, 2010). The strategies employed by these policy entrepreneurs will be discussed in the next section.

We base our analysis on the core DM model. However, we modify and adapt it to include the policy translation approach, and factor the newer understanding within the analysis. While we acknowledge that actors are only one of the six dimensions within the DM model, however, in our analysis, we integrate actors within each of the dimensions and in sum explore five questions. Further details on the adaptation of the DM framework are provided in Table 1.

In line with Stone (2004), we take the view that the intentionality of actors, their agency, the wider socio-political context, and the specific network of transfer agents are central to understanding policy processes. Therefore, we illuminate the key roles played by transnational and national actors.

**Table 1 - Adaptation of the DM framework**

| Policy Transfer (DM model) | Adapted Policy transfer | Further explanation / Remarks |
|---|---|---|
| Why do actors engage in policy transfer? Who are the key actors involved in the policy transfer process? | Who are the key actors? How do they get involved? What motivates the actors to engage with policy transfer? | In addition to addressing the questions raised by the DM model, we also ask how do these actors come together in the first place, what kind of networks and connections do they tap into, and how inclusive or exclusive are these sets of actors. Further, we engage with the motivations of the actors, and the organizations or ideologies they represent, in addition to identifying who they are. |
| What is transferred? | Which policy objects do the actors choose to transfer? Why? | First, instead of framing the question in a neutral way, we frame it by providing agency to policy actors in being selective and 'choosing' the policy objects. Second, in the context of GETFiT, we attempt to also answer why do they do so, relating it to instrument affinity, market-based ideologies etc. Third, we engage with the influences of development agencies and the interplay of transnational knowledge vis-à-vis local agency. However, the notion of direct 'transferability' is limited here as the specifics are more complex, messy and constantly evolving. |
| From where are lessons drawn? | From where do the actors draw their ideas, experiences, and lessons? Why are certain lessons drawn? | In addition to the question of where lessons are drawn from, we also engage with the questions of why are certain experiences and lessons drawn? Moreover, implicit in this is also the question of how actors engage in adopting and/or changing ideas drawn from elsewhere. |
| What are the different degrees of transfer? | We do not include this question in our adapted framework. | Policy transfer can typically involve one or more degrees of transfer: copying, emulation, combinations of both, and inspiration, hybridization etc. Instead of using a certain category rigidly, we focus on elucidating the process instead and also engaging with this better as part of the next question. |
| What restricts or facilitates the transfer process? | How do actors translate the policy process? | Instead of framing the question in an antagonistic and binary way, we simply attempt to elucidate the process as is, particularly focusing on the political context within which actors are operating. Policy translation allows us to conceptualize actors' behavior within a wider political discourse. The process is non-linear and highly contingent to the specific institutional and political circumstances, unlike a mechanistic and linear transfer process. Further, constraints and opportunities are socially and politically constructed, and are relevant only within a specific context. |
| How is the policy process related to policy success or failure? | What outcomes do the actors envisage? And do they achieve them? | Instead of engaging with an abstract notion of 'success' or 'failure', we link our question back to the actors in terms of what did they envisage, how did they perform vis-à-vis their targets or goals. |

*Source:* Authors' own elaboration; taking inspiration from Mukhtarov (2014)

## 3. Methodology

### 3.1. Case of Accelerating Transitions through Policy Translation

The case of Global Energy Transfer Feed-in Tariff (GETFiT) Uganda is a relevant example of the general pattern observed in global governance systems for RE, which are increasingly converging towards market-based policy instruments such as FiT and RAs (Haselip, 2011, IRENA, 2013). Uganda was the first country in Africa to unbundle electricity generation, transmission, and distribution into separate utilities, and to offer private concessions and open the sector to independent power producers (IPPs) (Eberhard et al., 2016). Lately, Uganda has received international recognition for having created a conducive investment climate for power generation (Eberhard et al., 2016) and was among the first in Africa to introduce FiT and RA policies (Meyer-Renschhausen, 2013). The GETFiT program has attracted many small IPP investments, including competitive bids for hydropower, biomass and solar PV. After South Africa, Uganda has the largest number of IPPs in SSA, and is "the only other competitively big, grid-connected solar PV program" (Eberhard et al., 2016). Even so, Uganda has been overshadowed by the academic attention given to countries such as South Africa and Kenya. The specific actor constellations, the particularities of the national context, and the positive policy outcomes makes the case of Uganda important.

### 3.2. Data Collection and Analytical Procedures

Focusing on the history of FITs and RE Auctions in Uganda (2010-2015), this article investigates how global policy ideas are translated and localized. For this, we employed a case study approach and undertook qualitative research to uncover the process, the actor strategies and the dynamics thereof (Yin, 2009). A case study design is appropriate for this research as it allows for an in-depth study of micro-level processes and illuminates important contextual conditions of relevance to the phenomenon under study (Yin, 2013). And a qualitative research approach is suitable for this as it allows for process-related questions, detailed narratives, and understanding of motivations and strategies of heterogenous actors (Eisenhardt and Graebner, 2007, Langley and Abdallah, 2011). The policy mobilities approach comprises interest on 'small p' politics and 'small p' policy-making, giving primacy to individual actors and practices (McCann and Ward, 2012). It emphasizes a closer look at the changed meanings, experiences and power relations with mobility, and the ways these entangle with local contexts (McCann and Ward, 2013). We draw inspiration from the ethnographic form of enquiry and study into micro-politics.

A purposeful sampling strategy was devised to identify the key actors involved with the transfer of the FIT and RA policies to Uganda. According to Yin (2011), purposeful sampling refers to "the selection of participants or sources of data to be used in a study, based on their anticipated richness and relevance of information in relation to the study's research questions". Based on secondary material, we identified three

potential interviewees. Subsequently, other interviewees were identified based on snowballing technique (Atkinson and Flint, 2001). The actors directly involved in the process were interviewed, and additional interviews were conducted with those actors supporting the program and/or involved in part. This led us to perform a total of fourteen (14) semi-structured interviews in 2017 and 2018 with a range of actors (see Annex I). From the interviews and secondary data, a timeline of historical events since 2005 was developed, the key actors identified, and their roles, interests, and strategies analyzed. Interview guides were prepared (see Annex II) which aimed at operationalizing the main elements from the framework described above. To verify the information obtained from interviews, several archival documents were analyzed including journal articles, GETFiT annual reports, brochures, policy briefs, World Bank (WB) documents, consultancy reports and conference presentations.

Following the framework presented in Table 1, the analysis was completed by summarizing and interpreting the data by identifying themes and emerging patterns (Braun and Clarke, 2006). We used a combination of both deductive and inductive approaches. The process required constant iteration between analytical concepts, themes, and the summarized empirical data, checking for alternative explanations and drawing theoretical insights for developing a rich case narrative (Klag and Langley, 2013). Prior literature was used to analyze thematic overlaps and validate them with theoretical interpretations (Gioia et al., 2013). The data analysis structure is presented in Table 2. The analytical framework represents the key dimensions of policy process inquiry as per the DM model.

An agency perspective refers to the "ability to exercise authority and influence policy change" (Eisenhardt, 1989, Dharwadkar et al., 2000). This entails studying individual and collective policy actors (Mukhtarov et al., 2013) and their actions in influencing policy events (Stripple and Pattberg, 2010). The policy entrepreneurs in our case employ various strategies to pursue policy change. Huitema and Meijerink (2010) suggests a framework in which policy entrepreneurs engage with five strategies: coalition building, networking, venue shopping, idea generation, and using windows of opportunity. Building on this, we operationalize the strategies of policy entrepreneurs in our case. Table 3 provides details of the strategies employed by policy entrepreneurs and their relation with the examples identified in the empirical data.

**Table 2 - Data analysis structure highlighting the relationship between the analytical framework and the empirical data**

| Analytical Framework | Sub-themes compiled from the literature | Examples from empirical data |
|---|---|---|
| Who are the key actors? How do they get involved? What motivates the actors to engage with policy transfer? | Exogenous factors, economic pressures, sectoral problems, political pressures, aspirational, business interests, preference or vested interest to promote certain solutions/models, spreading best practices, harmonization of political systems | The circumstantial factors include: energy supply shortages, failure to license projects in FiT-I and II, need for renewable energy in the electricity mix, and need for private sector. The actors developed new ideas to find solutions. The main motivations of actors included: diversifying energy mix, increasing energy supply, strategic business partnerships, leadership aspirations, advancing common ideologies and beliefs, promoting new models etc. We focus on capturing all types of actors engaged in policy making. |
| How do actors translate the policy process? | Developing ideas, gaining legitimacy, identifying instruments, seeking expert advice and consultants, but mostly mechanistic and linear, with prescriptive guidelines | Developing new ideas of FiT premium and risk mitigation, forming a small coalition of actors, defining common goals and values, sharing policy instruments affinity, mobilizing donor support, gaining legitimacy and support within the Ministry, and securing finances. Further, the process involved knowledge and expertise of transnational actors, experiences of multi-donor programs, and entailed negotiations, compromises, adjustments. |
| Which policy objects do the actors choose to transfer? Why? | Policy goals, policy content, policy instruments, policy programs, institutions, ideologies, ideas, attitudes and negative lessons. | The policy goals per se were set in line with the renewable energy policy of the country. The policy instruments, program design, institutional arrangements, ideologies, and ideas were transferred. This included: FiT and RA policy, risk mitigation product, simplifying regulatory procedures, institutional capacities, market ideology. |
| From where do the actors draw their ideas, experiences, and lessons? Why are certain lessons drawn? | Drawing lessons from other political systems, national governments and sub-national governments. Also, from policy networks, workshops and conferences, working groups, expert committees etc. | The actors drew a significant number of lessons and experiences from previous risk mitigation donor programs, experiences of international consultants, energy experts, and also through various platforms of knowledge exchange such as conferences, workshops, and also based on documents and reports on policy evidence. The international donor networks played an influential role, manifesting donor practices and ideology, and privileging transnational agency. |
| What outcomes do the actors envisage? And do they achieve them? | Policy outcomes in the form of 'success' or 'failure'. Exploring whether it was an uninformed, incomplete or inappropriate transfer with regard to failure. | In this, we measure policy outcomes in the form of the envisaged project outputs, targets and goals in the form of the total number of projects implemented, institutional capacities built, risk mitigation products offered, and how they enhanced the legitimacy of regulatory institutions and simplified regulatory procedures etc. |

*Source*: authors' own compilation

**Table 3 - Data Analysis structure for strategies of policy actors in the transfer/translation process**

| Actor Strategies | Analytical Sub-themes | Examples from empirical data |
|---|---|---|
| Development of new ideas | Policy change requires development of an idea; policy innovation, visions, and an agenda | Idea of FiT premium; incentives to support the enabling environment, more importantly the development of GETFiT which was in response to a larger problem of FiTs in developing countries. This was mainly developed by DB in consultation with international experts in energy finance; largely led by an ideology of privatization and market-led investments. |
| Build coalitions and sell ideas | Collaboration among policy actors as necessary, coalition building, differences and power asymmetry among actors, framing narratives, jointly developing a fresh agenda and vision, shared beliefs and agreements on how to use resources for common goals | Forming a coalition among the small set of policy entrepreneurs, setting common goals, and shared beliefs. Meetings with donors and development agencies to pitch new ideas and seek financial support, also to gain legitimacy within the donor network. This strategy was mainly employed by KfW to gain donor support, and by ERA to gain support from within Ministry. |
| Recognize and exploit windows of opportunity | Windows are particular moments in time that offer opportunities for policy entrepreneurs to launch and gain support for new policy proposals, linking solutions to problems, to make it palatable for decision-makers, networking and gaining support and legitimacy | Supply shortage, lack of private sector investments, no projects licensed in previous FiT, and lack of an enabling framework. These provided the platform/windows of opportunity and new ideas were developed by ERA and KfW, and subsequently linked to GETFiT. The strategy of stakeholder engagement and networking esp. with a range of government stakeholders was mainly employed by the GETFiT consultant in coordination with ERA staff. The program elements had to be constantly adapted by the policy entrepreneurs collectively to make it relevant to the context. |
| Recognize, exploit, create, manipulate multiple venues | Creating and exploiting opportunities in an institutional context, political, financial and administrative venues, inclusion and exclusion of actors, institutional structures and individual strategies; availing of existing venues, changing, altering venues, and creating venues | By the time the new set of ideas were developed, the institutional context had opened up to the idea of small-scale renewables given the energy vulnerability and insecurity that existed. Hence, the political and administrative avenues were generally open to the ideas for a better policy, including financial and non-financial incentives. However, issues such as tax reforms turned unfavorable for the private sector promoted by this policy, and several negotiations and discussions by KfW advisor, GETFiT consultant, and an external legal firm led to bypassing the issues. |
| Orchestrate and manage networks | Coalitions are characterized by agreements on policy ideas or objectives; networks are a broader range of actors relevant to solving issues or possess intellectual resources; creating and maintaining policy networks, close-knit and well-aligned, or short-lived. | The design of GETFiT structure involved a broader range of actors/experts in various committees to solve the problem of inadequate private sector investments in renewables in the developing countries. During the policy development, this strategy was employed in a number of instances: i) issue-based (risks to investment) support mobilizing private sector stakeholders; ii) finance-based support mobilizing donors and mobilizing additional funds based on new issues (solar PV, transmission infrastructure) |

*Source*: Structure is adapted from Huitema et. al. (2010)

These strategies can be aggregated into three broad categories i.e. scale-based, meaning-based and context-based, as developed by Mukhtarov (2014). This corresponds well with the way policy processes are shaped: i) scale-based: developing new ideas across multi-sites, mobilizing actors across scales, coalition building; ii) meaning-based: framing ideas and policy components within the global climate discourse; gaining legitimacy within the donor community; iii) context-based: actor dynamics within the local context, negotiations with government officials; appeasing and lobbying. We incorporate these elements in the progression of the policy process, and for analysis within the structural dimensions of the DM model.

## 4. Contextual Background: Feed-in-Tariffs in Uganda (2005-2010)

The history of FiT policy can be traced back to the RE policy, formally adopted in 2007. FiTs were explored, at the time, as a possible means to accelerate private investment in renewables. In line with the structural reforms initiated by WB and IMF globally, Uganda's electricity sector underwent reforms and restructuring in the late 1990s. These reforms aimed at privatizing and liberalizing the sector, including opening up the energy supply market to IPPs (MEMD, 2014). By 2005, the Uganda Electricity Board was unbundled into separate entities for generation, transmission, and distribution. It is important to note a number of major events and political processes at the national level that shaped this policy environment, including a series of major droughts from 2005-2007 which exposed the country's vulnerability from a sole reliance on hydropower.

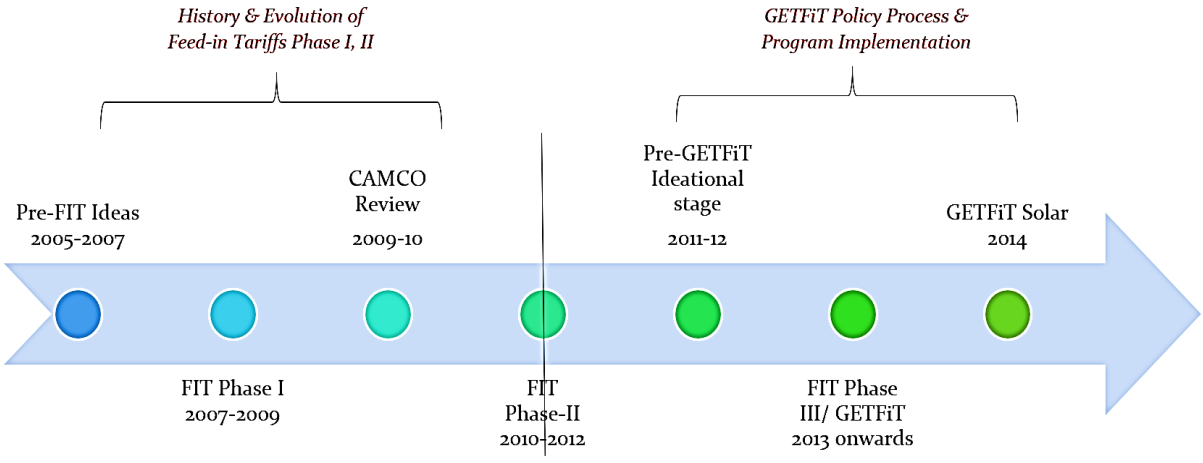
The government was forced to use emergency thermal power as a temporary measure (EMAConsultLtd, 2006). However, this was expensive, and "it led to end-user tariffs being increased by 12%".[i] The high diesel generation costs, combined with peaking oil prices, the weak financial position of the power off-taker i.e. Uganda Electricity Transmission Company Limited (UETCL), and a shortfall in the electricity supply led to an urgent need to diversify the energy supply sources and to exploit the country's RE resources (Meyer et al., 2018). The Electricity Regulatory Authority (ERA) received unsolicited bids for mini-hydropower projects, but they lacked a framework to support small IPPs.[ii] The ERA leadership looked outwards, and began investigating energy policies and mechanisms used elsewhere. They researched the global experience with FiT, especially in Germany, Brazil, Sri Lanka and Spain.[iii] Their search was geared towards finding examples of countries which had hydro and co-gen technologies, and had adopted FITs, and assessing their applicability to Uganda.[iv]

According to ERA, the rationale for introducing FIT in 2007 was to address the need for greater clarity and certainty for the private sector, a standardized process, and a stable and transparent tariff regime. FiT Phase I (2007-10) was designed exclusively for hydropower, involving fixed-tariffs and long purchase periods. However, no projects were licensed under FiT-I.[v] Expressions of interest (EoIs) were mainly received from speculators who were testing the government's willingness to licence expensive projects, thus submitting

inflated proposals.[vi] This period (2008-10) also coincided with a downturn in the Ugandan economy, marked by high inflation rates and oil prices escalating and peaking during 2007-08. The FiT-I created a steep learning curve for the ERA to understand the role of FITs and how they relate to – and are affected by – wider macro-economic variables. The economic and revenue currency exchange risks were a fundamental concern in the eyes of private investors, which also resulted in their lack of interest.[vii]

The electricity market underwent further turmoil during 2010-11 as Uganda experienced its peak load shedding and power supply crises due to consecutive droughts, unanticipated electricity demand growth, and delays in the finalization of the 250 MW Bujagali dam. In an attempt to continue seeking private investments, ERA launched FiT Phase II in 2010. Given that phase-I did not lead to any licensed projects, ERA had to re-think its strategy, for which it employed a consultancy firm (CAMCO) to study the established cost structure and applicable FiTs for Phase II (Curren et al., 2010). This phase entailed higher tariffs, newer technologies (biomass, biogas, geothermal, solar and wind), and capacity cap of 20 MW. Despite this, deeper sectoral problems remained, linked to the constraints of cost-reflective tariffs, high financing and project development costs, investor risks and lengthy regulatory procedures. One year into phase-II, the FiT rates had not achieved the risk-adjusted returns on private capital and did not attract equity investors. In parallel to FiT during 2010-11, ERA packaged a proposal to its development agencies, such as the German development bank (KfW), which eventually became the GETFiT program. The nature of these interventions is discussed in the next section (Section 5). A timeline of key events has been presented in Figure 1 below.

