UiO : Department of Sociology and Human Geography
University of Oslo

The governance of decentralized solar power in Kenya

Opportunities and constraints

Cecilie Fardal Nilsen

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The Department of Sociology and Human Geography

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The governance of decentralized solar power in Kenya: Opportunities and constraints.

Supervisor Kirsten Ulsrud

http://www.duo.uio.no

ABSTRACT

Electricity has in the latest decades become a vital human resource and is one of the most important infrastructures in everyday life. Lack of access to electricity has fundamental constraints to various development indicators such as health, food security, livelihoods, education and poverty reduction, as well as to the economic development in many developing countries. The need for accessing electricity has therefore become a major concern among various international organisations as well as national governments and local communities. Access to affordable and reliable electricity for all is one of the United Nations Sustainable Development Goals and is considered a basic human right by the World Bank. However, around a billion people still live without electricity access, mostly concentrated in South Asia and Sub-Saharan Africa. Both extension of central power grids and implementation of off-grid decentralized systems are necessary for achieving energy access for all. However, according to the IEA and the World Bank (2013), it is estimated that grid extension will only be feasible for around 40% of people lacking access. Hence, there is a major potential for the use of off-grid solutions to increase the electricity access for a large number of people in the world. Solar photovoltaic (PV) has large potential for providing energy access, not the least in Sub-Saharan Africa. This thesis investigates factors influencing the implementation of decentralized off-grid solar PV and what kinds of governance that play a role in these developments, using Kenya as the case study area. Decentralized solar power is approached as a socio-technical niche, and governance perspectives are applied in order to investigate the ways in which the solar PV niche in Kenya unfolds. The thesis shows that an enabling environment, which includes the right policies and regulations and well-functioning institutions, and private sector incentives are crucial.

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Abbreviations and Acronyms

ERC - Energy Regulatory Commision

FIT - Feed-in tariffs

FOCAC - Forum for Africa-China Cooperation

GoK - Government of Kenya

IEA - International Energy Agency

IPPs - Independent Power Producers

KBS - Kenya Bureau of Standards

KenGen - Kenya Electricity Generating Company Ltd

KEREA - Kenya Renewable Energy Association

KSh - Kenyan Shillings, 1 KES = 0,009881 US Dollar

MoE - Ministry of Energy

MP - Members of Parliament

NGO - Non-governmental Organization

PEV - Pre Export Verification Certificate

REA - Rural Electrification Authority

SHS - Solar Home Systems

SNM - Strategic Niche Management

PV - photovoltaic

SDG – Sustainable Energy Goal

TBS - Tanzania Bureau of Standards

TM - Transition Management

USD - US Dollar

VAT - Value Added Tax

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Chapter 1: Introduction

Electricity is necessary for a range of human activities and electricity supply can therefore be considered one of society's most central infrastructures. However, despite decades of efforts, almost 1 billion people worldwide still lack access to electricity, the majority in Asia and sub-Saharan Africa. In Kenya, 82% of the population did not have access to electricity in 2010 (IEA 2012). Ensuring access to "affordable, reliable, sustainable and modern energy for all" is recognized by the United Nations as an important part of achieving the Sustainable Development Goals (World Bank and IEA 2013).

Many developing countries find themselves in a difficult situation because of the need for vastly increasing the national energy production at the same time as mitigating climate change. A majority of these countries are additionally burdened by a dependency on imports of fossil fuels. Moreover, they also tend to inhabit a large share of people that are already experiencing several impacts of climatic changes. It is anticipated that the bulk of future electricity demand will come from developing countries due to population growth, economic growth, "changing lifestyles" and a general lack of sufficient investments in the power sector (Karekezi and Kimani 2002; Sawin 2004; Bird et al. 2008). The energy situation of developing countries is therefore a crucial challenge (Brew-Hammond and Kemausuor 2009). Several factors must therefore be taken into consideration when designing and implementing future energy systems.

> With increasing energy demand, changing energy consumption patterns, infrastructure decline and threats posed by climate change, governments confront the central question of "how to design a new energy policy with security of supply and climate change at the core" (Helm 2008:16)

Renewable energy technologies have the ability to reconcile several of the concerns mentioned above, such as the potential to cover a large share of the world's growing energy demand in ways that does not further exacerbate climate change (Painuly 2001). While these technologies are mainly promoted because they can reduce and avoid carbon emissions, there are also hopes that developing countries could avoid the 'carbon lock-in' of industrialized countries by transitioning directly into modern and environmentally sustainable energy systems (Karekezi 2002). Many countries in the Global South have a number of good preconditions for transitioning into non-fossil energy systems, such as high dependency on expensive fossil fuel imports and several renewable energy resources available. The global carbon trade market also offers financial incentives for renewable energy in developing countries (Bird et al. 2008). Many governments are therefore increasingly interested in

investing in renewable energy both as a fossil fuel replacement as well as an addition to fossil fuels.