**Figure 1 – Broad Timeline of RE Policy Development in Uganda**




*Source*: authors' own compilation

## 5. Development of GETFiT Uganda (2010-2015)

This section analyzes the policy translation process for GETFiT in Uganda between 2010 and 2015. We employ the adapted DM framework to analyze the policy process, with a specific emphasis on the actors, agency, and strategies. This also includes analytical reflections in relation to the empirical findings.

### 5.1. Who are the key actors? How do they get involved? What motivates the actors to engage with policy transfer?

In parallel to FiT Phase II, the then CEO of ERA realized that tariff changes per se will not work, and he "looked at the overall policy environment to see what could be inhibiting the private sector participation".[viii] This led to the beginnings of a new idea to provide financial incentives over and above the FiT rates, and also address non-financial risks. He discussed this with the Permanent Secretary (PS) of the Ministry of Energy and Mineral Development (MEMD), and approached KfW's former Energy Sector Development Advisor (based in Kampala), a professional contact "active and knowledgeable in the field".[ix] Representatives of ERA, KfW and sector experts undertook a structured assessment to identify "the missing pieces for projects proposed on paper…. getting them to financial closure and to construction stage".[x] This process led to insights such as lack of bankable documents, low tariffs, and many perceived risks.

Meanwhile in 2009, the German development agency (GIZ) had undertaken a detailed study on small-hydropower in Uganda, as part of their Project Development Programme (PDP) in East Africa (Plas and Kyezira, 2009). The program promoted business partnerships between German and East African companies through "strategic market development and linkage of the renewables – Made in Germany – initiative, focused on local industry dynamics" (Plas and Kyezira, 2009). It is evident that there was a strong interest and commitment from KfW and the German Government to support small-scale RE projects in Uganda.

Concurrently, new ideas around FiTs were mooted to KfW Frankfurt by the Vice President (VP) and the then Lead Analyst of GETFiT concept at Deutsche Bank (DB).[xi] GETFiT was developed by DB for the Advisory Group on Energy and Climate Change of the Secretary General of the United Nations (DBCCA, 2010, Rickerson et al., 2013, Bank, 2011). It aimed to upgrade existing national FiT policies through a country-specific combination of up-front payments, performance-based payments, risk insurances and attractive debt finance conditions (Huenteler, 2014). GETFiT envisioned "a global program that includes public money to support and expand FiT in the developing world, and the adaptation of advanced FiT best practices to serve national goals for energy access and renewable energy scale-up" (Bank, 2011). The KfW Frankfurt office linked Deutsche bank VP to the KfW Advisor in Kampala, to strengthen professional ties.

The KfW Advisor in Kampala saw value in the GETFiT concept, as it resonated with the problems in Uganda. This led to the three actors coming together i.e. KfW Advisor, ERA CEO and VP DB. In mid-

2011, their first meeting was held in Frankfurt, which also included the then Energy Advisor to PS MEMD. This meeting set the agenda formally towards developing a GETFiT Uganda program and creating an enabling environment. At this stage the objective was to fast-track the development of privately financed, main-grid-connected small renewable generation (hydropower, bagasse, and biomass) in Uganda.[xii] This was the first of many such meetings held in Frankfurt, operating in transnational fields, while being anchored in one nation. This also led to the actors agreeing on shared beliefs and making implicit agreements on how to mobilize individual capacities to achieve common goals. The process led to building a coalition of actors consisting of ERA CEO, KfW Advisor, VP DB, and an external consultant (who joined at a later stage).[xiii] The VP DB was involved in an advisor capacity, based in Frankfurt, with occasional visits to Kampala.

In sum, a number of sectoral issues, combined with KfW, and the German Government's interest in forging business partnerships and developing projects in Uganda, coupled with professional interests and leadership aspirations motivated the need for policy change. The key policy actors involved with GETFiT Uganda are presented in 4, comprising of four policy entrepreneurs and several supporting actors, and distinguishing between the various transnational and national actors.

Table 5 provides a summary of the motivations of the actors, their intentions and the roles played. In addition, it also highlights the individual capacities or resources that they contributed to the process.

**Table 4 - Renewable Energy Policy Actors relevant for GETFiT**

| | **Policy Entrepreneurs** | **Supporting policy actors** |
|---|---|---|
| National Actors | Electricity Regulatory Authority, Uganda (ERA) | Government Agencies - Ministry of Energy and Mineral Development (MEMD); and Ministry of Finance (MoF) |
| Transnational Actors | Former KfW Energy Sector Development Advisor, Kampala<br>Former Vice President, Deutsche Bank, Germany<br>Former Consultant/Lawyer, Germany | Independent advisors/expert committee<br>Multinational consultancy firm<br>Development partners (DFID, NORAD, EU-Africa Infrastructure Fund)<br>World Bank<br>Governments of UK, Norway and Germany |

*Source:* authors' own compilation

**Table 5 - Roles of transfer agents and their intentionalilty in policy translation**

| **Who are the actors?** | **What were the actors' interests and intentions?** | **What capacities did they bring to the process?** | **What specific roles did they play?** |
|---|---|---|---|
| ERA CEO | ▪ Professional interest as a regulator<br>▪ Leadership aspirations<br>▪ Ambition to build a credible institution<br>▪ Achieve policy goals, reduce energy insecurity | ▪ Knowledge of the sectoral context and its problems<br>▪ Insight into market's subsectors and their dynamics<br>▪ Acting beyond political control and pressure | ▪ Developing and strengthening ideas<br>▪ Decision-making<br>▪ Advocacy with the government |

| | | | |
|---|---|---|---|
| | | | ▪ Facilitating communication and negotiation |
| KfW Advisor | ▪ Professional interest as an energy advisor<br>▪ Promoting KFW's and German Government's commitment to RE development<br>▪ Enabling business partnerships | ▪ Knowledge of the energy sector<br>▪ Knowledge of the intent of the German government and their energy program<br>▪ Wider understanding of policy, energy and geopolitics | ▪ Designing the GETFiT toolbox<br>▪ Gathering support of the donor community<br>▪ Decision-making role |
| VP DB | ▪ Opportunity to apply the concept in a specific country context<br>▪ Individual drive to influence change | ▪ Conceptual authority on GETFiT<br>▪ Expertise on climate and sustainable energy finance<br>▪ Insights into investment opportunities and transactions | ▪ Developer of the original GETFiT concept<br>▪ Advisor on energy finance and tariff issues |
| Government Ministries (Ministry of Energy and Finance) | ▪ Achieving policy goals<br>▪ Reducing energy insecurity and vulnerability<br>▪ Increasing energy supply to meet the growing demand | ▪ Political support and political push<br>▪ Financial, legal approvals and negotiations | ▪ Policy support<br>▪ Budgetary/ Administrative support<br>▪ Legal, financial approvals |
| External Consultant | - | ▪ Professional lawyer<br>▪ Authority on the legal aspects such as contracts, conditions, agreements, criteria determination etc. | ▪ Coordinator and administrative support<br>▪ Designed the call for proposals<br>▪ Managed stakeholder and public relations |

### 5.2. How do actors translate the policy process?

The KfW Advisor recalled that GETFiT was developed as a generic concept, from a European standpoint, for developing countries.[xiv] But the concept had to be significantly adapted and localized to make it relevant for Uganda in ways such as identifying the top-up amounts, the funding sources and mechanisms, the risk guarantee options, and the technical assistance (TA) required to support ERA in the implementation.

In 2011, KfW Advisor and VP DB developed an official pitch document for GETFiT Uganda, with support from ERA CEO and MEMD. Having developed new ideas, the actors strategized to mobilize support and gain legitimacy among the donor community. In late 2011, this was presented to select development aid agencies working in Uganda and to the German government. In early 2012, a second round of meetings were held. Funding commitments were secured from the Norwegian Agency (NORAD), UK Dept. for International Development (DFID), EU-Africa Infrastructure Trust Fund (EU-AITF), and later by the German Ministry of Economic Cooperation and Development (BMZ).[xv] In parallel, ERA undertook stakeholder meetings to engage with private investors to better understand their needs and expectations.[xvi]

During 2012, design ideas were formulated, top-up payments determined, buy-in from development partners sought, commitment to development finance secured, and ways to unlock commercial finance were

devised. The initial plan was to develop 19 IPP projects with a combined capacity of 167 MW. The top-up donor-funded payment (or the GETFiT Premium Payment mechanism) was key to incentivizing developers/financiers to enter the market and supply electricity over a 20-year period. This was USDc 1.4/kWh for hydropower; USDc 1.0/kWh for biomass, and USDc 0.5/kWh for bagasse (Meyer et al., 2015). The process of determining these rates involved several iterations among actors, and also led to disagreements among the policy entrepreneurs (specifically KfW Advisor and ERA CEO) with regard to the tariff rates which private investors were willing to accept.[xvii] In consultation with KfW, ERA took a decision to increase the FiT for hydropower, thereby lowering the subsidy requirement, but justifying the criticality of donor funds.[xviii] A number of such modifications were made through the design process to reach common ground.

A key component of GETFiT was simplifying and streamlining the patchy enabling environment and removing legal and regulatory hurdles. This process entailed lengthy amendments and negotiations, and delays (KFW and Multiconsult, 2014). There were disagreements with regard to the standardized documents and the risk allocation between IPPs and the government.[xix] An external law firm (Trinity International LLP) was contracted to support MEMD and ERA to review and standardize the Power Purchase Agreement (PPA), Implementation Agreement (IA) and Direct Agreements (DA) (KFW and Multiconsult, 2014). Additionally, a consultant (procurement lawyer) from Germany (an acquaintance of VP DB) was hired by KfW to join the core policy team by serving as the GETFiT coordinator and supporting ERA with procurements, managing tender rounds, and undertaking continuous stakeholder engagement.[xx]

Subsequent to a donor group meeting in Kampala, WB offered their product, Partial Risk Guarantee (PRG) to GETFiT. This was an insurance product geared to protect IPPs from the risk of delayed off-taker payments, termination risk, and such political and commercial risks (Meyer et al., 2015). This allowed the policy entrepreneurs (KfW) to reduce investor risks as part of GETFiT. The inclusion of WB and PRG was not planned but an opportunity that came up during the process. Despite the differences in the instrument preferences and ideologies between KfW and WB, they were driven by common goals of increased private sector investments and promotion of small-scale renewables.[xxi]

While there were such inadvertent inclusions of actors, there were also exclusions. The policy focus was predominantly on electricity generation, and they did not take UETCL on board from the beginning. This resulted in legal issues and misunderstandings at the stage of signing the transaction documents. The issue of grid integration of the IPP projects were not discussed. During 2013, it was identified that the hydropower projects were clustered in a mountainous region, which would exceed the grid capacity and threaten to overload the local substation. UETCL would have had to pay for idle generation and this issue could have led to major contestations and a near halt of the program.[xxii] The policy entrepreneurs (especially KfW staff

in coordination with ERA) had to engage with the strategy of appeasing, political lobbying and managing stakeholder relations. This problem was eventually averted with the intervention of DFID by committing additional funds for strengthening and developing grid interconnection infrastructure.[xxiii]

The TA component for the program was developed, in close cooperation with ERA, to identify actual and emerging needs as well as capacity requirements over the implementation period. It focused on issues of tariff modelling, updating grid codes, drafting a standardized wheeling agreement, and due diligence for project licensing.[xxiv] Elements of TA were adapted later, such as introducing a regulatory information management system for ERA. TA focused on building competences of mid-level and junior staff at ERA, with insistence from the then CEO to ensure that institutional capacities are built in its core.[xxv]

During this process, the policy entrepreneurs (especially transnational actors KfW Advisory Staff and Consultant) had a deeper realization that the program was embedded within a larger actor-network and electricity infrastructure which proved the process to be complex, requiring several adjustments.[xxvi] This meant networking and managing relations across a broad range of actors. ERA CEO played a significant role in helping the team maneuver around political and bureaucratic issues, especially repeated taxation issues and reforms that might have negatively affected the IPPs. He helped in bridging the communication between the policy team and ministries. KFW's good relations with PS MEMD also helped to provide a certain political push for the program when needed. There was no explicit form of resistance by the political leaders towards the program. Instead, as the interviewees expressed, there was a lackadaisical mindset as the program only comprised of small-scale projects. In other words, individual projects were not large enough to get government stakeholders and political leaders interested.[xxvii]

For program implementation, governance arrangements were developed mainly drawing on transnational influences and collective experiences of multilateral banks and donor programs. The GETFiT governance structure (see a graphical representation in Annex III) comprised of a steering committee (SC), investment committee (IC), and an implementation consultant. The idea of a steering committee as a governing body is common to multi-donor programs.[xxviii] The SC was designed to handle key decisions, particularly those which had larger political implications. An investment committee (IC) was set up as an independent body to review project proposals. As the KFW Consultant noted, "the idea of investment committee came from fund management in general…GETFiT concept borrowed ideas from the Geothermal Risk Mitigation Facility (GRMF) in Kenya…another program funded by KfW some years ago".[xxix] For evaluation and selection of IPP projects, IC comprised of 6 industry experts, selected through a competitive process (Meyer et al., 2015). The idea of an implementation consultant was borrowed from "projects typically financed by development banks such as ADB, KfW… replacing the lacking implementation capacities in the country, hence outsourced to a consultancy".[xxx]

The GETFiT Uganda Program was officially launched in May 2013 and the Government granted delegated authority to KFW for procurement, contracts, and implementation of the program (KFW and Multiconsult, 2018a). The GETFiT Secretariat was (and continues to be) based at ERA, Kampala for management of the program and supporting its implementation. The secretariat was deliberately embedded within the regulatory agency to encourage local ownership. ERA had an instrumental role to play "giving the programme legitimacy and clout in the energy sector" (KFW and Multiconsult, 2018b). ERA CEO was involved through the phases of inception, feasibility, design, and implementation.[xxxi]

Deviating and reformulating the policy goals, in 2014, solar PV was added as an additional technology to the program. However, discussions and contestations surrounding this started earlier. In 2010-11, solar PV was not a preferred technology in GETFiT as the government could not justify purchasing expensive electricity, which was likely to exceed the projected levelized cost of electricity (LCOE) of USDc 9/kWh.[xxxii] During 2012, in response to the private sector interest, ERA CEO wanted to pilot a small-scale solar IPP. VP DB supported this inclusion. However, the KfW Advisor was not in favor as 1-2 small PV projects alone would use up a majority of the donor funds due to a higher subsidy amount.[xxxiii] Nonetheless, in 2013, a meeting with the EU Ambassador to Uganda resolved this issue. The EU Ambassador, a proponent of renewables, through the EU-Africa Infrastructure Fund, provided additional grants to support the inclusion of PV. In addition, solar PV was also *politically appealing* due to its potential to come online quickly and alleviate supply shortages in the short-term, compared to hydro projects, which were already experiencing delays with signing PPAs. Around this time, renewable energy auctions (as an alternative to FiTs) were rapidly gaining traction worldwide. They were introduced for the solar component in GETFiT to experiment with a competitive bidding scheme, and more importantly, to benefit from the rapidly reducing solar PV prices which were anticipated to yield lower average tariffs (as the regulator does not fix the tariff rate unlike FiT). The top-up premium was USDc 5.37/kWh.

These insights reveal that the process did not entail transfer and implementation of a fully-formed off-the-shelf policy. Throughout, the different policy entrepreneurs employed strategies like building coalitions, agreement on common goals, shared belief on market-based interventions, gaining support and legitimacy within donor network, negotiating, appeasing and lobbying government actors, availing of sporadic opportunities, networking and managing stakeholder relations across a broad range of networks, and maintaining continuity through strong embeddedness within local institutions.

### 5.3. Which policy objects do the actors choose to transfer? Why?

As mentioned previously, the objective was not just to implement policy instruments to meet the envisaged policy goals (in line with the renewable energy policy of Uganda) but to develop a wider set of incentive frameworks to encourage private investment, reduce investor risk and increase investor returns. The policy

entrepreneurs together chose to transfer different policy instruments (such as FiT and RAs), elements of program design and governance, risk guarantee options (product offered by WB), and certain institutional arrangements (such as simplified regulatory procedures and information management systems). The GETFiT program provided targeted assistance for implementation, for developing standardized and simplified contract documentation (such request for proposals, PPAs, IAs, and DAs), and developed a system (via grants and concessional loans) for ensuring reliable grid integration and interconnection for small RE; all of them contributing to an enabling framework. Prior to GETFiT, there was a lack of interconnection policy, and a lack of clear guidelines and responsibilities to assure developers and investors. Further, several ideas for the governance and management structure of GETFiT were borrowed from multi-donor programs and through examples of other successful programs.

ERA played a lead role in initiating the collaboration with development agencies, but also strategically engaged with them for institution building and strengthening the capacities of the core team members in the Department of Economic Regulation, working closely on the issues of agreements and tariffs. Training and skill development workshops were conducted by the UNEP-Frankfurt School (led by the former VP DB) for the ERA mid-level and junior staff on tariff methodology, standardized agreements, and financial modelling. This is an important 'object' of transfer, which aims to ensure better implementation and sustainability of policy, leading to improved skills and knowledge at an institutional level. As Peck and Theodore (2010) put it, "mobile policies are not simply travelling across a landscape – they are remaking this landscape".

As the previous section demonstrates, a number of beliefs and ideologies were implicit to the GETFiT program, reinforced through the development agencies (transnational actors), correspond with the overarching ideas such as liberal economic order, privatization, market-led development, transparency, and efficiency, which is prevalent within the larger discourse on climate policy and governance. Various empirical examples also demonstrate how global knowledge and narratives of successful programs and embodied expertise was made porous through transnational actors. However, there are limited instances of direct 'transfer' and more complex evolving process of interpretation and adaptation.

### 5.4. From where do the actors draw their ideas, experience and lessons? Why are certain lessons drawn?

FiTs have been implemented worldwide in a number of countries. However, the idea of a top-up payment over and above FiTs, supported by development finance, and other GETFiT toolbox elements were being implemented for the first time in SSA. Hence, "there were no direct experiences and lessons out there to draw from".[xxxiv] In the first place, GETFiT Uganda draws heavily from the core concept of GETFiT designed by German stakeholders, from a European standpoint. The ideas for the GETFiT governance structure derived mainly from a range of other multi-country donor programs and wind and geothermal risk

mitigation facilities, based also on the experience of KfW. Apart from the implicit lessons drawn from different countries globally, the experiences gathered from the German context, specific knowledge collated from the energy finance specialists (such as KfW, VP DB) and the country experts (such as ERA CEO) helped to shape the enabling environment and also strengthen the institutional arrangements.

In addition, Uganda was the second country to implement RE auctions in Africa, after South Africa (SA). SA was the first on the continent to implement RAs through the Renewable Energy International Power Producer Procurement Program (REIPPP). The success of FiT and Auctions (REIPPP) in SA (Meyer et al., 2015, Eberhard and Naude, 2017) influenced the adoption of GETFiT in Uganda, but to a limited extent. As the KfW Advisor noted, "we looked at the REIPPP documents, the tender documents…. but it soon got clear to us that that approach will not work in Uganda". The auctions program in SA were designed for large-scale projects, involving a number of lawyers and transaction advisors. Unlike SA, the market in Uganda was not as mature, and the auction program in this case was being designed for small-scale projects.[xxxv] Hence, the core actors had to design a competitive bidding program from scratch, and ERA was supportive and made sure that these opportunities were utilized to build capacities in the institution.