Rural electrification can be achieved either through extension of centralized grids or through the implementation of off-grid, decentralized electricity systems (Yadoo and Cruickshank 2012). Decentralized generation of electricity refer to small-scale energy conversion units that are in the same location as energy consumers and used by a small number of people (Alanne and Saari 2006). When these are off-grid, they are operating in isolation from the centralized grid. Off-grid power systems can both be viewed as a complement and as a forerunner to the national grid (Karekezi 2002). The two most common forms of off-grid electricity systems are village-scale systems (mini-grids and energy centres) and household-scale systems with different capacity and usage areas. Extension of the centralized national electricity grids has remained the most common mode of electrification. However, according to the International Energy Agency (IEA) and the World Bank it is estimated that grid extension will be feasible for only 40% of the population in the non-electrified rural areas in developing countries (World Bank and IEA 2013). This is mainly due to geographical hindrances and the high cost of long-distance electricity transport (Ahlborg and Hammar 2011). These limitations of the conventional electricity grids have created a market for renewable energy based off-grid solutions (Kaundinya et al. 2009), with solar energy as the most important.

There are two main types of solar technology. One is solar photovoltaic (PV) technology that produces electricity from sunlight. The other is thermal solar energy technology that produces hot water or hot air by the heat from the sun, for example solar water heaters and solar cookers. In this thesis, solar PV is the chosen technology, because of its large potential for off-grid electricity provision (Ahlborg and Hammar 2011). Batteries are used for storage of electricity. Falling import costs on the world market, improved quality of panels and batteries and government subsidies has increased people's interest in solar PV based electricity provision (GTZ 2009; IEA 2012).

Since there is a large potential for providing electricity access for a large number of people in the world through off-grid solutions, there is need for more knowledge about how the potential can be utilized. Such knowledge is relevant for governments, private sector companies and other actors that can influence the opportunities to use solar PV technology in vast rural areas, for example in Sub-Saharan Africa. I have chosen to focus on Kenya, because there are interesting initiatives on solar PV to analyze, and because I got access to important

informants in Kenya through a research project at the Department of Sociology and Human Geography at the University of Oslo (The Solar Transitions project). Previous studies has discussed some factors that influence the viability and affordability of off-grid renewable energy in developing countries, such as government subsidies, market development, and arrangements for operation and maintenance of the local electricity systems (Karekezi 2002; Kirubi et al. 2009; Chineke and Ezike 2010; Yadoo and Cruickshank 2012; Ockwell and Byrne 2017). Spatial and political aspects of energy transitions have also received less attention, but are crucial in socio-technical change, according to Smith and Stirling (2006) and Bridge et al. (2013). Questions of governance could therefore be important, both at the national level and at the local level of implementing decentralized, off-grid electricity provision in villages. In this thesis, I have therefore decided to combine a socio-technical systems perspective and a governance perspective, and thereby economic and political geography, in order to understand drivers and constraints to the implementation of decentralized, off-grid renewable energy in Kenya.

1.1 Thesis objective and research question

The objective of this thesis is to contribute to increased knowledge about factors that play a role for the implementation of off-grid solar PV in a developing country context, with a special attention to the role of political aspects and governance processes.

Research questions:

1) Which factors influence the implementation of decentralized off-grid solar PV in Kenya?

2) What kinds of governance play a role for the implementation of decentralized off-grid solar PV, and why?

The research questions will be answered by studying factors that facilitate and impede decentralized solar PV activities in Kenya, including governance processes that open up or constrain the space for manoeuvre in different actors' efforts. The thesis strives for an overall understanding of factors and processes influencing decentralized solar energy activities in Kenya instead of studying a specific solar energy project or single activity in the country. A limitation of the thesis is the time span between data collection and the finalization of the thesis, which I have accounted for in chapter 3. In the presentation of the findings, I relate to what was going on in 2010, even though there have been large changes since then. Hopefully, it will be interesting to compare these findings with newer studies in the same context or on similar topics.

1.2 Personal motivations

Firstly, with a background from development studies and human geography, my main fieldsof interest has been environmental issues, political geography and sustainable pathways for the future. This has made me become especially interested in renewable energy, and increasingly curious about potential win-win solutions between technological transitions and global development trends. Participants in the Solar Transitions project at the University of Oslo inspired me to combine these academic interests for the Master thesis and to focus on solar energy in the Global South.

While I, as well as many other Norwegians have occasionally romanticized life without electricity, I have also had some life changing experiences during the time period of the study that have increased my awareness and gratefulness regarding services that were previously mostly taken for granted in my own everyday life. Basically, my son was able to survive almost 5 years because of the privileged situation of being born in a modern hospital, and living in a society where modern and functional energy services are an integrated part of our everyday infrastructure. Even his daily nutrition routine was dependent on power charging (tube feeding). For many people in the developing world, stable electricity access is not a privilege taken for granted, not even in public health clinics or hospitals. Access to basic electricity services can not only have large impact on many people's everyday life, but entail major improvement of livelihood conditions for a majority of the world's poorest population. From a social health perspective, this can involve improvement of hospital conditions through the use of life saving medical devices and sufficient lighting during surgeries and giving birth, to storage of vaccines and the ability of hospitals to store patient files to avoid people filling out new forms every time they visit hospitals or health clinics. Although such kind of social issues was not my initial motivation for choosing the research topic, it became an important motivation for me when I got back to this study after my son passed away.