The varied educational backgrounds and prior experiences (internationally and nationally) of all the four policy entrepreneurs were important for the GETFiT development process. The actors drew on their relative expertise, resources and epistemic capacities, given their position and influence within a global network, to advocate for common preferences. The policy translation took place mainly through coalitions and partnerships. Hence, knowledge was acquired in this case largely through interpersonal interactions and exchanges within various organizational settings, across multiple scales, within the larger network of development banks and climate finance experts, in this case mostly German actors and venues of interface. The ideas and influences were from within the knowledge repository of development banks and aid agencies. The investment committee members were chosen by the core network members. And in that sense, the network may be exclusionary and accepting of predominantly those actors whose ideologies may agree, thereby creating actor constellations with shared beliefs.

### 5.5. What policy outcomes do the actors envisage? And do they achieve them through the GETFiT program?

Under the Phase III GETFiT program, seventeen (17) projects secured financial closure, with a total installed capacity of nearly 160MW (KFW and Multiconsult, 2017). Of these, six (6) projects have been commissioned, which include three hydropower projects of a total installed capacity 18.1 MW, two grid-connected solar PV projects totalling 20MW, and a 20MW extension of the Kakira co-generation plant. Reportedly, the license and permit application forms have been simplified, [xxxvi] project monitoring and evaluation has been made more robust, and the capacity to undertake financial and tariff modelling functions by ERA staff has been enhanced (KFW and Multiconsult, 2017). Throughout 2014, several

projects were delayed in the process of overcoming a number of legal and regulatory issues. Issues related to grid interconnection for several projects emerged as the most critical external risk to the program. However, most of them were overcome and a majority of the objectives envisaged were fulfilled. GETFiT Uganda standardized and simplified procedures, facilitated financial support to the projects, successfully selected projects which followed the strict evaluation criteria, and it also led to enhanced institutional capacities at a local level leading to positive outcomes.

In these ways, GETFiT led to positive policy implications. The RE sector managed to attract private sector developers and investors/banks under the GETFiT program, which it had previously failed to do. It is yet to be seen whether this momentum of private sector investment will continue in the near future, and whether the elements of this program sustain, and national actors evolve with the changing sectoral dynamics. For the policy entrepreneurs (especially the transnational actors), the process involved a steep learning curve. Further, the policy implications exemplify that not only did these policies and instruments lead to the intended outcomes of increasing private investments in the RE sector but they also delivered several co-benefits such as stronger institutions, streamlined and transparent governance, and reinforced capacities.

## 6. Discussion

The literature on policy translation along with its key concepts highlights individual agency, referring to actors who move around, mobilize ideas and localities, and articulate certain preferences, narratives and ideologies. Similar parallels have been drawn by scholars of the sustainability transitions literature (and through a geography informed perspective) in line with understanding niche actors and how they move around and mobilize ideas (Sengers and Raven, 2015, Coenen et al., 2012). Within this literature, Sengers and Raven (2015) suggest an enquiry into how global flows of materials, people and knowledge across national borders interact with the local place-specific dynamics. In response, we pursued an enquiry of specific actors – 'policy entrepreneurs' – in the global south, in an under-researched SSA context, using the case of GETFiT in Uganda. This article modifies the heuristic DM framework, adopts a more agency sensitive and multi-scalar understanding, and reflects on it in light of transition studies. The agency is in overcoming the path dependency of large utility-scale power projects, enabling small-scale IPPs including renewables, and signifying local embeddedness.

This case concerns a low-income country context with heavy donor involvement, dependence on development finance, high perceived risks, political interference and bureaucracy in decision-making. GETFiT Uganda reveals the significance of a multi-actor and multi-disciplinary understanding of the different processes of change and how they interact. This article demonstrates how sustainability transitions in practice can be steered and navigated by small but strategically skilled and positioned actors, who are simultaneously mobile and anchored. It also points to the niche developments (first grid-connected solar

PV projects commissioned) that resulted from a significant policy change. The strategies employed by actors, such as building coalitions, networking, appeasing, along with a pragmatic approach enabled the desirable shifts. The transnational actors (German agencies) heavily influenced the policy process, excelling in meaning-based and scale-based strategies, even while facing significant difficulties with maneuvering the context-based strategies. The program necessitated navigating a complex, messy and political terrain, contextualizing the original GETFiT components, modifying the design elements, and articulating specific activities during the implementation process itself.

The transnational actors here act as agents of globalization, as knowledge repositories, and carriers of particular preferences and values (e.g. privatization). This highlights the importance of understanding how transnational actors enable the circulation of ideas and ideologies between places, which has received limited attention in transition studies (Truffer et al., 2015, Hansen et al., 2017). Further, as the narrative illustrates, the complementary roles played by the transnational and national actors was decisive in shaping the outcome. The novelty was in the actor coalition, and the influential roles played by both national and transnational actors in leveraging their capacities and respective positions. This necessitates a better understanding of the processes of 'co-creation'. The ERA CEO proactively sought solutions to policy problems, engaged with a network of experts, mobilized political support, built capacities, and steered the program to attain policy goals. ERA gave the policy a territorial fixity and embeddedness, with crossovers into global flows and relations.

## 7. Conclusions and policy implications

This article is a response to the research question: *How did the actor constellations translate RE policy (case of GETFiT) and accelerate transitions within the specific political and institutional context of Uganda?* It provides a detailed account of how global renewable energy policies were translated through the case of GETFiT Uganda. Our aim was to focus on the policy making processes, driven by micro-politics and actor-strategies, to demonstrate how these insights can inform a better understanding of sustainability transitions more broadly, and how these can be accelerated through policy translation. In the context of a low-income country, our research reveals the significance of transnational networks, experience sharing, local embeddedness and the mechanisms of 'co-creation' as central to the process of policy translation. No single actor can be attributed to determining the exact transition pathway, rather it was the interplay of global and local actors that steered and shaped the policy transfer process, in pursuit of a common and agreed agenda to provide economic support to renewable energy projects.

In terms of policy implications, we share three key considerations. Firstly, the importance of operating within a macro-economic framework that is aligned with the logics of donor-funded policy advocacy. In this case, it was a reformed power sector operating with a transparent and credible regulatory body,

combined with buy-in from political actors and development agencies, which privileged foreign private investment, for which various multilateral donor agencies were willing to offer risk mitigation and investment guarantees. Secondly, the importance of clear and country-led goals and targets, e.g. to double the share of renewables in the energy mix by 2030, and to pursue an overarching vision of universal electrification by 2040 (REA, 2013). Thirdly, the importance of trial and error combined with the continuity of key individuals driving forward the policy translation process, both locally and globally, who are willing to embrace learning by doing, and collaborate in an open manner in pursuit of common goals.

## ANNEX I: Interviews Conducted

| Interviewee Number | Role | Affiliation | Interview Type |
|---|---|---|---|
| 1. | GETFiT Coordinator | GETFiT Secretariat, Uganda | Personal |
| 2. | Senior Energy Program Manager | KfW, Uganda | Personal |
| 3. | Former CEO | Electricity Regulatory Authority (ERA), Uganda | Personal |
| 4. | Projects Engineer | ERA, Uganda | Personal |
| 5. | Manager-Pricing | ERA, Uganda | Personal |
| 6. | First Executive Director | ERA, Uganda | Personal |
| 7. | Energy and Climate Advisor | DFID, Uganda | Personal |
| 8. | Former Energy Sector Development Advisor | KfW, Uganda | Skype |
| 9. | Operations Manager | Soroti Solar Plant, Uganda | Personal |
| 10. | Former GETFiT Consultant | KfW, Uganda | Skype |
| 11. | Project Director | The Madhvani Group, Uganda | Phone |
| 12. | Former Vice-President | Deutsche Bank, Germany | Skype |
| 13. | Senior Consultant | Multiconsult-Norway | Personal |
| 14. | Former Energy Sector Advisor | Ministry of Energy and Mineral Development, Uganda | Personal |

## ANNEX II: Interview Guide

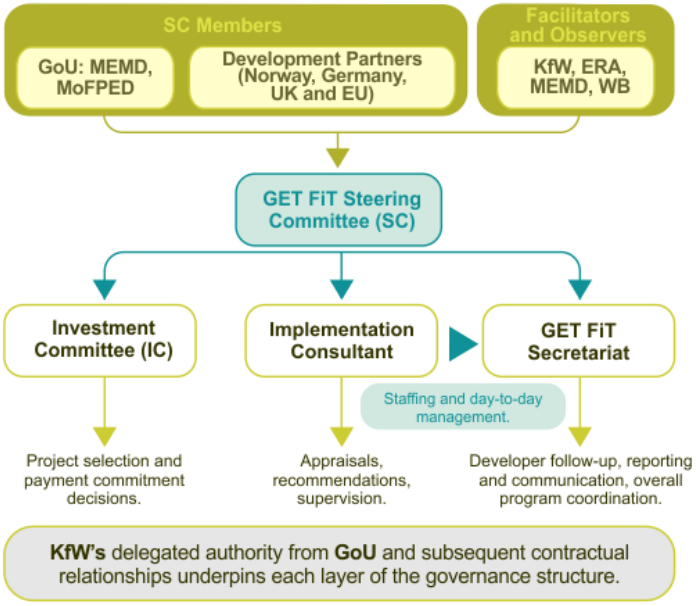
Guiding Questions regarding Feed-in Tariffs and Institutional Context

1. History of the electricity sector, reforms, and what was the need for feed-in tariffs (FiT)?
2. What was the impact of power sector reforms on private investments in the early 2000s? How many projects were licensed? Challenges?
3. Details on the history of FiT (when, how was this instrument chosen, why was this choice made, what other options were considered, any consultant hired for advice)?
4. Which countries were sought as examples, or from which countries did the FiT Uganda draw elements?
5. Key stakeholders involved in designing the FiT policy, who took the initiative (within and outside of ERA), how and why?
6. How was FiT policy received by the Ministry of Energy and other government officials? And by the private investors? Was there any resistance or disagreement?
7. Performance and effectiveness of FiT Phase I? Learnings? Issues? Concerns?
8. What was the need for Phase II? What were the main differences between Phase I and II?
9. How specifically did the external consultant support in designing the FiT-II?
10. Lobbying, negotiations, stakeholder engagement with regard to feed-in tariff rates, priority technologies, specific design elements etc.?
11. Impact of FiT-II? Did many developers express interest, send proposals? Were any projects licensed? Why not?
12. What were the reasons why private sector investments remained low throughout? What were their concerns? Or expectations?
13. What after Phase II? Where did the idea of GETFiT come from?

Guiding Questions regarding GETFiT and the process

1. How and why did you get involved in GETFiT? What was your motivation?
2. What was it about the GETFiT concept that made it relevant? How was it conceived? How was the model adapted to the context of Uganda?
3. What were your roles and responsibilities? Who were the other actors in shaping the program? What were their roles and responsibilities?
4. Did you seek to involve any external consultants or advisors for the program? Why or why not?
5. Which elements of the FiT/RA were transferred and which were left out/changed?
6. How specifically did the original model of GETFiT contribute to GETFiT Uganda, and how did it deviate? Why?
7. How did the GETFiT structure develop? Which ideas were influential for designing the governance structure?
8. What were the key challenges and points of disagreement?
9. Why wasn't solar included in the GETFiT program initially and why was it added later?
10. Why was FiT premium not applied in case of solar? Why auctions?
11. How was the auction designed? Who was involved? Which ideas were influential?
12. How was the GETFiT structured? How was donor support sought? Why and how were the specific committees formed? Which ideas influenced the process?
13. What were the changes/adaptations made from the idea/vision stage to the implementation stage? Challenges through the GETFiT process?

## ANNEX III: GETFiT Governance Structure and Toolbox




*Source*: https://www.getfit-uganda.org/

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[i] Personal interview # 3
[ii] Personal interview # 4
[iii] Personal interview # 3, # 4
[iv] Personal interview # 3, # 4
[v] Personal interview # 3, # 4, # 6
[vi] Personal interview # 3
[vii] Personal interview # 3
[viii] Personal interview # 3
[ix] Personal interview # 3, # 14
[x] Personal interview # 3
[xi] Personal interview # 12
[xii] Personal interview # 8, # 3, # 12
[xiii] Personal interview # 8
[xiv] Personal interview # 8
[xv] Personal interview # 8
[xvi] Personal interview # 11
[xvii] Personal interview # 8
[xviii] Personal interview #8, # 10
[xix] Personal interview # 8
[xx] Personal interview # 8, # 10
[xxi] Personal interview # 8, # 10
[xxii] Personal interview # 10
[xxiii] Personal interview # 7
[xxiv] Personal interview # 5
[xxv] Personal interview # 2, # 10, # 8
[xxvi] Personal interview # 10
[xxvii] Personal interview # 8, # 10, # 3
[xxviii] Personal interview #8, # 10
[xxix] Personal interview # 10
[xxx] Personal interview # 10
[xxxi] Personal interview # 3, # 8, # 12
[xxxii] Personal interview # 3, # 4
[xxxiii] Personal interview # 8, # 10, # 12
[xxxvi] Personal interview # 8
[xxxv] Personal interview # 8
[xxvi] Personal interview # 5

# Article 3

# China's involvement in the transition to large-scale solar power in Africa: exploring frictional encounters on-the-ground

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**Abstract**

The agendas of 'green growth' and 'universal access' to energy are central to the development of Sub-Saharan African (SSA) nations. Increasingly, China is being recognized as a 'rising power' in Africa, and growing Chinese investments in the renewable energy sector (including wind, solar and hydropower) in SSA are gaining considerable attention as well as attracting controversy. The ways in which China is shaping low carbon energy transitions in SSA, and the implications thereof, merit attention. While existing research tends to focus at the macro-level, it is equally crucial to undertake micro-level analysis, in order to further unpack the nature and complexity of Chinese involvement as it unfolds on-the-ground. Towards this end, the article draws on insights from the literatures on socio-technical transitions and Sino-African studies. Empirically, it explores the development of the first utility-scale solar PV project in Kenya, focusing on the frictional micro-level encounters between Chinese and Kenyan actors, specifically related to community development and employment. In doing so, the article contributes to an improved understanding of the politics of sustainability transitions in the Global South, while offering a finer-grained perspective on Sino-African relations in the renewable energy sector.

**Keywords**: Solar PV, Energy transition, Sino-Africa, Frictional encounters

## 1. Introduction

Nearly 1.2 billion people lack access to electricity worldwide (IEA, 2017), and almost half of these are in SSA (IEA, 2016, Ren21, 2016, Hancock, 2015). In recent years, there has been a growing political interest in addressing the challenge of energy access through low-carbon and sustainable energy technologies, which has led to ambitious regional and global policy commitments. However, it was recently confirmed in a progress review of SDG7 by the UN High-Level Political Forum that the international commitment of Sustainable energy for all (SE4all) by 2030 (WorldBank, 2017) may not be met. This calls for an urgent need to reappraise and identify alternative ways to consolidate actors and accelerate global efforts to promote sustainable energy, in a socially-just way (Ockwell et al., 2018).

In Africa, there is a rapid ongoing transition towards the deployment of utility-scale solar PV (i.e. above 5 MW capacity) in the electricity sector (Hansen et al., 2015, Ockwell et al., 2018). The increasing cost-competitiveness of PV systems in combination with favorable national policies, rising oil prices, and influx of development finance and private capital, has led to an increase in their installed capacity in Africa. In addition, solar PV technology is modular in nature, thus involving short installation time, and is relatively easy to maintain, all of which has contributed to an increased uptake. Indeed, the total cumulative installed capacity of solar PV in Africa has risen from 108 MW in 2009 and 662 MW in 2013 to around 1,935 MW in 2015 and 5,118 MW at the end of 2018 (IRENA, 2019). South Africa and Algeria represent the largest markets for utility-scale PV projects. According to IRENA's projections, the total installed capacity of solar PV in Africa could increase to 70 GW or more by 2030 (IRENA, 2016). Even though deployment rates have been relatively low in other parts of SSA outside South Africa, in the past decade, several PV projects have come up, with capacity additions of at least 200 MW in total in Rwanda, Namibia, Ghana, Uganda, Zambia, and Kenya. This transition to large-scale PV is being accompanied by a shift towards more independent power producers (IPPs) and market-based delivery models (Eberhard et al., 2016). The trend for international financial flows is based on turnkey projects delivered and operated by foreign developers (Rodríguez-Manotas et al., 2018). An additional dimension to this is the entry of new actors i.e. 'rising powers' especially China, India, and Brazil (as opposed to Western developers or donors), thereby challenging the status quo (Power et al., 2016). The scale at which solar PV is diffusing in Africa, when combined with the changing dynamics of new actors and institutional arrangements, warrants further studies on the nature of the involvement of specific actors, including their motives, modes of operation, and how their actions translate into socio-economic development.

This article engages with the questions of socio-political drivers and the interplay of *global-local agency*, and positions itself within the field of sustainability transitions. The literature on socio-technical transitions offers a multi-dimensional perspective on energy access beyond technocratic and economic analyses (Rolffs et al., 2015). However, only some transition scholars have focused on socio-cultural aspects of

sustainable energy transitions, and fewer still have researched their political aspects (Power et al., 2016, Scoones et al., 2015, Byrne et al., 2018). In a recent special issue on solar PV in Africa, Ockwell et al. (2018) foreground the socio-political realities, while asserting that transition scholars must learn from, and integrate, more elaborate conceptualizations of the same. They highlight a critical gap that exists in the limited understanding of the social science dimensions of PV transitions across Africa. Further, recent studies in the transitions field have stressed the importance of 'transnational actors' and 'linkages' in steering sustainable transitions in the Global South (Truffer et al., 2015, Gosens et al., 2015, Wieczorek et al., 2015). It has been highlighted that while the transition process entails various external dependencies and transnational linkages, it is less clear how these linkages operate and function with regard to influencing transition processes locally (Hansen et al., 2017).

In this article, we contribute to these discussions by analyzing the transnational as well as local actors influencing the transition to large-scale PV in Kenya, and the entanglements and intricacies of agency and political dynamics that unfolded during the transition process. Specifically, we focus on China as an increasingly prominent transnational actor in the renewable energy sector in Africa, using the 55 MW solar PV project constructed near Garissa town in Kenya as a case study (henceforth referred to as the Garissa project). The article pursues the following research question: *How do micro-politics and negotiations among Chinese and local actors unfold on-the-ground in the transition to large scale solar power in Africa?*

The remainder of the article is structured as follows. Section 2 provides a short description of China as a rising power in Africa as a background for the case study while Section 3 presents the analytical perspective adopted in the article. Section 4 describes the research methods used. In Section 5, the empirical findings are presented, which are discussed in Section 6. Finally, the conclusions of the article are presented in Section 7.

## 2. China as a 'rising power' in Africa

In 2015, China pledged an investment of US $60 billion in Africa in a variety of areas including renewables and technology transfer, as part of China-Africa cooperation (Shen and Power, 2017). The growing importance of China in the African continent has attracted considerable attention, especially in terms of reshaping geopolitics. In wake of the US withdrawing from the Paris Climate Agreement in 2017, President Xi Jinping declared China's intent to lead the world in renewable energy, with plans to spend US$380 billion on new systems by 2020 (Forsythe, 2017). The political rhetoric of Sino-African *green-cooperation* is gaining momentum, which has been attributed mainly to a saturated domestic market in China and increasing competition in European and US markets (Shen and Power, 2017).