1.3 Structure of the thesis

The thesis consists of six chapters. Following this introduction, chapter 2 presents the theoretical framework based on a socio-technical system perspective and political geography. Chapter 3 clarifies and reflects upon the research procedures and methods used. The empirical findings are presented in chapter 4, and discussed in chapter 5. Chapter 6 concludes and reflects upon the usefulness of the theoretical framework, the transferability of the case findings and issues that may be interesting for further research.

Chapter 2: Theory

I have chosen a governance perspective on technological change in order to investigate how renewable energy technologies expand and grow stronger in a society. The theoretical framework is based on governance perspectives from two theoretical directions; the literature on socio-technical change and political geography. The chapter starts with introducing social science perspectives on technological change, and explains why decentralized solar power can be seen as an emerging socio-technical system. Thereafter, the way governance has been treated within the literature on socio-technical change is being viewed, before presenting governance perspectives inspired by political geography. In this way, various types of factors and processes that influence the implementation of decentralized solar power in Kenya can be understood, as will be argued below.

2.1 Social perspectives on technology and technological change

In order to study the emergence and growth of renewable energy technology in society, it is relevant to look at perspectives on technological change. Bozeman (2000) argues that the concept of technology involves more than just technical devices since every product has its knowledge base. Technology is therefore inseparable with knowledge, representing both hardware and software. A concept that has increasingly been used to describe "technology in context" is a *socio-technical system* (Geels 2002). A socio-technical system consists of both technical and social elements. These elements include social regulation and policies, production chains and networks, industry structures, functionality, markets and user practices, infrastructure, price structures, institutional context, artefacts, cultural and symbolic meanings (Geels 2002).

2.1.1 The social shaping of technology

The socio-technical system perspective attempts to understand the social dynamics inherent in technological change (Smith et al. 2005; Markard and Truffer 2008), and does therefore not focus solely on the impact of technology on society, but also the social impact on technology, i.e "the social shaping of technology" (MacKenzie and Wajcman 1999). The concept of *coevolution* is used to describe how technology and society interact and gradually interweave by mutually shaping each other through an integrated evolution process (Geels 2004). Coevolution emerges through the co-production of technology and social arrangements (Russell and Williams 2002). Within the literature on technological change, there has been a socio-technical turn that has resulted in greater recognition of technological infrastructures

and practices emerging through complex interactions between artefacts, institutions and agency (Smith and Stirling 2006). Technological change, in the form of increased use of technologies that are not familiar to society, is associated with new linkages and knowledge, different rules, organization and roles and a new "logic of appropriateness" (Kemp et al. 2005; Geels 2005). Figure 1 below illustrates some of the interactions that occur within a socio-technical system, through the interdependent and interwoven relationships between *technology, institutions* and *agency,* as presented by Rohracher (2001).

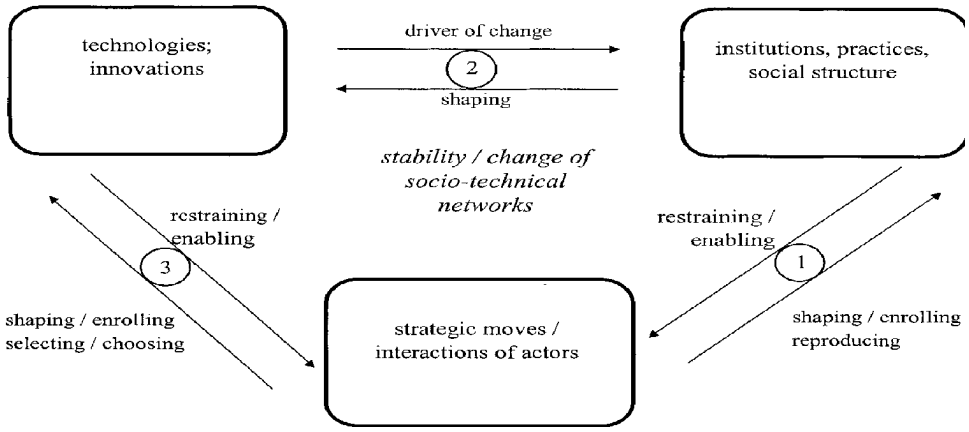

Figure 1: Inter-related elements of socio-technical systems. From Rohracher (2001).

As illustrated in Figure 1, a socio-technical system perspective on technological change means that technical character of the system is only a small part of a larger picture, a wider social system, where these components interact with a wide spectre of actors and institutions interactively shaping technological change.

2.1.2 Socio-technical niches and the larger system context

Energy systems are examples of socio-technical systems. These can be more or less established in society. The literature on socio-technical change focuses on how technological systems become established in society. The socio-technical system perspective combines three analytical levels in order to understand different degrees of system embeddedness and the type of processes that can lead to large-scale transitions to new socio-technical systems. These are socio-technical *niche innovations*, *regimes* and socio-technical *landscapes* (Geels 2010; Smith and Raven 2012).

Niches are emerging socio-technical systems that have yet to become established in society (Rohracher 2009). Niche technologies are promoted in market niches where they are

perceived as having advantages of being more practical and cost-efficient alternatives compared to conventional technologies. Here, consumers can be willing to pay higher prices for a service or a product because only a few other alternatives are available (Smith and Raven 2012). The use of solar PV in small-scale off-grid systems in areas where the electricity grid is not in place is an example of such market niches. As with the more established technologies, niche technologies have their own manufacturing facilities, equipment, infrastructure, user practices, institutions and actors, but have neither institutional nor market domination. Different kinds of system innovation can also be achieved *within* niches.