China's investments specifically in the wind and solar sectors are driven by multiple factors including macroeconomic conditions, industry conditions, policies to invest overseas, and financing support from

Chinese banks that enable these investments (Tan et al., 2013). China's solar industry relies on the international market for 95% of its sales (Li et al., 2011). Moreover, as Conrad et al. (2011) note, China's engagement in Africa's renewable energy sector enhances its global recognition as a contributor to climate change mitigation and reaffirms China's position as a leader in the Global South (Wang and Zadek, 2016). In addition, African host countries' policies have also been favorable towards attracting investments in the solar and wind sectors (Tan et al., 2013).

Renewable energy projects developed by Chinese companies in Africa include biomass projects in Ethiopia, the Bui hydropower dam in Ghana and wind farms in South Africa (Hansen, 2019). Over 90% of Chinese-built power projects in the region are contracted by Chinese state-owned enterprises (SOEs) (IEA, 2016). A number of studies have captured China's involvement in the renewable energy sector in Africa, in particular focusing on the environmental, social and governance impacts of large hydropower dam projects (Baker and Shen, 2017, Tan et al., 2013, Kirchherr et al., 2016, Yankson et al., 2018, Hensengerth, 2013). However, analysis of China's engagement with new renewables, in particular wind and solar, is scarce . Further, research on China's investments has also tended to focus on macro-level analysis indicating meta-trends that rely on secondary data (Brautigam and Hwang, 2017). These limitations indicate the need for improving our understanding of China's involvement in new renewables through specific in-depth case studies.

## 3. Analytical perspective

We draw broadly on a small but rapidly growing literature on socio-technical transitions in the Global South (Berkhout et al., 2009, Byrne, 2011, Baker, 2015, Sengers and Raven, 2015, Wieczorek, 2018, Hansen et al., 2017). Insights emerging from this stream of literature have especially reflected on the application of theoretical frameworks in developing countries, highlighting aspects not usually covered in the literature, in particular the importance of external dependencies and transnational linkages. While empirical findings based on research in developing countries do not falsify existing theories, they do entail a need to adopt a reflexive approach towards operationalizing analytical concepts (Wieczorek, 2018). Indeed Sengers and Raven (2015) and Hansen et al. (2017; 202) emphasize the need to unravel how the "global becomes entangled with place-specific networks, institutions and infrastructures locally". Such a perspective may advance our understanding of the significance of global relations and resource flows for transition processes in particular localities.

Studies in the sustainability transitions literature have repeatedly stressed the importance of devoting attention to analyzing how imported technology becomes embedded into the local socio-technical context (Byrne et al., 2018, Ockwell et al., 2018). This societal embedding of technology and the closely interlinked nature of technology and society is a cornerstone in the literature (Rip and Kemp, 1998) (Geels, 2002). To understand socio-technical transitions, transition theory examines "how technology is shaped by social,

economic, cultural and political forces as well as how new technologies shape society and the interaction between various actors" (Elzen et al., 2004; 4).

In the context of transition studies in the Global South, this involves understanding the social, institutional and political aspects of the transfer, diffusion and uptake of technology, especially given that they typically rely on foreign technology and investment flows (Hansen et al., 2017, Turner, 2019). These scholars also stress looking at different kinds of relations, ideas and practices involved in diffusion processes in order to understand on-the-ground developments. Further, with a focus on the 'political economy' of solar PV transitions in Rwanda, Rodríguez-Manotas et al. (2018; 72) highlight that "transitions are not neutral processes" [and] "the actors driving the processes have vested interests and varying levels of power". Baker et al. (2014) and Newell and Phillips (2016) highlight the uneven social consequences of energy transitions, and raise pertinent questions about why certain actors, interests, and classes are privileged over others. These studies also bring attention to the power of capital and global institutions in shaping transitions (Power et al., 2016). We use insights from this literature as a basis for exploring the nature of the involvement of the Chinese and Kenyan actors directly active in, and indirectly affected by, the project.

Further, to pursue such an actor-oriented perspective, we draw on the growing academic literature on Sino-African relations, which focuses specifically on the interests of the actors involved and the possible conflicts and tensions arising during their interactions (Lampert and Mohan, 2014). In particular, we make use of the concept of Sino-African 'encounters' to identify and analyze such tensions and conflicts of interest emerging on-the-ground during the project development (Bräutigam, 2003, Lee, 2009). Such encounters and interactions can also provide insights into the social backgrounds, beliefs, practices and interests of multi-actors (Giese and Thiel, 2014). A key feature of this conceptual understanding is the ability to engage with the agency of Chinese and African actors simultaneously (Lampert and Mohan, 2014).

Sino-African encounters have been characterized by frictions, tensions, and 'conviviality' (Lee, 2009, Lampert and Mohan, 2014, Arsene, 2014, Giese and Thiel, 2014). Thereby encounters can be both a site of empowerment and for domination (Lampert and Mohan, 2014). In social sciences, interactions and exchanges are regarded as frictional, "as power and resistance to power often come into play" (Björkdahl et al., 2016; 292). Studying the Ghanaian-Chinese employment relations, Giese and Thiel (2014) argue that frictions or tensions may arise if expectations are not met on both sides. Other arguments pertain to a lack of trust (Haugen and Carling, 2005). Such frictions have been increasingly attributed to the intersection of different class positions and embodied identities. Further, Lee (2009) frames these tensions in terms of political economy (i.e. interplay of neoliberalism, casualization of labor and subordination of trade unions). The individual narratives of conflict around the Chinese economic presence are multifaceted and nuanced, and require empirical grounding (Lampert and Mohan, 2014). On the other hand, a few studies have also explored conviviality in Sino-African relations. In an important contribution, Lampert and Mohan (2014)

state that encounters could be convivial where African actors can leverage significant benefits from the Chinese presence (Lampert and Mohan, 2014). Bräutigam (2003) showcased how Chinese presence could kick-start local economic development in Africa. Nevertheless, most studies offer a negative narrative and highlight the skewed power structures and unequal international relations, attributing power especially to Chinese state actors.

However, African actors are not entirely passive recipients, without agency or expression. Increasingly, scholars emphasize the importance of African agency in the dominant discourse of China-in-Africa (Mohan and Lampert, 2013, Brown, 2012, Mohan, 2015). Mohan and Lampert (2013; 92) argue that "African actors have negotiated, shaped, and even driven Chinese engagements in important ways". In such encounters, there is always some scope to maneuver and exercise influence (Carmody and Taylor, 2010). However, according to Mohan and Lampert (2013), such agency is rarely conceptualized or empirically analyzed. They highlight a need to conduct on-the-ground analysis and address the "informal operation of power and influence […] at play" (Mohan and Lampert, 2013; 95). Further, it is important to unpack the multiple interests of actors (Gu, 2009, Gu, 2011). For instance, Schmitz (2014) elaborates that while the state-level partnership between China and Angola is viewed positively overall, individual interpersonal relationships at micro-level remain fragile. At a micro-level, it is about how negotiations play out when a project is unfolding on the ground, which may be critical in shaping the direction and outcome of an intervention (Scoones et al., 2013).

In this article, we use the concept of 'encounters' to identify and analyze engagements (conflictual or beneficial) between global and local actors. Such a global-local focus can helps us "move beyond fixed notions of identity and explore ways in which interaction occur" (Lampert and Mohan, 2014; 13). We explore how multiple actors coalesce, and how agency is exerted and also co-constituted in the relational process. Towards this end, we identify the key actors (including Chinese contractors, African state authorities, on-site employees, and local community representatives), the multiple roles they assume, their perceptions, and contestations as they engage with the Garissa project. In line with Scoones et al. (2013), Lampert and Mohan (2014), we focus on encounters that occur during negotiations and practices on the ground. Our approach is to explore "multidimensional interdependencies" (Giese, 2014; 7) between Chinese and Kenyan actors instead of focusing only on the differences.

## 4. Research methodology

### 4.1. Case selection

According to the IEA (2016), the total investments in electricity generation (MW capacity) by Chinese in SSA have significantly increased over the past decade, amounting to USD 13 billion only in the period between 2010 to 2015. China accounts for almost 30% of the total renewable energy capacity added in

Africa between 2010 and 2015. Further, 56% of the Chinese-built projects (including those completed, under construction or planned) identified by IEA over a period of 2010-2020 use renewable energy sources. Of this, hydropower accounts for the largest share (49%), while other renewables, including solar, wind and geothermal comprise a relatively smaller share (7%). The increase in non-hydro renewable energy projects, however, is more of a recent phenomenon.

Several Chinese companies are engaged as suppliers and technology providers, rather than as project developers or construction contractors (Hansen, 2019) in the utility-scale solar PV projects in Africa. This includes Yingli Solar, Suntech Power, BYD, Jinko Solar, Trina, Chint, Hanwha Solar, Renesola and PowerWay (Shen and Power, 2017, Baker and Sovacool, 2017). According to Baker and Shen (2017), the prominence of these companies is a reflection of the role of China as the world's largest manufacturer of solar panels and the highly export-oriented nature of the industry. For instance, Chinese companies supply technology for 9 out of 10 PV projects under implementation in South Africa, totaling 1,170 MW. In addition, 2 out of 10 projects involve Chinese equity investors, and 1 project involves a Chinese engineering, procurement and construction (EPC) contractor (Baker and Shen, 2017).

In this article, we examine the case of the first ever utility-scale PV project in Kenya, which currently is the largest solar project in East Africa, in order to analyze the nature of Chinese engagement in the solar sector in Africa. The Garissa project is the first Chinese-backed solar venture in East Africa, involving not only Chinese loans (from Exim bank) and technology (Jinko solar) but also a Chinese contractor, China Jiangxi Corporation for International Economic and Technical Cooperation (CJIC). It is thus a highly Chinese-dominated engagement supplied in the form of a fully operational turnkey *package*, making it important for an academic enquiry. The Garissa project may be considered representative of a larger number of Chinese-built solar PV projects in Africa, which share similar features in terms of the size of the investment, the scale of the project, the Chinese actors involved, and the turnkey nature of the contracts with Chinese firms. Other similar projects include a 20 MW solar PV in Ghana developed by Beijing Xiaocheng Company and the 75 MW De Aar PV project in South Africa by Powerway. However, there is scarce data on these projects, except for media reports. Following Miles et al. (1994), our case selection criteria consider the significance of the case, its representativeness, its theoretical relevance, and data accessibility.

### 4.2. Data collection and analysis

We used a qualitative approach based on case study methods to capture actor accounts, roles, and power dynamics. The case study design is borrowed from Yin (2014; 16), defined as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-world context”. Case study is a useful approach for exploratory and descriptive research, and qualitative approach allows to deepen contextual

understanding. Within this case study, we explore two types of encounters at the micro-level between the two sets of actors in the context of the Garissa project (see Figure 1).

**Figure 1 - Overview of the project and the micro-level encounters in the Garissa project**


We focused on the pre-construction and construction phase of the project, as the Chinese involvement during project construction offered an opportunity to study the nature of the interaction and encounters at the micro-level between the actors.

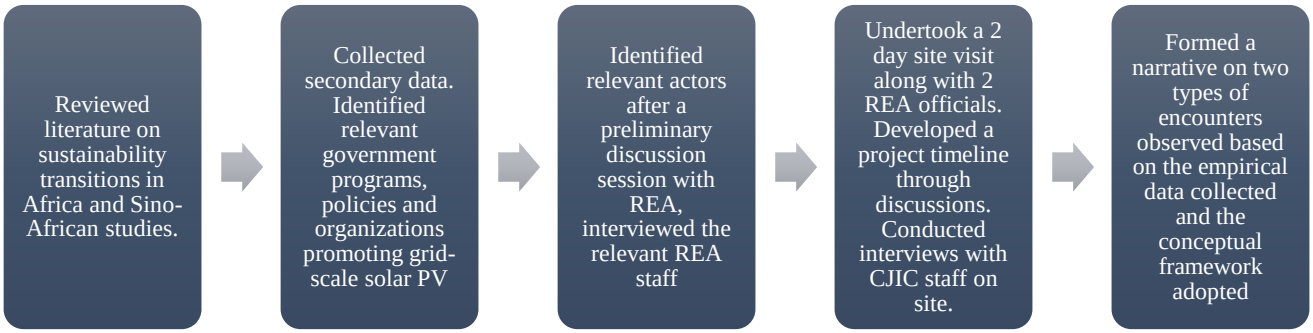
Data collection entailed fieldwork in October 2017 in Kenya. For this, we collected secondary data mainly available in the mainstream newspapers, online media and from the website of the Rural Electrification Authority (REA) in Kenya. Based on this, we gathered details about the agreement between Chinese and Kenyan Governments. Next, we conducted interviews with various staff members of REA in Nairobi, Kenya. This was crucial as REA is the main project developer and among the most important stakeholders of the project. The rest of the interviewees were identified through a snowballing method (Atkinson and Flint, 2001), and focused on those directly related to and/or affected by the project.

This was followed by a two-day visit to the project site, located 15 kms away from Garissa town in Garissa County, 400 kms from Nairobi in North Eastern Kenya. The county borders Somalia and is characterized by armed conflicts, heavy military presence and restricted movement of people. In total, including Nairobi and Garissa, nine semi-structured interviews were conducted with representatives from the renewable energy team of REA, Chinese Engineering, Procurement and Construction (EPC) contractor CJIC, Energy Regulatory Commission (ERC), and one focus group discussion with the local county and village representatives (see Annex I). The questions to these interviewees were designed for gathering information about the cooperating agreements, project-related background information, timelines, stakeholder and community engagement processes, and local employment policy (see Annex II). It is important to note here that access to the local community, except for the focus group interview, was not permitted by REA due to sensitivities, and there was little scope to engage with the site workers directly (African and Chinese) due to time-bound access restrictions and language constraints. Hence, the representation is mainly of staff from REA and CJIC. Further, as REA is the project owner and developer, direct communication between CJIC

and the local community was limited, as REA acted as an intermediary. An overview of the research process is presented in Figure 2.

In addition, semi-formal interviews with government officials, ERC, and private sector firms were conducted in order to gauge the overall policies of the government with regard to promoting grid-connected solar PV. For instance, participation at a conference held in Nairobi during the fieldwork, entitled Future Energy East Africa, provided an opportunity to discuss and engage with a number of energy sector stakeholders in a less formal setting. Subsequently, the information was gathered into field notes. The notes were summarized, organized and synthesized for data analysis.

**Figure 2 - An overview of the research process**




The data analysis approach involved exploring data themes emerging from the empirical data, and linking them with theories. This entailed several iterations of analysis between the theoretical concepts and the empirical themes, in order to synthesize data in line with thematic analysis (Braun and Clarke, 2006). A preliminary analysis was conducted focused on understanding actor interests and motives, their roles, and activities related to the project. Based on the framework presented in Table 1, China-Africa encounters were analyzed to identify emerging themes. Since REA was acting as a mediator between CJIC and the local community, in some instances, the encounters were between the REA, a Kenyan state corporation and the Garissa county and local community leaders.

**Table 1 - Overview of analytical concepts and the empirical themes**

| **Analytical concepts** | **Type of evidence sought during data collection** | **Excerpts from the interviews (examples)** |
|---|---|---|
| Frictional encounters between Chinese and African actors | ▪ Unmatched expectations vs reality<br>▪ Disagreements among the stakeholders<br>▪ Any protests or disruptions during the project construction<br>▪ Unresolved issues, if any | "they create problems, they strike outside the boundary gate, the leaders refuse work but most laborers want to work and earn income"<br><br>"had to avoid a land parcel on the site, where ancestors were buried – this was not informed during the initial stakeholder meetings but came up at a later stage" |

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|---|---|---|
| | | "the communities questioned why only 100 laborers, and why not 300 or more" |
| Benefits leveraged by the African actors and/or mutually beneficial activities | ▪ Local employment criterion or policy pertaining to this project (% of jobs allocated or agreed upon)<br>▪ The specific nature (skill level) of jobs for which African employees are hired<br>▪ Type of job contracts under which African employees are hired<br>▪ Local African suppliers of sub-contractors engaged<br>▪ Enhanced technical capacities<br>▪ Local community development activities and community engagement | "REA had agreements with CJIC to hire manual labour from the Garissa county, specialized people from bigger towns and Nairobi, and highly specialized staff members/technicians from China"<br><br>"CJIC will train Kenyan project staff and REA employees to conducted maintenance and operation of the project"<br><br>"Looking at this as an opportunity to develop additional local capacities"<br><br>"The new Garissa county governor and representatives come with their own agendas and they would like to influence CSR activities" |
| Existential vulnerabilities | ▪ Perceptions of Chinese employees towards a new country-setting, Garissa town and the African employees<br>▪ Perceptions of the local community towards Chinese engagement<br>▪ Experience of Chinese employees living and working in Kenya for a year through construction phase<br>▪ Local community associations with the land given to the project, or inconveniences etc. | "for Somali-Kenyan pastoral communities, fencing (boundary wall) creates a certain distance and exclusion"<br><br>"pastoralists are used to free movement"<br><br>"the local community members only saw Chinese employees working on site full-time, and no Kenyan government representatives"<br><br>"it is a high-risk border area; working here is difficult" |

*Source*: Authors' own elaboration based on fieldwork and data analyses.

## 5. Project background: The deal between Jiangxi Province and Government of Kenya

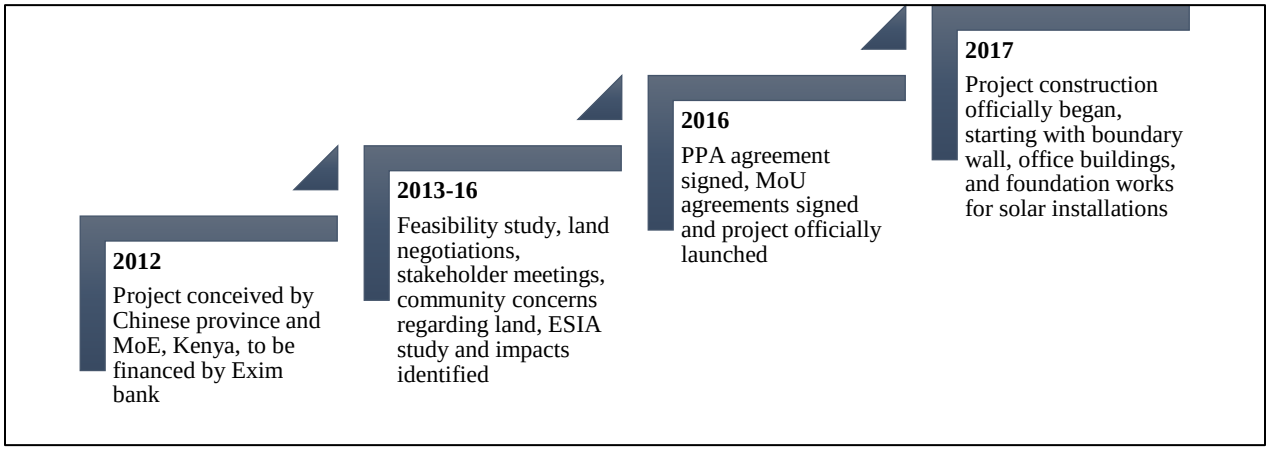
The Garissa project was conceived by the government of Kenya's Ministry of Energy (MoE) and government of China's Jiangxi Province in 2012, as part of discussions on infrastructure development in Kenya.[i] It was agreed by the MoE and Jiangxi Province that China's Exim Bank would provide a concessional loan towards development of the project, and Jiangxi state enterprise, CJIC, would support with the project construction.[ii] The concessional loan amounted to around 13.6 billion Kenyan shillings (or 135 million USD) (Energy, 2016). The project involved a bilateral government-to-government negotiation, and no tender for an EPC contractor was involved, making it the first power generation project in Kenya receiving Chinese preferential loan. As an REA interviewee remarked, "concessional financing is relatively cheap and is provided at favorable interest rates".[iii]

This investment is part of a larger industrial cooperation between the two countries. China is Kenya's largest source of financing, largest construction project contractor and its second largest trading partner (Xianhuanet, 2015). Kenya is among the top five recipients of Chinese loans in Africa, amounting to 5.2 billion USD cumulatively in the period from 2010 to 2014 (Brautigam and Hwang, 2016). However,

increasingly, there are concerns that such loans might lead to a debt crisis in Kenya (Onjala, 2018). Many observers argue that China's loans are only able to compete with western donors because they do not attach conditions of good governance and transparency (Sanghi and Johnson, 2016). Further, the loans are often mediated by Chinese construction companies, who also develop feasibility reports and select project designs and technology suppliers. These may be explained in part by Chinese funding support requirements, such as export credit funding, which stipulate that investors are eligible for export credits only if the equipment used is manufactured in China (Shen and Power, 2017). Such an approach is reported to exclude Kenyan contractors and limit the potential of beneficial impacts from these projects (Onjala, 2018).