Regimes refer to well-established technological systems, for instance for energy supply, that in the course of several decades have become an integrated part of society, with well established infrastructures, government structures, user practices, national markets, consumer behaviours and institutional frameworks (Geels 2010). In the literature on energy transitions, which is mostly based on experiences from industrialized countries, energy regimes refer to *conventional* socio-technical systems for electricity supply based on a centralized electricity grid. Based on the definition of a regime, traditional energy systems, such as traditional biomass and kerosene, which tend to dominate among households in developing countries, can also be seen as established energy regimes.

The socio-technical landscape refers to the wider, exogenous environment beyond niches and regimes that usually changes slowly and influences niches and regime dynamics (Geels 2010). Part of this wider landscape can be natural disasters, societal conditions in different countries or global conditions such as fuel prices on the world market or climate change.

2.1.3 Drivers and constraints to emerging technological systems

In Kenya and many other countries, renewable energy niches are gradually growing stronger. However, there are still several factors that constrain their further implementation and use. The socio-technical systems literature presents several factors that may hinder growth and establishment of emerging energy technologies. Such factors are often closely related to the socially and institutionally integrated nature of established regimes. This is because the various social, technical and policy elements of regimes, including infrastructure configurations and institutions, are not always compatible with the requirements of niche technologies. Established regimes therefore often require fundamental transformations or liberation from existing practices and institutions for changes to occur (Smith et al. 2005).

Energy regimes are usually in a strong position because the technological, institutional, economic, and social elements have developed over a long period of time and have become strong and established. Stabilizing mechanisms of regimes may also be related to vested interests and decreased cost of previous investments, behavioral patterns and values, machines and infrastructure or standards and regulations (Geels 2010). Perez (2002) argues that the socio-institutional framework tends to change more slowly than the techno-economical framework because it is constrained by routines, ideology and economic interests. Such factors can contribute to make developments continue in certain pathways although there may be alternative solutions available that some actors try to establish (Berkhout 2010). The concept *path dependence* (Arthur 1989) has been used to describe an inertia of prior choices constraining future pathways based on self-reinforcing limits, such as sunk costs and network effects (Araujo 2014). When socio-technical systems, like conventional energy systems have been institutionalized in society over time, a so-called "lock-in" situation may occur, which may require extensive efforts to break out from. The degree of difference or similarity in infrastructure configurations and user practices between established and new energy systems may also influence how difficult it will be to achieve a comprehensive technological change (Unruh 2002).

Energy regimes may also have weaknesses or instabilities that may create windows of opportunity for the emergence and growth of alternative energy systems (Geels and Schot 2007). Weaknesses can be related to established infrastructures, which can be more or less developed or vulnerable. Furthermore, external landscape developments and pressures, such as increased concern about environmental problems within a population, market incentives or commitments related to climate change, can lead to cracks or tensions in conventional energy regimes (Unruh 2002; Geels 2010). When the normal functioning of the regime is under severe stress, peripheral members or outside actors may be able to intervene to a larger extent than during stable circumstances, which can represent windows of opportunity for radical niche-innovations to break through more widely and enable actors to experiment with alternative solutions more freely (Ulsrud et al. 2011; Bridge et al. 2013). Such factors may strengthen achievements of a more comprehensive socio-technical change.

However, niches may not necessarily replace existing technological configurations or represent a transformation of established regime practices such as the conventional electricity supply. Radical niche innovations may for instance also serve different areas than the

established energy regime practices, and therefore not necessarily threaten existing interests (Unruh 2002). Yet, niches still have lower levels of maturity and experience, and are often highly reliant on protection against competition (Geels 2004). Barriers may therefore both occur in relation to their adaptability with the new context and the process of coming "out of the niches" in order to further contribute to a more comprehensive socio-technical change. The next section looks at governance perspectives within the socio-technical system literature and at factors that influence the opportunities for new technologies to develop and grow stronger in society and how such technological change is consciously encouraged and governed.

2.2 Governance from a socio-technical system perspective

The literature on socio-technical change has gradually shifted from focusing on encouraging specific technologies to increasingly focus on creating opportunities for green socio-technical systems to catalyse fundamental system-wide change where whole sectors become more environmentally sustainable (Smith et al. 2005; Kemp and Loorbach 2003; Kemp et al. 2005; Berkhout 2002). Governance has here been discussed under the headings of *Strategic Niche Management* (SNM) and *Transition Management* (TM). The literature on "transitions towards sustainability" builds on a socio-technical system perspective and focuses on how clean energy technologies can develop and grow strong enough to eventually replace fossil fuel based energy systems (Smith and Raven 2012).

2.2.1 Governance as management and the government's roles

Established energy systems, such as fossil fuel based energy technologies, have received government support over a long time period before they became established (Mackenzie and Pershing 2004). Governments therefore seem to possess an important role in ensuring good framework conditions for the development of renewable energy niches. Governments can use direct and indirect policy tools to stimulate and protect technology that are not yet able to survive outside the niches that can gradually be removed. According to Kemp and Loorbach (2003), this should involve all levels of government. The government is also among the central actors who can contribute to the construction or destruction of expectations in a population and informing consumers can be part of government regulation (Schot et al. 1994). According to theory on socio-technical systems, the creation of visions is an important aspect of path creation because it can frame socio-technical problems and potentially motivate

problem solving among actors. In the pursuit for change, this can be done by envisioning possibility spaces through normative tools and shared narratives (Smith et al. 2005).