In the Garissa project, one of the Exim bank loan conditions was a requirement to conduct Environmental and Social Impact Assessment (ESIA) prior to the project development. According to REA staff interviewed for this article, "feasibility study and ESIA was completed in 2013 by a private consultancy firm".[iv] For 3 years after that (between 2013-16), there were major delays due to prolonged negotiations on the power purchase agreement (PPA) and disagreements on tariffs between REA and the national utility company, Kenya Power, to whom the power will be sold. Subsequently, REA signed a 25-year PPA with Kenya Power to sell electricity generated from the solar plant at $0.12/kWh (Xianhuanet, 2015). This is reflective of the feed-in tariff rates in Kenya at that time, a rate that would probably have been lower had they opted for renewable energy auctions involving competitive bidding. The sequence of events prior to project construction is presented in Figure 3.

**Figure 3 - Sequence of key events prior to project construction phase**




*Source:* Authors' own elaboration based on the data collected for the article.

In 2016, Jiangxi Province signed an agreement to assist MoE to build the project. A memorandum of understanding (MoU) for a 145 km transmission line for the project was also signed between MoE and Jianxi Province. In Table 2, we highlight how the key actors framed their interests and priorities as part of the bilateral cooperation, which seem to be broadly aligned.

The Garissa project is spread over 85 hectares and is located 4 kilometers from Raya village in Sankuri division, Balambala sub-county, Garissa County. The targeted towns for receiving grid electricity with the additional capacity include Mandera, Garissa, Turkana, Wajir, Lamu and Tana. According to the Head of the Renewable Energy Department at REA, this project is particularly meant to "stabilize power in Garissa town and other surrounding areas such as Madogo and Bangaley" [as] "the town relies on long transmission lines from Kindaruma dam (distance of over 250kms), which are unreliable and that has caused frequent power outages and inconvenience to the local businesses and social facilities".[v] Previously, Garissa town only relied on diesel generators for electricity supply.

The project construction by CJIC started in March 2017. CJIC is a Chinese engineering and construction company, which focuses solely on international projects. It has prior experience with solar projects in China, but this is their first project in Africa.[vi] They have also won several other contracts across Africa, for hydropower projects and road and bridge building projects in Zambia, Ghana, and Zimbabwe. For this project, CJIC has signed an MoU with Jinko Solar Holding Co. Ltd., a leading manufacturer of solar panels, for technical support and supply of equipment for the project. Jinko Solar planned a pre-assembled modular approach to facilitate installation, future operation and maintenance of the 210210 solar panels (Newswire, 2012). REA subcontracted the tasks of technical supervision during the feasibility and construction stage, due to lack of internal capacity, to a consortium of engineers and advisors led by Maknes Consulting Engineers Ltd. in Kenya, who were responsible for monitoring the overall progress and overseeing technical aspects of the project on behalf of REA.[vii]

Against this project background, in the following section, we analyze the two micro-level encounters between the Chinese and Kenyan actors identified in this case. These encounters took place during the pre-construction and construction phase of the project.

**Table 2: Overview of the main political actors involved and their agendas**

| **Key actors** | **Interview excerpts on interests, motives and expectations from the project (examples)** | **Key points** |
|---|---|---|
| Jiangxi Province Vice Governor | ▪ "Strengthen cooperation of the government with Jiangxi enterprises, of which CJIC is the leading one"<br>▪ "It is a significant part of "Ten Cooperation Plans" put forward on China-Africa Cooperation Summit in Johannesburg 2015"<br>▪ Support "the development of renewable energy and energy industry in Kenya" | ▪ Business cooperation<br>▪ Strategic relations<br>▪ Technical expertise and superiority<br>▪ Infrastructure development |
| Jiangxi Enterprises CJIC | ▪ "The project will display the sophistication of Chinese PV technology and its productivity"<br>▪ "CJIC will strive to build it into a top-notch power plant, and enhance the cooperation with Ministry and REA"<br>▪ The replication of its success will induce a "Bright Movement" of Lighting Kenya". | |

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| Energy Minister and Cabinet Secretary, Kenya | ▪ "This project is a break from over-reliance on hydroelectric and geothermal power"<br>▪ "the power plant would bring great economic and environmental benefits as well as create ample opportunities for employment"<br>▪ "Its construction will raise the technical level of local employees and flourish the local market of construction materials, logistics, the mechanical and electrical installation and the related industries"<br>▪ "look forward to further cooperation with CJIC in more projects"<br>▪ "We hope with this the cost of power will come down to $0.054 per unit". | ▪ Local economic development<br>▪ Employment and Jobs<br>▪ Tariff reduction<br>▪ Strategic cooperation<br>▪ Energy security<br>▪ Reduced dependence on fossil fuels and imports |
| REA | ▪ "We are going to see improved electricity generation and reduced reliance on fossil fuels, savings in foreign exchange on importation of fuel for power generation"<br>▪ "Our focus now is on green energy"<br>▪ "Garissa has an arid climate and vast desert landmass, making it geographically optimal for a solar power plant"<br>▪ "the project is committed to serve 200,000 customers" | |

*Source:* Authors' own elaboration based on the data collected for the article.

## 6. Micro-level encounters

### 6.1. Micro-level encounter 1: Local community development

It was recognized by REA early on that the project must engage with the local county and community stakeholders, both in exchange for the community land provided for the project, and for obtaining a social consent in a remote rural location. In a group discussion with the county chief, his personal assistant, ward representative, chief sub-county, assistant chief, and community elder, it was highlighted that "the community land was previously being used by pastoralists for grazing purposes and also contained a few scattered huts". The local communities are dependent on agricultural farms and animals, and the land diversion for the project would directly affect their livelihoods, albeit to a limited extent. Hence, the county and community representatives expected direct benefits to the community in the form of compensation, including "more schools, dispensaries, access roads to agricultural farms, better infrastructure of administrative block and renovation of the police station". During the discussion, they added further that unemployment has long been a pressing issue in Garissa, and from this project they "expect more job creation and increased access to education and technical skills in the local area" [and as an indirect consequence] "more industries to be set up and economic focus in the Garissa region to improve"

Prior to the project inception, the local county and community leaders were informed by REA about the project and its main purposes. Such information contributed to raise expectations among many in the local community that power supply would be provided to the local unelectrified villages. As an REA staff recounted,[viii] such anticipation instantly led to a positive narrative about the project spreading in the local communities. However, in later meetings between REA, Chinese officials and local community representatives, it was clarified by REA that the electricity would feed into the regional grid, and thereby

would benefit the region at large, but not the villages living in the vicinity or *below the grid lines* of the project. This reportedly led to disappointment and frustration among the local communities about the benefits accruing from the project.

These preliminary meetings were followed by the preparation of a feasibility study, and identifying the potential project impacts through an ESIA assessment in 2013. Much later, during finalization of land parcels for the 5km long transmission line connecting the project with the Raya sub-station in Garissa), the issue of burial land was brought forward to REA by the local community representatives. "The ancestors of the local community were buried under certain parcels of land where the transmission line route was planned," they claimed. REA agreed to divert the transmission line in order to solve the problem and avoid possible blockages. However, as a newspaper article stated, "Land in Raya location […] is owned communally. In order for REA to compensate the community, a legal ownership status and documents have to be put in place. It was therefore agreed between the local community, leaders and REA that the project continues, as legal ownership documents and compensation mechanism are worked out" (Kamau, 2018). Thus, issues pertaining to compensation and legal ownership documents remained unresolved through the construction phase of the project, which perhaps contributed to building frustration among the local communities and a sense of being overlooked and neglected.

During late 2016 and early 2017, several residential buildings were constructed by the EPC contractor for the Chinese employees to reside on site until project completion. The CJIC project manager mentioned it as a "high-risk border area", "bush area", and that "people are armed beyond this".[ix] The enclosed and gated residential section within the project boundary was secure for Chinese employees. There were demarcated spaces for leisure, community hall and kitchen activities. The furniture items, kitchen utensils, and a majority of food materials were imported from China, fully exempted of any taxes for this project. A group of Chinese chefs prepared food regularly. The movement of Chinese employees outside the project boundary was limited. Based on our observations on site and informal discussions with a Chinese employee (who spoke broken English), this space provided a social cohesion, a sense of belonging, which contributed to preventing a feeling of exclusion in a foreign environment.

The construction of the boundary wall for the project began in early 2017. The main construction works started around March 2017 including the office buildings for the operation phase, such as for supervisory control and data acquisition procedures. Throughout this initial period, Chinese employees were permanently based on site, very few of whom could speak English. REA staff was based in Nairobi, and visited the site infrequently. According to our interviews, language barriers and cultural differences appear to have prevented the local county and community representatives from approaching or communicating with the Chinese contractors. Further, as an REA staff member remarked, "fencing [boundary wall] creates a certain distance and exclusion",[x] both literally and figuratively, since "the local community members only

saw Chinese employees working on site full-time, and no Kenyan government representatives".[xi] Among the local communities, there was a perception of fear associated with those who was referred to as *foreigners*, which seems to reflect widespread mistrust and lack of communication on both sides: the local community conceiving of the Chinese personnel as foreign intruders while Chinese employees feeling that they were living in an unfamiliar and risky environment – which seems to have contributed to a mutual feeling of "existential vulnerability" (Giese and Thiel, 2014; 1101)

During May 2017, the accumulated frustrations for not being listened to led some of the Raya community members to intrude upon the building site, which according to REA and CJIC staff members involved "an attempt to break a small part of the project boundary wall".[xii] As a result, the construction work came to a temporary halt. Subsequently, REA deployed a social liaison manager for the project in mid-June 2017 to ensure that a Swahili-speaking local REA representative would be accessible, visible and available on site frequently, in order to ensure a sense that the *"*community concerns were being heard".[xiii] Accordingly, the social liaison manager undertook meetings with the local community and county representatives with the aim of managing their expectations. Parallel meetings were held with CJIC to inform them about the status of the community development issues. As the REA social liaison manager explained, "the community had grievances and there was no one to address them, they had nowhere to go…they approached the Chinese employees who…then told them to discuss [them] with REA" [and] "there was nobody from REA on site, and they were frustrated"[xiv]

The main reason for the protest was the increasing realization among local communities that contrary to their expectations, they would not be able to benefit directly from the project in terms of employment and local community development. Concerning the latter, both CJIC and REA intended to undertake 'socially responsible activities' from the inception and throughout the project, which was explicitly reiterated on several occasions during communication with local community representatives. Specifically, the aim of such activities was to improve the social and physical infrastructure in the area. Both CJIC and REA had committed financial resources specifically towards it. According to a CJIC representative, they set aside "a small proportion from their budget in discussion with REA" [xv] for the purpose. The local county and community members formed a representative committee that would collectively represent the community's interests to identify priorities for CSR strategy. The committee comprised of a combination of county representatives and community leaders. During the initial meetings between the committee and REA/CJIC in late 2016 and early 2017, the community representatives attending the meetings put forth various needs in terms of local community development, which were discussed and agreed, although budget amounts were not clearly assigned. CJIC's overall communication with the local community representatives was limited and REA thus acted as an intermediary, facilitating coordination between the two parties.

According to REA's liaison manager, the communities' needs put forth during the preliminary meetings were [xvi]: 1) construction of a cement paved road parallel to the river to facilitate transportation of agricultural yield during rainy season and improve access to the farms; 2) primary school near Raya village; 3) health center or health dispensary services in the Raya village; 4) piped water supply to the Raya community; 5) reliable electricity in Garissa town, with fewer power outages; 6) formal employment of the locals with contracts after the project construction phase; and 7) renovation of County Chief's office. Reportedly, there were several iterations of agreements on these activities.[xvii] During the interview, an REA representative added, "the local community has changed their versions, responses and position with regard to what their needs are, what do they seek, and what activities should be focused on for CSR".[xviii]

Further, in August 2017, as a result of the county government elections, the local leadership changed (i.e. the Member of County Assembly and the Chief of sub-county), and thereby, the representation within the committee negotiating for project-related benefits also changed. New set of negotiations were undertaken and the community development activities were modified again. It appears that this negotiation process mainly represented the views of the local county representatives, which meant that these discussions became enmeshed in local county government politics and related leadership agendas and voter politics. As an REA interviewee expressed it, "the local county representatives, the representative Member of Parliament, the governor, county chief changed during the county elections in 2017, they came with their own interests and influenced the project activities, especially with regard to CSR, there is an elite capture...they would like to change them.… we have to keep on engaging and negotiating with them constantly as the CSR activities were pre-determined and budget was limited".[xix] As the community needs and demands with regard to CSR increased, the pressure to attain clarity on the budget dawned on REA/CJIC. At the same time, the social liaison manager of REA believes that "the project is politicized at the local county level and it is not very clear whose interests are being put forward".[xx] Multiple local representations and interests were being advanced using this project as a window of opportunity to mobilize resources aimed at meeting various objectives. As such, the project turned into an arena for various local actors to pursue their own interests and agendas (Mosse, 2003, Long, 2003).

Given the tight timelines for construction by CJIC and the pressure on REA to present this as a model case to the Kenyan private sector and to the region at large, both CJIC and REA had a strong incentive to prevent delays in project construction. In combination with the increasing pressure from the local community representatives, REA was also inclined to meet many of the community development demands put forward by the local community representatives. Accordingly, in late 2018, REA documented that all of the community needs had been fulfilled (REA, 2018), including formal employment of the locals with contracts after the project construction phase, which we turn to in the following section.

### 6.2. Micro-level encounter 2: Local employment

The priority for local employment was discussed and verbally agreed upon by CJIC and REA during the project inception, albeit the project was not subject to local content requirements, as has been the case elsewhere, such as in South Africa (Baker and Sovacool, 2017). CJIC had subcontracted civil works and recruitment of manpower to another Chinese sub-contractor, China Energy Construction Company Ltd. (CECC). It is well-known that most of the local employment opportunities are created only in the first year of a solar project's lifetime i.e. during the construction phase (Cameron and Van Der Zwaan, 2015). During communication with local community representatives, REA repeatedly assured that the project would provide substantial opportunities for local employment. Consequently, expectations were raised significantly in the local communities, which were nurtured by the limited employment opportunities outside pastoralism and the agricultural sector available to them. A number of media reports quoting the Chairman of REA stated that "at least 1000 local jobs" will be created (Bungane, 2016a, Agency, 2018, Otuk, 2016) [and] "we are setting up a mini-city in the middle of a desert with over 1000 workers, meaning we are opening up that place" (Bungane, 2016b). In addition, a few even reported that "the project was expected to generate 2,000 jobs" (SolarMag, 2016). This is reflective of the explicitly high statements being made publicly by REA and Ministry of Energy officials pertaining to local employment benefits. All of this clearly culminated in a hype that led to high (and perhaps unrealistic) expectations from the project at the local level.

In reality, during 2017, the early construction phase, only between 50-70 Kenyan-Somali workers were employed daily from Garissa based on the volume of work available - as carpenters, masons, drivers, manual lifters, and security guards - who were paid lower salaries and wages than Chinese employees engaged with semi-skilled tasks. The workers were engaged in the construction of the perimeter wall and office buildings, as well as transporting and organizing equipment on site, and other such manual tasks. These clearly did not entail much skills development. The guidance and supervision of these tasks was provided by Chinese employees on a regular basis, but there was limited verbal communication between the Chinese supervisors and Kenyan workers. Their communication primarily involved hand gestures and head movements, which we also observed during the field visit to the project.

Alongside, during the early construction period, between 20 to 25 Chinese employees were engaged, which included 2 permanent employees of CJIC responsible for project management, 1 translator, and a number of semi and highly skilled laborers of CECC engaged with steel works, who prepared the steel structures for the office buildings and performed other related tasks such as welding, operating machinery and handling electrical works. While a few of the CECC's Chinese employs had relocated to Africa for the first time for the Garissa project, most of them were reportedly recruited from within Africa, from among those who had previously worked on other infrastructure projects especially in North Africa and West Africa.[xxi]

As the Chinese translator noted, "the Chinese employees/technicians (levelers) have worked in Africa for over 10 years and they're familiar with the countries".[xxii] Certainly, this adds nuance to the widespread narrative that most Chinese projects employ migrant labor directly from China (Brautigam and Hwang, 2017).

The Kenyan workers were hired on a 'casual' basis during the early construction phase, which was also one of the most labor-intensive periods. The 'casualization' meant that the workers did not have any formal contracts and associated wage assurance or medical benefits. The project manager informed us that "it is nearly impossible to get semi-skilled and skilled laborers in Garissa, manual laborers only; semi-skilled from other towns and cities in Kenya".[xxiii] He added, "these people are so lazy, their work is slow, no efficiency" [and] it was not feasible to offer contracts as "with most local laborers, one day they will come and next day they will disappear".[xxiv] The main criteria which guided employment for CJIC was *efficiency* (time and cost), which translated into the need for *less lazy people*. Therefore, CJIC relied more on machinery to expedite the construction process. In the early construction phase, this meant operating JCB digging machines and tool machines for installing solar mounting structures.[xxv] Reflecting on experiences and challenges of working in Garissa, the project manager expressed, "challenge is from local people", "lot of problems" "they always strike outside the boundary gate", "the leaders refuse to work but most workers want to work and earn income".[xxvi]

On the other hand, the project had certainly not met the expectations of the local community of a high number of local jobs. This had started to be evident in the early construction phase. The low employment levels along with the communication barriers (as highlighted in the previous section) resulted in a community protest in mid-2017, during the construction of the boundary wall and office buildings. REA's liasoning manager stated that "the communities questioned why only 100 laborers, and why not 300 or more"[xxvii] had been employed. The expectations of the local community were deliberately misguided, which has led to the disappointment and frustration among them due to the limited number and the low-quality nature of the locally available jobs. As a result, additional demands were put forth by the county representatives that "they expect formal employment for local people, in the operation phase of the project".

A discussion with the project manager suggested that "nearly 50 Chinese skilled workers/technicians and over 200 local Kenyan workers (some semi-skilled) were to be engaged during the peak construction phase of the project in 2018" [but] "most work will be done by machines…if manual, will take long time…we have only 1 year for project construction".[xxviii] However, a few semi-skilled Kenyan employees were indeed involved during the peak project construction phase including for steel works and electrical works for solar panels. This was complemented by additional manual workers engaged with the tasks of lifting, transporting, and placing the panels on the modular base structures, among others. And additional Chinese employees were hired on a need-basis.

The employment during operation phase is being managed by REA, as CJIC's role was limited to the construction phase only. An REA representative explained that "they (CJIC) will train our people to do the maintenance and operations of the project…we plan to get more staff for the management, but we also plan to outsource core technical tasks to a consortium of specialist engineers".[xxix] After project completion in late 2018, 5 Kenyans and 4 Chinese employees were reportedly hired to handle the operations and maintenance of the project on a formal (contractual) basis (Hanlin, 2019).

Earlier findings in the Sino-African literature claim that Chinese infrastructure projects "rarely hire African workers or rely primarily on workers flown in from China" (Hook, 2013, Rotberg, 2015). In this case, Kenyans were employed, albeit a majority of them as unskilled workers, and only a few to undertake semi-skilled tasks. Moreover, the total number of jobs was much lower in reality than what was promised to the local community. Hence, while the local community expectations were certainly not met during the construction phase, the conditions of formal employment were only met partially during the operation phase.

## 7. Discussion

The Garissa project clearly illustrates the highly political nature of how the transition to large-scale solar PV unfolds at the local level. Indeed, by adopting an actor-oriented approach in this article, we are able to demonstrate how the political economy of Chinese investments in the renewable energy sector manifests at the micro-level. Such a perspective contributes to enhance the current understanding of the underlying processes of technology adoption through the lenses of potential conflicts of interests and negotiations arising locally during project implementation (Baker et al., 2014, Avelino and Wittmayer, 2016). These insights respond directly to the calls put forward by Markard et al. (2012) and Rogge and Reichardt (2016) to enhancing the understanding of the micro-politics of transitions. While the Garissa project may be conceived of as an example of South-South technology transfer, we argue in line with Kirchherr and Urban (2018) that technology transfer is an inherently political process, which entails fundamental questions of who benefits and who gets access to the decision-making process.

In this case, the empirical observations presented in the article pointed at the Garissa project functioning as an arena of conflict and disagreement, which raise the issue of power and legitimacy in the transition to solar power in Africa (Power et al., 2016, Ockwell et al., 2018). Previously, local involvement in energy transitions in developing countries has been discussed primarily in terms of the degree of 'participation' (Chilvers and Longhurst, 2016) and 'inclusiveness' (Swilling et al., 2016). However, it appears that such broad concepts do not do justice to capturing the nuances of the nature of engagement. Indeed, there seems to be a need to move away from such conceptual simplifications focusing mainly on *whether* local involvement or participation is present, toward examining in detail the question of *how* such processes take place.

It appears that the local community had limited influence or control over the key decisions made on the overall project design and localization, and the project was therefore, to a certain extent, *handed down* from the political level. This top-down nature of the project was exacerbated by the delivery of a total package 'parachuted' in from China, which is also witnessed in other such turnkey projects (Rodríguez-Manotas et al., 2018, Hansen, 2019). As the project became a reality and increasingly moved towards the construction phase, the local communities responded by becoming involved in pursuing various objectives, which included resistance and intrusion, for example in the form of obstructing project construction. By illuminating the frictional encounters and micro-politics emerging on the ground, we advance the sustainability transitions literature further, which according to Chilvers and Longhurst (2016) has tended to focus overly on transitions mainly from a technocratic and neutral perspective. Indeed, as pointed out by Romijn and Caniëls (2011), transitions rarely follow a democratic and inclusive pattern and may involve a significant degree of contestation and conflict (see also (Avelino and Wittmayer, 2016).

While the growing prominence of new 'rising powers' in Africa is a pertinent topic, this article shows the importance of analyzing the involvement of China in particular. Indeed, as suggested by Shen and Power (2017), the growing involvement of Chinese actors in the renewable energy sector in Africa, including state agencies, investors and technology suppliers, merit attention as an independent topic of research. We posit that Chinese involvement in the ongoing transition toward large-scale solar PV across the continent should be understood in light of the increasing outward flows of technology, knowledge, investments and ideologies from China at a global scale.

The article argues for a need to explore further nuances in the prevailing academic and political discourse by contributing to unraveling the multiple contradictory dimensions of Sino-African relations. Indeed, the article shows the subtle nature of Sino-African encounters, where tensions exist along with cooperation, negotiation and compromise. We thereby contribute to providing a more balanced view than the longstanding skepticism pertaining to Chinese investments in Africa (Brautigam, 2011, Brautigam and Hwang, 2017). As shown, we argue in favor of adopting analytical perspectives allowing greater attention to African agency in the study of Sino-African relations (Mohan and Lampert (2013).

## 8. Conclusion

The article began by pointing at the growing importance of China in the ongoing transition to large-scale solar PV in Africa. Using the Garissa project as a case study, we set out to explore how the micro-politics and negotiations among Chinese and local actors unfolded on the ground in the transition to large scale solar power in Africa.

We find that the Garissa project served the strategic and diplomatic needs of both the governments of Kenya and China. As part of a larger Sino-Kenya cooperation, which entails several mega-infrastructure projects, the implications of such a project are certainly much wider than the project itself.

Further, the article demonstrates the manner in which frictions arose through myriad unfulfilled expectations, trust issues, language and communication barriers, preconceived notions, cultural differences, and vulnerabilities. It also illuminates the dynamics of local-level political stakes, inclusiveness and participation. We highlight that the PV project eventually functioned as a platform of conflicts and contestation, which contributed to mobilize local actors to exercise agency and enhance their bargaining power to negotiate better terms.

The overall outcomes may seem favorable when viewed in terms of a completed project (with minimal delays), community development activities and infrastructural improvements, and reinforcement of local political leadership. However, unlike what was promised to the local community, the project led to limited local employment benefits and limited skill development. This could be viewed as a missed opportunity, which REA could have utilized specially to focus on enhancing local skills and technical capacities, and support the development of domestic industry.

To understand how the micro-politics around such projects take shape, we draw inspiration, as well as contribute to advancing the emerging literature on the socio-political aspects on sustainability transitions, with an empirical focus on the Global South. We contribute analytically by employing the conceptual lens of ‘encounters’ to study the micro-politics of transitions. By doing so, this article emphasizes the need to adopt an agency-oriented analysis in order to study the politics of sustainability transitions.

## Annex I - Interviews Conducted

| Interview No. | Role | Organizational Affiliation | Interview Type |
|---|---|---|---|
| Interview 1 | Head of Department, Renewable Energy | Rural Electrification Authority (REA) | Personal |
| Interview 2 | Renewable Energy Manager | REA | Personal |
| Interview 3 | Public Relations Manager, Social Liaison Officer | REA | Personal |
| Interview 4 | Senior Wayleaves Officer, Land Diligence | REA | Email |
| Interview 5 | Engineer | REA | Personal |
| Interview 6 | Project Manager | China Jiangxi Corporation for International Economic and Technical Cooperation (CJIC) | Personal |
| Interview 7 | Chinese - English Interpreter | CJIC | Personal |
| Interview 8 | Chinese laborer on site | China Energy Construction Company Ltd (CECC) | Personal |
| Interview 9 | Renewable Energy Manager | Electricity Regulatory Commission (ERA) | Personal |
| Group Discussion | County chief, PA, ward representative, chief sub-county, assistant chief, community elder | | Personal |

## Annex II – Interview Guide

Guiding Questions

1. When, how and by whom was the project conceived?
2. Why is REA, a government agency implementing a large-scale project? How and why did REA get involved as a project owner and developer, without ever assuming such a role before in REA's history? Was any private sector developer considered? Why or why not?
3. What was the rationale behind selecting Garissa town as an appropriate location? Were other areas considered?
4. Why was utility-scale solar PV preferred as a technology?
5. When and how did the Chinese government get involved?
6. Why or how was a Chinese EPC contractor selected?
7. Was there any consideration of an open competitive tender to select a contractor?
8. How much land was required for the project? What type of land?
9. Is there any compensation being paid for the land? How? To whom? On what terms?
10. Was there any impact assessment for the project? When was it conducted? And by whom?
11. Was the impact assessment mandatory for the project? Why?
12. When did the project construction begin?
13. Which all stakeholders were informed and involved in the pre-project stage?
14. How did REA engage with the local community stakeholders?
15. Were there any meetings held with the local community prior to the project construction?
16. What were the concerns, expectations or issues expressed in the community meetings?
17. Was there any obligation for the Chinese contractor to employ a certain proportion of local laborers?
18. Did a change in the county government officials lead to changes in the interest, or willingness or cooperation or support towards the project?
19. Did all stakeholders at a local level express support towards the project?
20. How do you perceive the impacts of the project?
21. What are your expectations, interests and experiences with regard to the project?
22. Do you anticipate any other benefits from the project?
23. How many laborers were employed during the early construction phase and peak construction phase?
24. How many laborers (Kenyan and Chinese) are required during the peak construction phase? And for what kind of tasks?
25. What are the salaries being paid to the Kenyan workers? By what mode are they paid?
26. Does CJIC have a lot of experience with solar projects in China?
27. What have been the main challenges for implementing the Garissa project till date?

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[i] Personal interview # 1
[ii] Personal interview # 1
[iii] Personal interview # 1
[iv] Personal interview # 2
[v] Personal interview # 1, # 2, # 3
[vi] Personal interview # 6
[vii] Personal interview # 5
[viii] Personal interview # 2
[ix] Personal interview # 6
[x] Personal interview # 2
[xi] Personal interview # 2
[xii] Personal interview # 6, # 3
[xiii] Personal interview # 3
[xiv] Personal interview # 3
[xv] Personal interview # 1
[xvi] Personal interview # 3
[xvii] Personal interview # 3
[xviii] Personal interview # 2
[xix] Personal interview # 3
[xx] Personal interview # 3
[xxi] Personal interview # 7
[xxii] Personal interview # 7
[xxiii] Personal interview # 6
[xxiv] Personal interview # 6
[xxv] Personal interview # 7
[xxvi] Personal interview # 3
[xxvii] Personal interview # 3
[xxviii] Personal interview # 6
[xxix] Personal interview # 5

# Article 4

# Getting on the ground: exploring the determinants of utility-scale solar PV in Rwanda

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**Abstract**

Solar PV is gaining ground in low and middle-income countries, especially in sub-Saharan Africa where a change from donor to more market-driven investments has been observed. This article contributes to energy transition research in low-income countries, taking Rwanda as a case study and focusing on the factors that determined the implementation of what was the largest on-grid solar project, upon completion in 2014. The multi-level perspective (MLP) is used to structure our analysis of the various socio-technical levels, and their interaction, to better understand the conditions that are enabling this transition. Our analysis reveals the central importance of bureaucratic and regulatory support for investment in low-carbon energy technologies, within a political economy influenced by processes of neo-liberalisation, while creating significant space for private contract negotiation. In particular, the provision of legal and financial guarantees were crucial to reduce risk for foreign capital investment, revealing contradictory forces that both promoted market rule, while limiting private capital's exposure to competitive pressures. We also focus our analysis on the aspect of control and driving forces, in particular the role of development partners and private sector project champions.

**Keywords**: *Energy Transition, Multi-Level Perspective, Rwanda, Solar PV*

## 1. Introduction

According to the Africa Energy Outlook [1], sub-Saharan Africa (SSA) is the only region in the world where the amount of people without access to electricity – more than 620 million in 2014 – is increasing, i.e. where population growth is outstripping the rate at which people are gaining access to modern energy services. Solid biomass remains the dominant source of domestic energy use, mainly used for cooking. The significant technical potential for renewable energies in SSA opens the door for the development of non-fossil fuel electricity generation projects based on such technologies, 'leapfrogging' in the transition to a low-carbon energy system [1,2].

Investment in PV in Africa has increased in the last decade due to falling costs as the technology matures [1]. Donor agencies have been key players in financing energy projects in Africa, but a change in the general trend from donor-driven to market-driven investments within solar PV, esp. off-grid and mini-grid [3,4], and more independent power producers/projects within the power sector has been observed, especially since 2011 [5]. This new trend for foreign direct investment (FDI) is based on turn-key plants delivered and operated by foreign project developers, typically under Power Purchase Agreements (PPA) with national utilities [6]. This article focuses on the case of Rwanda in order to strengthen the empirical basis for understanding this ongoing technological 'transition'.

Rwanda was chosen as the country of study for several reasons. First of all, the first largest and most quickly-built utility-scale[1] on-grid solar power plant in SSA was constructed there in 2014, in Rwamagana. Secondly, this power plant was mostly privately financed indicating a new approach to technology transfer, structured by a PPA signed between the government of Rwanda and an Independent Power Producer (IPP) to supply electricity to the national grid. Finally, our interest in Rwanda follows its remarkable economic development over the last 20 years post-genocide, and a unique socio-political historical context.

Specifically, we seek to answer two main research questions: *1. What type of transition pathway is taking place in the case of* utility-*scale PV in Rwanda? 2. How have the key players and institutions involved in decision-making influenced and responded to each other in reaching that outcome?*

Through an application of the multi-level perspective (MLP) framework and paying close attention to the agency and politics of transitions, we seek to explore how and why we are observing this transition, i.e. what are the critical factors at the landscape and regime level that are creating the conditions for the transition towards utility-scale PV power in Rwanda? What are the impeding and enabling conditions for this transition? What was the role/involvement of different local/national and transnational actors in what was the first utility-scale solar plant in Rwanda?

Our aim with this article is to explore, in detail, how the Rwamagana project came into being and to understand the extent to which it qualifies as a market-driven investment indicative of a wider trend towards a low-carbon energy transition in SSA.

## 2. Setting the scene: energy and electricity in Rwanda

In 2016 Rwanda had a population of 11.5 million, predominantly rural (83.5%), with a relatively high population density of 471 inhabitants per $km^2$ [7]. Rwanda is classified as a low-income country with a GDP per capita of $697.3 in 2015 [8]. However, between 2001 and 2015 real GDP grew 8% per annum on average, including strong growth rates in recent years of 7% in 2014 and 6.9% in 2015, up from 4.7% in 2013 [9]. According to the World Bank's *Doing Business* report for 2016, Rwanda was the second 'most-improved' country in the world and the most improved among those surveyed in SSA. The World Bank also considers Rwanda to be the best performing country in East and Central Africa, and the second easiest place to do business in Africa [10].

Energy consumption in Rwanda consists of biomass, oil, gas and electricity. Biomass is the main primary energy source in the country and accounts for 85% of all energy needs [11]. In 2012 electricity only accounted for about 4% of the total energy consumed [12]. Electricity is generated mainly by hydropower (47%), while the rest comes from diesel-powered generators (27%), methane (14%) – mainly from the Kivuwatt project in Lake Kivu – and other sources, including solar power [13].

Rwanda had an electricity generation capacity of 160 MW in 2015 [12], which increased to 216 MW by 2017 [13]. According to the Energy Sector Strategic Plan (2015), Rwanda aims to reach 563 MW of generation capacity by 2018. The roadmap includes, among others, the installation of about 40 MW from solar power plants during the period 2014-2018 [12]. Nevertheless, this target is unlikely to be met since 347 MW are yet to be installed, as of late 2017.

In terms of access to electricity, more than 60% of the urban population is grid-connected [14], but this falls to 7.7% in rural areas [15]. The majority of the Rwandan population live in small villages, mostly unconnected to the grid. The country has ambitious plans to electrify at least 70% of all households by 2018, aiming to provide on-grid access to 48% of households and off-grid to 22% of households [12]. But again these targets are unlikely to be met on time.

Major electricity consumers in the country are households (51%) and the industrial sector (42%), including companies in the cement, mining, textile and agricultural sector [12]. Before 2017 the average wholesale electricity grid price was $0.24/kWh, which was relatively high for the region. Consumer electricity tariffs were not cost reflective and were heavily subsidized due to the relatively large share of diesel-based power generation. In 2015 the government estimated that the real financial cost of electricity in Rwanda was 50% higher than the average cost in East Africa [12]. However, from January 2017 the government established

a new electricity tariff – distinguishing residential, non-residential and industrial users – which depends on consumption blocks and time of consumption (only for industrial users). For residential users tariffs are now structured progressively, with the first 15 kWh per month charged at $0.10/kWh, from 15-50 kWh at $0.216/kWh and above 50 kWh at $0.224/kWh [16]. The Rwanda Energy Group (REG) is the electricity utility in the country, and has two subsidiaries: EDCL and EUCL. The first one manages electricity generation, whereas the second one manages maintenance, and plays an important role in the execution of PPAs with IPPs [17]. Since the liberalisation of the electricity market in 1999 [18], private companies have been able to generate electricity by owning and operating electricity generation facilities, operating as IPPs when supplying to the grid. There are many private developers of IPP power projects, both foreign and local, that work in Rwanda.

## 3. The transition to low-carbon energy technologies

Sustainability transitions is a rapidly emerging and influential field of research [19]. The energy transition is a form of socio-technical transition, involving transformative change in the overall configuration of the energy system, with the aim of achieving sustainability [20]. In other words, not only technology and infrastructure are included, but also policy, markets, consumer practices, cultural meanings and scientific knowledge, making them complex and long-term processes [21, 22]. It is therefore essential to understand the multi-dimensional nature of energy transitions and the dynamics of structural change more broadly [20].

Transitions and system changes have been explained by different theories - the Multi-Level Perspective (MLP), Strategic Niche Management (SNM) and Technological Innovation System (TIS) are most popular among transition scholars. These have mainly evolved within a European context but have lately gained traction and relevance across multiple contexts, globally. However, the transition towards sustainability in low-income country contexts differ from those in their high-income, western, counterparts given several cultural and structural differences [23, 24]. These include: a greater reliance on foreign technology and capital, less efficient bureaucracies, weaker institutions, different socio-political circumstances including non-stable democracies, lower levels of technical capacity, high social and income inequality, and weaker negotiation power in global dialogues [25].

In response to earlier criticisms to the western bias, non-OECD countries have received increased attention within transition studies and have offered new insights to the existing frameworks. Several of the transition approaches were adopted in rapidly developing Asian economies [26, 27, 28, 29, 30], and in low-income countries in Africa [31, 32, 33, 34, 35, 36]. There has been a recent stream of research specifically focusing on the donor interventions in these contexts [37, 38]. Wieczorek illustrated key lessons and insights from an extensive review of publications using transition approaches in non-western contexts [24]. Some of the

major recurring themes include: the prevalence of experiments and upscaling, strong transnational linkages, less uniformity among regimes, path dependence, contextual historical forces and normative orientation. In this paper, we acknowledge the existing works and further build on some of them by presenting new empirical insights. Rwanda makes for an interesting case study as: i) it has received limited attention within the existing transition studies in SSA, and ii) there is a lack of an in-depth analysis of the utility-scale solar PV developments in Rwanda.