The stimulation of social learning, for instance through practical experimentation in niches, is another aspect of governance highlighted in the socio-technical system literature that can lead to socio-technical innovation. Here the government can here play important roles by creating or stimulating networks between actors that develop and promote new technology, and thus participate in the networks that emerge (Schot et al. 1994). An example of governance strategies led by the government is *Strategic niche management* (SNM). SNM concerns how governments can support niche experiments in order to make niche technologies develop (Kemp et al. 1998; Hoogma et al. 2002). Raven (2005) describes the strategic management of niches as a "creation of protected spaces" where socio-technical experimentation can take place with reduced competition from the regime. Socio-technical experiments are pilot and demonstration projects that create social learning in a realistic user context (Rohracher 2009). Such experiments stimulate learning for suppliers, contractors, users, researchers and public authorities by removing insecurities, learning about user needs, and experiencing how established regulations create barriers for new technology (Raven 2005). This can provide new technology with a chance to prove that it works, which may also contribute to a change in people's preferences. A weakness with government facilitation of experiments is that it may create a narrow focus, and make actors believe that they have to work through the government arrangements instead of developing alternative initiatives (Schot et al. 1994).

2.2.2 Governance beyond management

While previous governance approaches have largely focused on the role of governments and suggestions for policy in achieving system innovation, critical perspectives within the literature on socio-technical systems argue that niche developments are not necessarily consciously driven and rarely actively managed in practice, and therefore argued that one should be careful not to overemphasize the manageability of such governance processes. The most important critique of previous governance approaches to socio-technical change is their tendency of being too apolitical in nature by perceiving governance as an unproblematic and that technological change is perceived as something that is steered through policy tools. Such functionalist views of policy interventions has a tendency to overemphasize the role of government and contribute to display a picture of governance as a largely instrumental

process forever trying to “catch up” with socio-technical change (Smith et al. 2006; Lovell 2007).

Some scholars have in particular questioned the ability of governments to actively govern socio-technical change. According to Lovell (2007), increased liberalization of the energy sector may reduce government interests and power to influence the process of strengthening niches, which lead to a lack of long-term policy frameworks and ad-hoc rather than innovative government strategies. Smith et al. (2003) also question the assumption that governments necessarily have the power, political will and ability to make strategic decisions about innovative system changes, because governments tend to be deeply embedded within existing socio-technical regimes, which makes governments mostly aimed towards encouraging incremental and conservative innovations, i.e. gradual improvements of existing technologies.

Thus, the literature has increasingly acknowledged that there is no single actor with the resources alone to manage a long-term fundamental change, such as an energy transition, and agreement among this wide range of actors is needed in order to successfully proceed with policy change (Berkhout 2002; Geels and Schot 2007). Energy systems are mediated by the resources, interests and expectations of institutionally embedded networks of actors (Smith et al. 2005) and are closely linked to decisions of human actors and their motivations **(**Ley and Corsair 2008). However, actors will not have equal opportunities to influence such a process and people will also become affected by it differently. In contrast to the notion of path dependence*, path creation* highlights the agency of entrepreneurs who, at least in part, define the flows of events as ”agents of change” (Garud and Karnoe 2001). Agency can be seen as the ability to take action and make a difference over a course of events (Giddens 1984:14) and is thus intimately related to power. The creation of visions is an important aspect of path creation. Some visions may acquire greater credibility and legitimacy than others because of the influence and stance of the interests behind the vision, or because of its intrinsic value (Smith et al. 2005).

Smith and Stirling (2006) distinguish between *social commitments* and *social appraisal* as two intertwined and mutually co-constitutive participatory processes in governance of technological change. Social commitments is about attachments to particular technological pathways and refer to actors relying on the functioning of a system, such as rural lighting, where participation in the form of coordinated efforts of mobilization and resources, both

material and discursive, reproduce the socio-technical system. Social appraisal refers to the production of substantive understandings, social learning and cultural meanings, which may frame motivations and create harmony among actors as a foundation for social commitments (Smith and Stirling 2006). Ideally, social appraisal is about *informing* commitments, and social commitment is about *forming* tangible social choices in the governance of technology choice. However, Stirling (2008) raises important questions regarding power asymmetries between social appraisal and commitments. He argues that there tend to be a thin line between empowerment and public education in practice, and therefore emphasize the importance of acknowledging the underlying rationales and motivations behind social appraisal. Lovell (2007) also argues for a stronger focus on the role of power biases and the creation of legitimacy in the processes of forming new technological systems. According to Smith et al. (2005), recognition of a vision by agents with effective power must be understood relative to the cultural and political context in which a vision is set out. This makes the process of overcoming path-dependency of well-established systems more political and chaotic than earlier suggested (Smith and Stirling 2006).