### 3.1. The Multi-Level Perspective (MLP) and Transition Pathways

In this paper we apply the MLP framework which conceptualizes the "overall dynamic patterns in socio-technical transitions" [20]. The MLP defines transitions "as outcomes of alignments between developments at multiple levels", occurring as a non-linear process [20, 39]. This interaction is based on three different levels from a macro to a micro perspective. The landscape level includes the 'exogenous' factors which influence the development of the energy system. These can be macro-economic trends, political developments, and deep cultural patterns [20, 40]. The regime level is assumed to provide the stability of an existing socio-technical system [41]. The niche level refers to new energy practices and technological innovations. It comprises learning processes, price-performance improvements, support from powerful groups and the establishment of market niches [40]. However, sometimes it is difficult to introduce new niches as the existing regime is stabilized by lock-in mechanisms and new niches do not fit with the existing regime [20]. Geels and Schot [39] present a classification of transition pathways based on the multi-level perspective [20, 42, 43]. The four 'classic' transition pathways are based on the nature of interaction (reinforcing or disruptive) between niche-innovations and landscape pressure with the regime, and the timing of these interactions [39]:

- Transformation path: A moderate landscape pressure takes place, but niche-innovations cannot take advantage of it as they are not yet sufficiently developed.
- Reconfiguration path: Radical innovations which are developed in niches are initially adopted in the regime level as add-ons or complements to solve small problems or improve performance.
- De-alignment and re-alignment path: A large change takes place in the landscape level, causing a de-alignment of the regime. In this, multiple niche-innovations co-exist and compete until one gains momentum and becomes dominant.
- Technological substitution: A specific shock in the landscape level takes place. Niche-innovations are sufficiently developed and have gathered internal momentum, resulting in the replacement of the existing regime.

These transition pathways have recently been reformulated by Geels *et al.* [44] based on the idea that they should not have only a 'global'/ 'outside-in' conceptual logic, but also a 'local'/ 'inside-out' conceptual

logic. The first one represents the general development processes of an innovation, while the second one focuses more on the immediate processes that lead to particular development episodes, as described by Poole and Van de Ven [45]. The reformulation of the transition pathways is built upon "who the dominant actors are and how they shape the reproduction or change of rules and institutions", basically in terms of actors, technologies and institutions [44].

We bring in these ideas to counter the oft-cited claim that the MLP framework does not take into account agency and negotiation, i.e. that the MLP and the transitions literature more broadly often fail to recognise or account for the explicitly *political* nature of socio-technical transitions.

### 3.2. The Politics of Sustainability Transitions

The MLP has faced numerous criticisms for its limitation in accounting for the issues of agency and politics in transitions [46, 47]. In response, there is a growing literature sensitive to agency and politics and provides explanatory power to actors [48, 49, 50], acknowledging that energy transitions in low-income countries are, in fact, inherently political [34, 51, 52]. As opposed to the more techno-managerial orientation of socio-technical transitions, these studies bring our attention to the political terrain of competing visions and material interests, the power of capital and global institutions to set the terms of transitions, and to the distributional politics of transitions. Transitions are not neutral processes but entail 'social', 'material' and the 'political' [53], and the actors driving the processes have vested interests and varying levels of power. Further, this power is not concentrated at a particular level (e.g. niche or regime) or within specific actors, but differing degrees of power is dispersed across a number of actors at numerous levels [53, 54]. This also relates to the politics of sustainable development and the politics of science and technology at large [55, 56].

Avelino *et al.* [53] assert that the politics of transitions warrants more attention and better integration in transition studies. In their comprehensive review on the politics of sustainability transitions they organize existing works under three cross-cutting recurring themes: the *materialities* of transition politics, the *dispersed nature of agency and power* and the *importance of historical and spatial contexts*. Examples of these include: politics as co-produced through socio-material procedures and entanglements with infrastructures [57], as discourses and knowledge [58], politics of conflict and capture by vested interests [59], and politics in the post-apartheid South Africa [60]. Using the case of the Netherlands, Pel [61] illustrated how innovations can evolve along with actor-networks who seek to promote innovation in accordance with their political ambitions. Other studies also interpret politics more narrowly referring to the changing political agenda of the national government and its implications on the wind energy transition in the context of Norway [62]. All of these cases illustrate how politics of socio-technical transitions is pervasive across multiple scales: geopolitical, national, local etc. and extends beyond formal niche-

incumbent regime dialectics, and actor-roles and power relationships, into diverse political agendas, political willingness (or unwillingness), the politics of neo-liberalisation, among others.

We contribute to this research stream by furthering the analysis of drivers and actor dynamics by zeroing in on a specific case, and also by illustrating the political dynamics within authoritarian political regimes and its implications for the solar PV transition. This interpretation relates to the two themes on politics: distributed agency and power (i.e. the power of decision-making authorities), and also important historical context (e.g. post-genocide economic development, ethnic conflicts, human rights violations). In the case of Rwanda, we witness a form of developmental authoritarianism, referring to a nominally democratic system with significant centralized state control over every facet of the society [63], unique to study its implications for transition processes.

## 4. Methodology

The timespan of our secondary data analysis covered the period from the end of the genocide against the Tutsis (1994) to the last year of Vision 2020 (2020) [64], the country's development roadmap. Nevertheless, the five-year period between 2011 and 2016 is of particular interest, as many new policies and laws entered into force and new relevant energy projects were planned and constructed.

Primary data collection was undertaken in Rwanda between June and July 2016, with 12 in-depth semi-structured interviews conducted with key informants and decision makers, including the project developers. This encompassed conversations with individuals from private companies – Scatec Solar, Afritech Energy, Climate Concern, Remote Group, Hobuka Ltd and GigaWatt Global – and agencies and ministries from the government of Rwanda – RURA, MINIRENA, RDB, REG (EDCL and EUCL). The aim of these interviews was to develop a rich understanding of the various decision-making processes (planning, political, financial etc.), the relative importance of various visions, targets, and policy incentives and actors networks. Observations were also made during a site visit to the Rwamagana plant in July 2016.

The mix of qualitative primary data collection, combined with publically available secondary data, was determined by the nature of the research questions and analytical framework, which aim to critically examine the context, processes, actors and networks within the different socio-technical levels of the corresponding energy transition [65].

## 5. Analysis of Rwanda's first utility-scale solar PV power plant

The Rwamagana solar power plant was the first major solar power plant in East Africa, with a generation capacity of 8.5 MW. Upon delivery it was touted as the fastest-built solar project in Africa, as it went from contract signing to construction and connection in less than a year. It is located 60 km east of Kigali, in the Rwamagana district, and during the first year it produced approximately 15 million KWh [66]. To date,

only the diffusion of biogas technology [67] and off-grid solar PV in the country [68] have been studied from an energy transitions perspective. As described by Jacobsson [68], the government of Rwanda has worked closely with a variety of western donors to promote a range of renewable and alternative energy technologies. However, the Rwamagana solar plant was developed and financed largely through private sector leadership and risk taking.

### 5.1. Project inception and the landscape-regime interaction

A combination of two key factors led to the initial idea for the development of this project. The Agahozo-Shalom Youth Village (ASYV), where the plant is located, had a large area of land that was used for agriculture, but the value and benefits from this land were not significant. At the same time, the founder of the youth village had an interest in developing a solar power plant in the area. In February 2012 the ASYV and Gigawatt Global (GG) – a multinational renewable energy company focused on the development and management of utility-scale solar fields in emerging markets – started to develop the project concept [69, 70].

Active pursuit of private sector participation - central to the development of the Rwamagana plant and future solar projects – is present in many of Rwanda's official strategies and policies. Firstly, there is the *Rwanda Vision 2020* (2000, revised in 2012) which aims to promote economic development and stability, to reduce donor dependency. Private sector development and the role of foreign investment are considered central to achieving this goal [64]. Secondly, the *Green Growth and Climate Resilient Strategy 2012-2017* advocates greater private investment in renewable electricity by providing feed-in tariffs and long term PPAs to provide a secure investment environment for IPPs, and implement renewable energy norms and codes of practice in order to remove uncertainty for private sector investors and project developers [71]. The *Energy Sector Strategic Plan 2013/14-2017/18* (2015) also presents actions to promote private sector engagement. Examples include updating the investment code, establishing the Rwandan Energy Development Fund for early-stage funding, and developing investment processes for IPP energy projects [12]. One goal of the *Rwanda Energy Policy – REP* (2015) is the creation of "an enabling environment for increased private sector participation in energy supply and service provision" [11]. The government is aware of the importance of a clear legal and regulatory framework to increase investors' confidence in Rwanda, especially to attract foreign private investors. Consequently, the government plans to strengthen the legal and regulatory framework for renewable energy by "revising current legislation and putting in place new laws, regulations, and technical guidelines and standards" [11]. The private sector is becoming more and more important for the development of solar projects in Rwanda, at all scales. Foreign private project developers tend to rely on foreign private capital, thus providing a source of foreign investment, which is a cornerstone of the government's economic development agenda.

Drilling down further into the legal and technical framework upon which these policies and 'visions' are based, it was the *Electricity Law (2011)* [18], which opened up the electricity market for private sector participation, through investments in generation and grid projects. This marked a fundamental change at the regime level, reflecting the interest of the government of Rwanda in attracting private sector investment and skills, to help deliver it national energy policy objectives.

None of the initial actors involved in the Rwamagana project came from Rwanda – the government was not involved at the inception stage. However, the project developer bought experience from many other countries and had technical knowledge regarding the potential of solar PV technology in Africa. More broadly, global interest in developing on-grid renewable projects has increased since 2011, manifested by high-level political promotion of renewable energies in general, and PV solar in particular. This can be considered as a landscape pressure to the socio-technical energy regime in Rwanda, which is influenced by the Paris Agreement on climate change, the uncertainty in oil prices and constant improvement of PV solar technology and concomitant price reductions. These landscape factors make solar PV a more reliable and attractive generation technology for countries such as Rwanda that have minimal or non-commercially attractive hydrocarbon resources, are land-locked and far from the coast.

Interest in developing a PV solar plant in the ASYV was also driven by the strength of the resource: even though the country is located in the sub-Saharan region where the rainy season lasts approximately half of the year, average daily solar irradiation is between 4.3 and 5.2 kWh/$m^2$/day. However, PV suitability – also taking slope and vegetation into account – varies significantly across the different regions, with the country's eastern province the most promising for PV [72]. Land availability for developing the project was paramount. Compared to most of its neighbours Rwanda is a small country, with the highest population density in Africa after Mauritius.

GG's interest in the Rwamagana project was also in part a result of a two-day Forum on the Energy Sector in February 2012 in Kigali, organised by the government of Rwanda. The main goal of this conference was to attract private investors in the development of on-grid energy projects, as the country at that time was in urgent need of electricity generation capacity [73]. The need to increase electricity generation and access in the country is another landscape pressure. The political stability and rapid economic growth that followed the genocide against the Tutsis in the 1990s has enabled Rwanda to develop faster than its neighbours, and the use of solar PV technology, at various scales, has been a priority technology for the government in recent years. However, the government's ambition for Rwanda to achieve the status of a middle-income country translates into political support for any technology that will increase electricity generation in a sustainable and affordable manner.

The above-mentioned and slowly changing external factors – climate change awareness, proven feasibility of utility-scale, on-grid, PV solar technology, uncertainty in oil prices, economic development and the

declining price of PV – are key transition drivers as they apply a pressure, creating destabilizing effects at the regime level. This, in turn, can create opportunities for niche development. The Rwamagana project was the result of a changing socio-technical energy regime, modified in part by these external factors. These pressures resulted in the establishment of several policies and strategies in Rwanda, which have provided implicit and explicit support to on-grid PV solar power, as part of a broader drive towards a lower carbon energy system.

It is widely acknowledged that governments have a key role in bringing about policy-driven energy transitions [40]. At the broadest strategic level, the *Green Growth and Climate Resilient Strategy 2012-2017* (2011), which aims to guide Rwanda towards becoming a "developed climate-resilient, low carbon economy" by 2050, proposes to phase out oil and peat-fuelled generation and promote renewable energies [71]. Also central to our analysis is the *Law on Investment Promotion and Facilitation (2015)*, which promotes and facilitates investment in Rwanda, and where energy is considered as one of the priority economic sectors. Particularly for operations related to solar energy generation, there is a preferential corporate income tax rate of 15% [74]. *Law nº34/2015 of 30/06/2015 establishing the infrastructure development levy on imported goods* established that "industrial machinery and equipment for energy" and "specialised solar equipment and accessories" are exempted from the levy of 1.5% on the customs value of imported goods [75]. Rwanda's green development strategy and other laws demonstrate the enabling support offered to PV solar projects: the promotion of renewable energies in the energy mix is clearly stated, as well as the interest in PV technology by making these projects more economically attractive.

However, despite the enabling effect of the above mentioned legislation, PV technology was not taken into consideration in the *Rwanda Grid Code* (2012), which is a set of documents that determine the technical and other requirements for the connection to, and use, of the grid [76]. Indeed, the current Grid Code does not make specific allowance for renewable energy sources of power. This slows the process of compliance, as PV project developers are forced to seek an exemption [77], which acts as a break on the development of such projects, creating additional bureaucratic hurdles for project developers to clear.

### 5.2. Project development and regime-level interactions

Regarding project development, GG conducted the technical design work and coordinated the feasibility study to analyse the project in technical and economic terms, while ASYV was in charge of the contacts and communications, and provided local expertise in the early phases. GG contacted the government of Rwanda via the Rwanda Development Board (RDB) and expressed its interest in developing this project through an unsolicited Expression of Interest (EoI). See Table 1 for a summary of the main state agencies and their functions

As previously mentioned there was an urgent need for more electricity generation in the country, during the time when the project was being discussed. Throughout East Africa, there were major power shortages due to the depletion of water resources, consecutive droughts. Rwanda had to rely on expensive diesel generators/emergency thermal power for nearly two years (2010-2012). This partly explains the expediency with which GG signed a Memorandum of Understanding (MoU) with the Ministry of Infrastructure (MININFRA).

The Rwamagana project did not follow a bidding process, instead it was directly negotiated between the project developer and the electricity regulator. Competitive bidding processes usually result in more competitive contract prices than directly negotiated projects (e.g. South Africa and Uganda vs. Nigeria and Rwanda) [5]. The *Rwanda Energy Policy – REP (2015)* states that the default procurement choice has to be a competitive bidding of all energy-related projects, including IPP generation projects, which should increase transparency and ensure value-for-money in the use of public funds [11]. Therefore, after the Rwamagana project was complete, the government of Rwanda defined a more efficient procurement process. We speculate that this subsequent change in the regime level was influenced by the learning process from Rwamagana, which itself occurred during a period of major power shortages and hence a higher willingness to pay for new, reliable, power generation.

**Table 1. Main state agencies and their function, as they relate to the development of utility-scale solar projects in Rwanda.**

| | |
|---|---|
| **Rwanda Energy Group (REG)** | • Providing technical assessment<br>• Providing PPAs |
| **Rwanda Utilities Regulatory Authority (RURA)** | • Setting tariffs<br>• Regulate the sector<br>• Provision of licenses, permits and authorizations<br>• Review of PPAs and grid service contracts |
| **Rwanda Development Board (RDB)** | • Promotion of private sector investment<br>• Investment process<br>• Guidance<br>• Facilitation<br>• Leading negotiations for strategic projects<br>• Issuing EIAs<br>• Designing incentives |
| **Ministry of Infrastructure** | • Policy and strategy formulation<br>• Granting both concessions and MoUs |
| **Ministry of Finance and Economic Planning** | • Taxation formulation<br>• Granting Government Guarantees |

The REG provided a technical assessment to GG when the feasibility study was submitted in December 2012 [70]. The initial design of the power plant specified a generation capacity of 10 MW, but this was later reduced to 8.5 MW for technical reasons related to the limited capacity of the national grid, at the proposed connection point. After the solar plant started its operation, the transmission line was improved

[78]. The development of this project also revealed the need to change a technical aspect of the regime: large on-grid power projects require adequate infrastructure. Increasing the grid coverage to supply electricity to rural villages will be costly and likely take many years. Therefore, increasing the country's generation capacity through utility-scale solar projects in the short/mid-term will not help to provide electricity to the majority of the population, given the absence of grid coverage. Instead, the electricity generated by utility-scale plants would be added to the total electricity capacity, mainly contributing to the development of the urban residential and industrial sector.

Another important factor for the implementation of large scale solar is the capacity of the grid to accept intermittent power supplies. Many investors had been interested in utility-scale solar projects in Rwanda, but the government was not able to accept most of the proposals partly due to the risk of a higher share of intermittent power in the grid [79]. In relation to this, the construction of the Eastern Africa Power Pool (EAPP) – a common power grid in East Africa – will connect Rwanda to its neighbouring countries [80]. This connection would technically make possible the construction of more utility-scale solar plants, as Rwanda could export the excess of solar energy generated, ironing out the supply and demand for electricity over a far larger geography, thus reducing the limitations of intermittent power supply from solar resources.

When the Government of Rwanda decided to go ahead with the Rwamagana solar plant, electricity in the country was mainly generated from hydropower (60%), and the rest came from diesel-powered generators and other sources [11]. However, since 2015, a change in the electricity mix has taken place. Even though hydropower projects are still being developed – e.g. Nyabarongo I (28 MW) under construction [81], a 45-MW hydropower plant at the Rusumo Falls shared between Rwanda, Burundi and Tanzania under development [79] – projects based on other energy sources are also being considered. The use of methane from Lake Kivu within the KivuWatt project could significantly increase Rwanda's electricity generation. Phase I, running since 2016, has a capacity of 26 MW and there are plans to increase this to 150 MW [82].

Although these changes at the regime level are mainly determined by energy resource availability and the basic economics of project feasibility, Rwamangana raised awareness within the government with regards to the potential of solar PV to supply power to the grid, at industrial volumes, relatively quickly [78]. However, this project and the foray into solar PV did not spark any resistance, since the government aimed to achieve an 'energy mix' (i.e. reduce the vulnerability associated with reliance only on hydropower), and not replace one regime with another. This can also be linked with other parallel developments taking place within the space of solar mini-grids and off-grid solar home systems, both receiving government support and fitting into the larger electrification agenda, and of attaining middle-income status.

In the MLP framework, niche-regime interaction is often conceptualized in a dichotomous manner through a 'David and Goliath' metaphor [53]. In agreement with Swilling *et al.* [60], we conceptualize regime more as a socio-political constellation embedded in economic structures, as opposed to a rigid abstract socio-

technical system. Instead, regime can be conceptualized as comprising of multiple arenas of development [83] within which these different actor-constellations are embedded. The emerging solar niche co-exists with the incumbent hydropower technology. This also corresponds with Wieczorek's findings [24] that the regime is not always tied to one specific technological configuration, rather is embedded in a diversity of modes where old systems coexist alongside new ones [84].

The demonstration effect of Rwamagana also went beyond Rwanda's borders. The project manager of the Rwamagana plant (REG – EDCL) stated that they have received many visits from other countries in the region, and that "they opened the door to other countries" to develop these kinds of projects. Apprehension over the technical feasibility and intermittency of solar was one of the main reason why other countries did not promote or develop this technology, possibly due to misinformation but also the lack of experience from countries with similar energy markets, institutions, incomes and demand profiles [79].

A team of experts from the REG coordinated the Rwamagana project, together with GG. They were in charge of analysing the proposal, facilitating site identification, assessing the equipment, approving the technical design and the feasibility study, and overseeing the Environmental and Social Impact Assessment [85]. This phase could have taken years (and often does), but the strong willingness of the government to get the project completed was widely cited as the main enabler of speedy progress.