Critical authors within the literature have proposed a broader perspective on governance in order to understand the social and political complexities inherent in socio-technical systems. Smith and Stirling (2006) separate governance into what they call "outside" and "inside" perspectives on governance. Whereas the outside perspective conceptualizes governance external to the socio-technical system including policy activities, the inside perspective conceptualizes governance internal to the socio-technical system as co-constituting the socio-technical. They argue that, in reality, the governance of socio-technical change tends to move between these two ideal types of objective management and reflexive politics, but should be understood as an inherently *political*, rather than a purely *managerial* process. This extends the focus of analysis from investigating management failures and policy tools to also focus on the creation of legitimacy, normative evaluations, and political agency in governance.

2.3 Governance from a political geography perspective

This last section identifies some additional perspectives and key concepts of governance inspired by political geography that might complement the socio-technical systems literature presented above with a focus on renewable energy developments in the Global South. Along with the geographical tradition of calling attention to the "where's" and "why's" in the spatial

distribution of power, the section starts by addressing key political geographies of renewable energy.

2.3.1 The spatiality of energy and politics of change

Renewable energy technologies are often implemented in a decentralized way. Since the consumption of energy is decentralized by nature, decentralization of energy systems is associated with increased proximity between production and consumers of energy (Alanne and Saari 2006). This implies a shift in the nature and *location* of energy supply with new consumption patterns of highly distributed character, which can have huge distributional impact on society (Bridge et al. 2013). It involves changes in ownership and management of energy, and may also change the traditional producer-consumer relationship to one where ”well-informed” consumers can play a much more active role as ”co-providers” of electricity supply (Nye et al. 2010). Technological change towards more distributed forms of electricity provision require the involvement of a large number of actors in a more open system in which both established actors, configurations, structures and institutional settings and new ones, interact (Ngar-yin Mah et al. 2012).

Bridge et al. (2013) argue that niches and regimes are expressions of the different degrees in which energy systems are *spatially* embedded in society, which makes energy transitions fundamentally a geographical project. They therefore argue that there are good reasons for thinking about energy transitions in spatial terms. The political implications of highly distributed and centralised systems are quite different. Changes that involve an interference with existing systems will consequently create new winners and losers in society (Young 2003). When decentralized renewable energy solutions are gradually becoming a more important part of the energy sector, this tends to demand changes in the way energy sectors should be governed. Since energy is fundamental to society’s day-to-day dealings, governments are among the central actors that can be expected to take an active interest in how energy is sourced, accepted and utilized (Araujo 2014). Bridge et al. (2013) adopt the verb *scaling* rather than the noun *scale* as one important spatial component of energy system change because the scale of organisation of energy systems arises as a product of economic and political decisions, rather than being pre-ordained. They argue that energy issues are typically scaled as a national concern, because no government wants to risk a failure in energy supply. Furthermore, they state that energy policies tend to rest on assumptions about the geographical scale at which energy systems should be governed.

An increased use of decentralized renewable energy implies certain redraw in the political landscape of governance, including passing on decisions and authority from ”top-down” steering bodies to more “bottom-up” steering and network governance. New steering logics, such as changes in administration and ownership issues, may therefore collide with national logics of steering (Crook 2003). It may also create tension between local and central parts of government. Energy transitions towards more distributed pathways are therefore highly political. The challenges and opportunities of realigning interests, responsibilities and capacities for action in governance of new energy pathways, raises a number of key governance issues, such as the role of the state, conflict of interest, power asymmetries and participatory governance (Hood et al. 2000; Beierle and Cayford 2002).

2.3.2 Understanding governance in context

What separates governance theories from traditional political theories is that the literature does not accept institutional capacity at face value (Pierre and Peters 2000; Kjær 2004). From the 1980s, governance scholars within human geography have been investigating the political system as a complex of sometimes ill-defined and unstable dynamic entities of formal and informal arrangements (Pierre and Peters 2000). Hyden (1999) makes an analytical divide between the activities of public organs (state policy), and the facilitative or impeding institutional framework in which policy is made (regime politics). He describes the latter as the political “rules of the game”, which refers to managing the rules in which policy is formulated and implemented. This covers the whole range of institutional setups that may characterize public policy making. Such a broad definition of governance still safeguards some kind of hierarchical role of the state. Yet, the potential role of the government mainly lies in its opportunities to set the ground principles in governance (Kjær 2004).

According to Turner and Hulme (1997), all public organizations exist in, and are shaped by a distinct and diverse environment, which consist of a complex cluster of economical, cultural, demographic and political factors that affect the operations of actors in governance, including policy makers, administrators and implementers. Such organizational environments are shaped by a country’s historical background, such as past practices and the historical role of the state. Country-specific factors will therefore largely decide how governance “works” in relation to processes of societal change, including present capacities to govern and perspectives on what the government are expected to do and how (Pierre and Peters 2000). While there are large internal differences within the Global South, many developing countries

still share some common historical features that have played an important role for present societal conditions and politics, which have contributed to shape organizational environments of the public sectors in distinct ways from western organizational environments. The majority of African states have, for instance, undergone processes of colonization and external pressure for a minimal state since the 1980s, where other countries' policies and interests have had major influence on their governments ability to set the ground principles in governance. It has also provided participatory spaces in governance with their own sets of rules and standards in order to fill "institutional voids" (Büscher and Dietz 2005). A typical characteristic of the post-colonial state bureaucracies is that public administration of resources is influenced by maintenance of so-called patron-client networks where rulers have tendencies of using their position to distribute and accumulate economical capital based on personal connections and interests (Turner and Hulme 1997). The continuous dependence on external financial support and capacity building among post-colonial state bureaucracies have created considerable room for non-state actors to move into traditional state tasks (Mol 2001; Oosterver 2009). In spite of several historical similarities, there are also substantial differences and contrasting development trajectories within the category of post-colonial bureaucracies, which have become more marked over time and led to an increasing differentiation between developing countries, according to Turner and Hulme (1997). By approaching governance in context, this incorporates cultural and historical background into the complex and diverse set of political battles that are fought over in society, which largely shape and shade the existing "rules of the game".