### 5.3. The Rwamagana plant as niche starter

New market niches based on renewable energies differ radically from previous market niches in low-income countries [86]. On the one hand, it may be that previously there was no alternative technology in play, so the new market niche is filling a gap. On the other hand, the new market niche may be better in terms of implementation, economics, etc. than the existing ones. In the case of Rwanda, the niche innovation was not in the form of coming up with 'new technology' rather adopting, and diffusing the technology developed at a global scale. The technology was accessible and available for the country to utilize by mobilizing international investors and technical experts. Hence, in these contexts, capital and knowledge assume primacy over developing a new technology.

#### Commercial negotiations and project financing

After the feasibility study was approved by RDB, GG started commercial negotiations with RDB and the REG. A variety of stakeholders were involved in those negotiations: (i) RDB in-house lawyers, (ii) the legal, technical and financial team from the public utility (REG), and (iii) a law firm that provided legal support to GG [85]. According to the project developer both sides, the government and GG, were well prepared, which enabled them to produce a good PPA. This process took around four months to complete. The IPP model was new to Rwanda at that time and the Rwamagana solar plant was the first IPP solar project to be built in the country [70].

The tariff was negotiated between GG and the RDB, and then approved by RURA [85]. The PPA included the term 'deemed energy' which obligates REG to pay to GG for the energy that could have been generated in case of a curtailment that occurs under any issue (e.g. grid failure) [77]. The agreed tariff rate is not publicly available, however it is understood to be approximately 0.2 USD per Kwh, making it relatively high by international standards for projects of this size [88]. However, this price was less than the existing average wholesale grid price in Rwanda, thus helping to reduce the market price. GG also signed a Concession Agreement with the Ministry of Infrastructure (MININFRA), which established the conditions under which the project could be developed [77]. To reduce investment risk, GG was also granted with a Government Guarantee by the Ministry of Finance and Economic Planning (MINECOFIN), where the government would be responsible of paying for the electricity generated in case REG failed to do so, for whatever reason [77]. Abrams (2016) [77] states that REG was not a creditworthy institution, so the Government Guarantee was a key element on the viability of the project and stood to greatly reduce the financial risk to investors.

From the time GG signed the PPA, it had just six months to secure all the financing. Finding financial partners for the project was a challenging task, but GG reached financial closure on time, by February 2014. The PPA was conditional on this very ambitious timeline, due to the urgent need for the country to increase its electricity generation capacity, meet growing national demand [88].

The tax exemption for solar projects in Rwanda was a decisive factor for the financing phase of the project. The solar plant had a total investment cost of $23.7 million, and was financed by an international consortium of debt providers (75%) and equity investors (25%) [88]. Table 2 summarises the financing consortium for the project. Regarding investment risk, Rwanda currently has very few Bilateral Investment Treaties in force, none with The Netherlands where GG is registered as a legal entity. Consequently, GG decided to rely on agreements – change of law, force majeure (events outside of its control such as war), and international arbitration – directly negotiated with the government, and to rely on the purchase of political and currency risk insurance to reduce investment risk. This is not uncommon for such projects in low-income countries, though the profile and reputation of Rwanda as a relatively stable political-economic regime was doubtless crucial to securing the private capital investment. Credit enhancements were also considered as an investment risk mitigation mechanism, to compensate the lack of creditworthiness of REG in terms of future payments. The government guarantee that was granted was considered sufficient to obtain the debt and equity from the financing partners. It was not accompanied by a liquidity support (i.e. a Letter of Credit) – commonly required in power projects in SSA – due to the good investment grade rating and lower risk profile of the country [77].

The construction of the project was relatively fast, taking only six months. The plant was constructed on land owned by the ASYV, who is leasing the land to GG. The leasing fee covers approximately 10% of the

expenses of the village [87], understood to provide a greater income compared to its previous use for agriculture. The project successfully reached Commercial Operation Date (COD) in July 2014, when the interconnection to the grid was completed, but it was not until September 2014 that it became fully operational [69].

In the case of Rwamagana solar plant, its initial purpose was to rapidly increase power generation capacity in Rwanda, and the renewable nature of the technology was considered a desired co-benefit [79]. Two years after its construction and as a result of an increase in baseload electricity capacity thanks to the Kivuwatt project, more utility-scale solar projects could contribute to increasing the share of renewable energy in supplying the national grid. Nonetheless, the Rwamagana project was often viewed as a 'demonstration project' by local stakeholders [93]. Indeed, it is clear that utility-scale on-grid solar projects are not an established niche in Rwanda. However, it is relevant to note the pace at which the project was established. There were no pilots or demonstration projects prior to Rwamagana, thus it has been portrayed in various communications as part of a market-driven shift towards low-carbon energy technologies in Rwanda.

**Table 2. Summary of the financing consortium [89, 90, 91, 92]**

| **Investor** | **Amount** (\$ million) | **Instrument** |
|---|---|---|
| Scatec Solar, an independent solar power producer headquartered in Norway | ≈3.5* | Equity (lead equity investor) |
| Norfund, the Norwegian Investment Fund for Developing Countries | ≈2.61 | Equity and mezzanine loan |
| KLP-Norfund, the largest pension fund in Norway that co-invests together with Norfund | ≈1.73 | Equity |
| FMO, the Dutch development bank | ≈5.3* | Senior debt financing |
| EAIF (Emerging Africa Infrastructure Fund), a public private partnership | 10.6 | Senior debt financing |
| ACEF (Africa Clean Energy Finance Initiative), part of the US government's Power Africa initiative | 0.40 | Grant |
| EEP, Energy and Environment Partnership, an EU-funded programme which promotes renewable energy, energy efficiency, and clean technology investments | 0.30 | Grant |

**Estimated*

The off-grid solar power market in Rwanda is far more developed than the on-grid utility-scale market, and recent strategies aim to increase the role and importance of this technology. In our analysis of the Rwamagana solar project the relationship between these two markets seems to be very weak or non-existent. First of all, firms that develop utility-scale projects and those that install off-grid solutions are specialized in their fields and do not compete in each other's markets. Rwamagana's project developer only develops large-scale projects – e.g. 40 MW in Kenya [94]. Mobisol – the leading off-grid solutions provider in Rwanda – does not develop utility-scale projects; it only focuses on solar home systems [95]. As the operation of utility-scale (on-grid) solar power plants and off-grid PV systems is very different, the skills and capacities required to drive the market also differ. In the Rwamagana power plant, there are two

(Rwandan) technicians working full time to keep the plant up and running. They were previously working in similar power plants in South Africa and acquired specific experience in the operation and maintenance of large on-grid solar PV [87]. Meanwhile, the technical skills required to install, operate and maintain solar home systems are more generic and commonly available. As such, on and off-grid PV solutions do not compete as they operate in different markets, at least while the grid infrastructure remains under-developed. However, utility-scale solar projects do compete with other large-scale technologies, such as hydropower or biogas power plants. As such, it is relevant to consider the role of utility-scale PV in the country's wider transition pathway, politics and governance structures.

Our observations from Rwanda are limited to understanding the determinants of getting one solar power plant 'on the ground', which is perhaps the beginning of a new industrial sector. Even if it remains a niche 'experiment' it provided useful insights into the politics of transitions at the level of utility scale solar in a low-income country context. The project scrutinised in our research did not involve a long gestation period of experimentation, learning and scaling up, partly because the technology is already competitive and available globally. Awareness regarding the co-benefits of low carbon energy supply has increased in recent years, and prices for solar panels have declined and stabilised significantly.

However, while all of these factors are operating simultaneously, the aggressive leadership of the government in expediting and taking hard top-down decisions cannot be overlooked, which allowed fast-track implementation of the project. While exogenous factors played a role to create favourable conditions, it is the endogenous factors within Rwanda that determined the outcome, in the form of political intervention, favourable policies, tax incentives, favourable tariff rates and a conducive, low-risk, business environment. In other words, we observe a managed neoliberal regime, driven by strong political will.

However, we question if this form of fast-track niche development will actually enable a wider transition to take shape. Is this a bubble of a nascent industry, lured by profits, low risk (because of government guarantees), and the social currency of clean energy; or is this a deliberate attempt to steer the country in a sustainable pathway, while meeting the increasing energy demands?

## 6. Discussion

### 6.1. A transition pathway?

Interactions between the different socio-technical levels determine the transition pathway of any given energy transition, which in this article focuses on the development of on-grid solar PV technology in Rwanda.

During the last two decades, several disruptive pressures occurred in Rwanda. The need to generate more electricity has been a consequence of the significant population increase and rapid economic growth and

development. Additionally, global climate change agreements and national policy is driving the use of renewable energies, which has been strengthened by the uncertainty of long term oil prices. However, despite these pressures the electricity regime is fairly stable, with hydropower being the pre-dominant source in Rwanda. As such, the on-grid solar power niche is not necessarily challenging or disrupting the existing regime. Instead, the regime hosts this new niche within its ambit, allowing multiple technology niches to co-exist.

Consequently, actors at the regime level have changed and new institutions have been established, facilitating the development of utility-scale solar power projects. After the liberalisation of the Rwandan energy sector, the IPP option was introduced, allowing the participation of private (and foreign) companies in the electricity generation sector. RDB, the investment promotion agency, plays an important role in the promotion of these projects in terms of private foreign investor participation. However, the role of the State as a whole has been crucial in reacting to the landscape pressures by modifying its development path and innovation activities.

Changes in the rules and regulations were not specifically designed for the development of utility-scale solar projects, rather for any energy generation project, promoting solar PV through technology-neutral incentives. However, these wider changes benefit the development of the on-grid solar market niche, as it is dependent on the development of other niche markets – which could also act as a lock-in mechanism. In other words, the prospect of implementing more on-grid projects is closely linked to the development of other electricity generating projects, based on non-intermittent energy supply.

Regarding solar PV technology, the government is particularly focused on promoting off-grid solutions to provide electricity access to rural populations, given the far higher cost of delivering grid-based power. Therefore, the niche market for utility-scale PV has not been sufficiently developed yet in Rwanda, and the Rwamagana project appears to be, for now, a niche-level experiment, as the first step towards the development of a niche [96]. What we have seen is a complex interplay of multi-scalar actors, operating with their respective interests and agendas, steering a single technology/project to market within a relatively short period. It remains to be seen if this fast-tracking of a single solar power plant will trigger additional investment, worthy of constituting a true energy transition.

All this indicates that the 'transition pathway' which is currently taking place corresponds to the *transformation pathway*, as characterised by Verbong and Geels (2010) [97]. This states that the hierarchy in the transformation scenario in terms of policy goals is firstly cost-efficiency, then reliability and finally environmental issues, which coincides with the direction that Rwanda is taking in terms of electricity generation. However, in the near or mid-term future, the transition pathway might change to the reconfiguration pathway if the landscape pressure becomes stronger, especially pressures from the

international community to prevent carbon emissions, to achieve universal electrification through sustainable energy, and to reduce poverty.

### 6.2. Political Intervention and Decision-Making in the Transition Process

Our analysis indicates the central importance of the Rwandan state mechanisms in enabling the Rwamagana project. Indeed, State support in the form of legal guarantees that helped reduce investment risk was a fundamental determinant. By documenting and breaking down these processes, and how they interact with, and were shaped by, the role of private sector project developers and foreign investors (both public and private), we are able to explore the manifestations of the State's enabling framework, in the early stages of the energy transition in Rwanda. Behind these bureaucratic processes lie more explicit political forces, the nature of which was difficult to comprehensively document, reflecting the opacity of ruling party's decision-making processes. However, insights were obtained through interviews with key informants who indicated strong top-down approval was provided for Rwamagana, which is likely to have enabled what was a relatively fast contract negotiation process.

To shed light on the role and importance of government politics in Rwanda, in relation to its energy transition pathway, it is necessary first to understand the system of government under which the country is ruled. Rwanda has officially been a democracy since 2003 and Paul Kagame, member of the Rwandan Patriotic Front (RPF), has been the President ever since. Although Rwanda is officially a democracy, the ruling political party, the RPF, has no established opposition. Only one opposition party succeeded in registering for the last presidential elections in 2010, the Parti Social (PS)-Imberakuri [98, 99].

Rwanda's one party, one leader, rule has overseen significant economic development and poverty reduction, since the genocide. Although the country's economic development has stood out, against most of its neighbouring African countries, the government is both praised and criticized. On one hand, high-profile figures such as Tony Blair and Bill Clinton, together with most aid agencies, are ‘Friends of the New Rwanda’, basing their positive view on the rapid development of the country, in which foreign aid has played a key role. On the other hand, “most academic observers” have a more critical view [98], also with regard to economic exploitation of neighbouring Congo [100, 101], suppression of free speech, repressed political dissent and the stifling of independent civil society [102]. However, while Reyntjens (2013) [98] is openly critical of the government of Rwanda for oppressing its political opposition, he highlights the government's success in modernising the country – which includes investment in high-tech clean and renewable energy technologies. He states that “when the Rwandan government wants something, it wants it immediately, and it sets close and clear deadlines” [98].

As such, Rwandan governance could be described as technocratic-authoritarian, as decisions are based on the most efficient option and are not contingent on public opinion, which is consulted only during

presidential elections that have secured high levels of official support. The government of Rwanda has expressed in its *Green Growth and Resilience Strategy* [71] its commitment to scale up investment in renewable energy technologies, thus maintaining the status quo – i.e. use of fossil fuels – does not appear part of the government's agenda.

The second distinctive trait of the government of Rwanda is Paul Kagame's long term in office. The RPF has been ruling the country since its rebel army ended the genocide in 1994, but it was not until 2000 that Paul Kagame became acting President. He was elected in the first presidential elections in 2003 and re-elected in 2010 [9]. According to the constitution, presidents cannot rule more than two terms, but in December 2015 the government held a referendum to amend it and allow longer mandates which secured 98% popular support [103]. Paul Kagame was then able to participate in the 2017 elections, and was re-elected president for the third time with 99% support, extending his mandate until 2024 – meaning at least twenty-five years of RPF government [104].

Such long-term mandates present both drawbacks and advantages for the country's energy transition. Open and competitive elections and alternations in power are constrained, when presidential terms are not limited. It is widely agreed that presidential limits strengthen democracy, the rule of law, and reduce the risk of authoritarian governments, that often result from long-term mandates [105]. A new President might also revitalise the government's way of doing politics, supporting innovation and allowing for the participation of younger and fresher minds. On the other hand, there is a distinct risk that a change of government may lead to radical change at the regime level (to use the MLP terminology), thus disrupting or otherwise repealing the conditions, rules and regulations that enable specific investment decisions. This translates into uncertainty and risk, pushing up premiums and the demand for higher rates of return by private investors, as is typical in many other SSA economies. Indeed, the Rwamagana solar power project broadly seems to conform to the existing socio-political milieu of Rwanda by diversifying the national energy mix, striving for electricity for all, sustainable energy technology, increased flow of international finance, and improved image-building overall. In other words, the project doesn't challenge the state-centred social control which is strongly rooted within the political culture and institutions in Rwanda [102].

### 6.3. A neoliberal energy transition?

When the government of Rwanda decided to liberalise its energy sector, allowing foreign capital and operators to invest in the country, it endorsed the introduction of market forces in the provision of public services. The government also decided to re-structure and create new agencies such as RDB and REG, focused on promoting private investment and developing energy projects, respectively. These agencies were given the required power to fulfil the government's goals, which can be broadly characterised as following a 'neoliberal' logic, which states that public services can be effectively provided by profit-seeking

operators, to the benefit of consumers at all income levels. The extent to which this model has been implemented, successfully, in non-OECD countries is well documented in a parallel academic literature on energy market reforms [106, 107].

At the same time as embracing the basic tenants of neoliberal economic rule, in which technology investment decisions are determined largely by profitability, the Rwandan State has shaped and steered the energy market towards a lower-carbon pathway, through numerous laws, policies and strategies.

The government of Rwanda has particularly supported and shaped the solar energy sector through tax concessions and tariff protection. Regarding the specifics of the Rwamagana solar power plant, tax exemptions helped reduce the cost of the project, but a relatively high tariff and tariff protection was of paramount importance, as articulated by key informants interviewed for this research. The final agreed tariff prices are especially important as it determined the basic bankability of the project, reflecting the predominance of market rule in government decision-making. The rules for PPAs establish a guaranteed price for the electricity generated for a fixed period of time, although the exact price paid is confidential. In effect this offers a form of feed-in-tariff (FiT) support, providing investors with a stable income and attractive return on investment. In MLP terms, this kind of tariff (income) support can be seen as an example of niche protection.

The difference between guaranteed prices established on the PPA and FiTs are that PPA prices vary, subject to negotiations and are hence specific for each project. As such, the PPA framework opens up significant space for political influence, either in the form of direct government pressure, lobbying and/or commercial negotiation. In addition to the tariff protection for private foreign capital, there were other aspects that motivated investors' willingness to invest in Rwamagana. The project was seen as innovative as it was the first utility-scale on-grid PV solar project in SSA outside of South Africa, thus offering a degree of prestige. Furthermore, Rwanda is seen by foreign investors as a relatively stable political and economic regime in SSA. In business terms, the prolonged period of peace reassures future potential investors, and Rwanda's investment environment is currently rated as 'B' by Standard and Poor's [108]. However, the wider point in terms of the basic political economy of Rwanda's energy transition is that it has been influenced by processes of *neoliberalisation*, as documented in the case of Kenya by Newell and Phillips [51].

## 7. Conclusions, practical lessons and future research

The Rwamagana plant in Rwanda is indicative of the wider shift from largely donor-driven to market-driven solar PV projects that is taking place in SSA. However, the state remained central to enabling, shaping and guiding the market, especially for large infrastructure investments that are traditionally the domain of state control and oversight. In this case, the state's centralized regime accelerated the pace of the transition as it did fit and conform to the political and institutional structures. The government, the private

sector and the investors made this project possible, with a relatively minor contribution from public donors in the form of start-up grants. Good project ideas appear to be a crucial first step, but having a project 'champion' to coordinate and inspire all stakeholders is equally important.

An expression of the Rwandan government's strong support was the agreement to pay a globally competitive tariff, negotiated within the PPA. To have confidence in the agreement, the project developer and the investors relied on the Rwandan government as the ultimate guarantor – i.e. that the investors would actually get paid the electricity price initially agreed upon –, and so the rule of law, and faith in public institutions, is important to minimise investor risk. Other key determinants were the clear conditions and the incentives for solar PV technology, which reduced the cost of the project. Rwanda offered favourable conditions to implement solar projects and, more broadly, to do business.

Foreign expertise was also central to the development and implementation of this project. Rwanda lacks a sufficient number of experienced project developers, solar panel manufacturers, and electrical engineers specialised in these kinds of projects. With regard to the MLP framework, our analysis has focused mainly on the regime and niche levels. The corresponding transition pathways – i.e. transformation and reconfiguration pathways – showed the regime level was affected by the landscape and niche levels, and the interactions between them, which were not only dialectical. We can conclude that the role of politics, and the specific kind of political intervention, and socio-political-historical context in the development of on-grid solar projects in Rwanda were the key determinants of this emerging energy 'transition'. More broadly, we argue that there is a need to address this dimension in future applications of the MLP framework, which usually overlook or underplay the importance of politics and the political elite, especially in the study of energy transitions in low-income countries.

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