2.3.3 The politics of participation

Shirlow et al. (2009) states that all social organization, both formal and informal, involves power. Analytical concepts of power tend to struggle between perspectives that focus on *power* in structures and power in human *agency* (Peet 1998). This chapter will not provide a review of the concept of power, nor commit to a particular theory of power. Instead, the aim is to get a deeper understanding of how actors are involved in distributed modes of governance, and thus identify and sketch out some key concepts that might contribute to an understanding of the mechanisms employed in negotiating spaces of inclusion and exclusion in governance.

Participation in governance is increasingly characterized by an involvement of actors in networks according to the "stakes they hold" based on the reciprocity of stakeholder benefits.

(Swyngedouw 2005; Shirlow et al. 2009). Networks, as opposed to top-down planning, permit inter-organizational interactions of exchange, concerted action and joint production in a more or less formal manner (Keeley and Scoones 1999). Different forms of network constellations will exist under the headlines of civil society, state and market and actors can be active within a relatively autonomous public space between these formal spheres (Törnquist 2001). However, when authority is relying less on legal power and more on critical resources and collective interests, new challenges of coordination and steering may arise (Pierre and Peters 2000). The following sections investigate specific concepts that can help understand political agency and foundations for participation in governance.

Political space

A concept that has been used within political geography to conceptualize participatory power and agency in governance is *political space* (Engeberg-Pedersen and Webster 2000). They originally use the concept in an actor-oriented analysis of local governance and poverty alleviation. Webster (2000) defines political space as "the types and range of possibilities present for pursuing poverty reduction by the poor or on behalf of the poor by local organizations" (Webster 2000:2). Related concepts used within political geography are the analytical categories of "invited" and "invented" space, referring to more or less formal spaces of local participation in governance (Swyngedouw 2005). This thesis does not open up for a specific study or evaluation of local participatory spaces and power relations at the local level. The governance of renewable energy involves a wide set of actors, visions, positions and interests at different geographical levels in governance. Still, the focus on how actors seek to change their current circumstances and the conducted policy by taking advantage of the political opportunities that exist makes the concept of political space meaningful in the pursuit of investigating solar energy actors' space of manoeuvre in light of the framework conditions in which they orientate themselves in and act upon, also described by Webster (2000) as their "political terrain for action".

Three important dimensions of political space are important. These are *institutional channels and political rights, discourses,* and *social and political practice and experiences* (Webster 2000). Institutional channels and political rights can open or limit the influence of different actors in political decisions and the implementation of these, and therefore concerns how actors get access or become constrained in processes of decision-making (Webster 2000). Discourses regulate the activities of actors, how political activities are legitimized and motivated, and these are expressions of visions and values that becomes guiding for policy

designs (Stokke 1999). Social and political practice and experience refers to established forms of interaction that influence actors' perceptions of opportunities and constraints in their political terrain for action (Webster 2000).

Power in networks

According to Engeberg-Pedersen and Webster (2000), political space must be filled with actors and an issue complex in order to exist and be understood in relation to other political spaces and the associated power relations. Some may be allies and some may be in opposition. Inspired by theories on political mobilization structures, Klandermans (1991) refers to such network channels as *systems of alliance* and *systems of conflict.* Systems of alliance support changes with organizational resources and open for political opportunities, while systems of conflict undermine actor engagements by constraining resources and limit political opportunities for change.

International environmental agencies, multinational companies and development organizations can represent important alliance systems for the implementation of renewable energy. Since renewable energy technologies are still in an early phase of experience, both at the policy level and the practical level of experimentation in different localities, transnational resource networks and cooperation tend to play an important role for their implementation. The lack of necessary knowledge on complex technological options among national decision-makers can make governments and local communities largely reliant on technical and policy "experts", research teams or recognized expert-authorities working within government agencies or international development agencies to draw policy conclusions. Such factors may also influence which actors are provided with an opportunity to participate in governance and thereby what type of results a technological change will have. Haas (2011) refers to such transnational knowledge networks as "epistemic communities", and emphasize their influential role through their ability to inform politicians, civil-society organs, government officials or private companies about technological options based on *normative* objectives. This type of political legitimacy differs from bureaucratic bodies that are largely operating to preserve missions and budgets (Haas 2011). While such transnational networks can be more "empowering" and suitable to respond to local conditions and demands than public democratic channels, they also pose a democratic risk of external actors indirectly governing national and local decisions (Miraftab and Wills 2005). The role of normative power asymmetries has also been briefly raised within the socio-technical system literature by Stirling (2008) in relation to social commitments and social appraisal.

Networks that serve the interests of well-organized interest groups within the recognized system of electricity supply may represent conflict systems for stakeholders in the renewable energy field. There are theoretical similarities between conflict systems and the regime related resistance presented in the socio-technical systems literature. Similar types of powerful network alliances have also been described as "iron triangles", which refer to a strategic relationship between industry representatives, officials in the management activities and legislators who possess the authority to make decisions (Young 2003). Such networks may be further strengthened by weak boundaries between shareholding and policy formulation in decision-making procedures (Painuly 2001). However, the boundaries of conflict and alliance systems remain vague and previous coalitions may change in the course of events (Klandermans 1991). Since dominating interests are never fixed, conflict and alliance systems can be a way of conceptualizing power in networks in a more flexible way, including those that may surface internally to niche and regimes and those that extend the niche-regime dichotomy, both formal and informal.

The struggle for political space

Political space is closely related to an actor's or an organization's capacity to advance their interests. Actors are likely to be flexible and able to make demands on different political arenas of participation in different settings (Robins et al. 2008). The degree of openness and strength of formal institutional frameworks may influence choice of strategies in terms of whether actors choose to work inside or outside the formal system to influence processes of societal change (Webster 2000). The concept of political space therefore deals with the formal and informal opportunity structures available. Political space is therefore constantly being contested and challenged. Moreover, actors' *own interpretations* of the political opportunities and constraints that exist are essential for their choice of strategies and where they choose to focus their work (Klandermans 1997; Törnquist 1999). People will perceive their political terrain for action in different ways and respond to what they have constructed as being possible to influence and what is appreciated, and choose different strategies depending on where they believe they have best opportunities of accomplishing results (Miller 1994; Marston 2000).

According to Turner and Hulme (1997), actors' political terrain for action should be approached as a zone of contestation rather than a clear empirical reality. For the purpose of this thesis, the concept of political space may help understand the struggles and strategies of actors committed to change, such as solar energy actors in Kenya, how they negotiate their

positions, and why some actors manage to reach forward with their interests and demands in governance, and others not.

2.4 Summary

This chapter has described theoretical approaches that can help investigate factors that create opportunities or constraints to the implementation of decentralized solar power in Kenya, including what kinds of governance that play a role. The chapter has presented analytical concepts and governance perspectives from two theoretical realms, the socio-technical system literature and political geography.

The socio-technical system perspective provides an understanding of the complexity of technology and the system around it. This literature focuses on strategies for how to consciously steer technological change and how technological niches develop in relation to their exogenous environment. Critical perspectives within this literature extend the focus from governance as objective management to also view governance as reflexive politics, which acknowledge the complex politics happening both internal and external to emerging technological systems.

Governance perspectives inspired by political geography extend the focus on governance and political aspects of energy system change with emphasis on North-South dimensions in development planning and implementation of renewable energy systems in the Global South. Changes in access to critical resources such as the introduction of new infrastructure systems are expected to entail new political geographies of governance, including a change of steering principles and the premises for involvement. The concept of path creation is complemented with the notion of political space in order to further investigate how power emerges to represent struggles or prerequisites for solar energy actors and how energy system change is negotiated. As “agents of change”, solar energy actors can be seen as operating within their political terrain of opportunities and constraints, including a complex organisational system of supportive and opponent sectors, both formal and informal. The theoretical perspectives and concepts presented in this chapter are used as an analytical framework in the following analysis to explore framework conditions and governance processes for the implementation of decentralized solar power in Kenya, because this is likely to be regulated in complex ways.

Chapter 3: Methods

This chapter will present and discuss the methods that have been used in the research process. Further, it will account for the choices made and reflect on factors and conditions, including my own position as a researcher, which may have influenced the collection, interpretation and presentation of the data. The quality of the data for this thesis will be discussed in relation to the concepts of reliability and validity. The final section will reflect on ethical considerations during this research.

3.1 Qualitative research

According to Widerberg (2010), choice of method is basically a choice of knowledge. Making methodological choices will therefore be dependent upon what kind of knowledge one is interested in producing. There are different perspectives on what kind of knowledge it is possible to obtain through qualitative research methods. While a positivist perspective would regard the informant's accounts in an interview situation as something accurately reflecting events or experiences, a constructivist perspective would argue that descriptions of actual experiences in the 'outer world' cannot be conceived through an interview situation because knowledge is bound by context and created in the present situation (Gomm et al. 2000). Still, Thagaard (2009) argues that it is possible to describe real events and at the same time reflect on the way in which social reality is produced, including how the informants understands their own experiences and perceives the researcher. The focus on reflection in qualitative research could somehow imply that objectivity remains a goal in qualitative research. Yet, the goal of striving for a neutral presentation of the data refers to achieving a fair and credible understanding of a social reality rather than searching for an objective truth. Hesselberg (2008) states that it is better and worse ways of doing qualitative research, and that the researcher must strive to find the "best" possible way of presenting a social truth, which is the aim of this thesis.

3.1.1 The qualitative case study design

Case studies are a common way to do qualitative inquiry and can both be seen as a *process* of inquiry and as a *product* of that inquiry. According to Stake (2005), a case study is not a methodological choice, but a choice of what to be studied. It is a suitable choice of inquiry when the researcher has little control over events, and when the focus is on a contemporary phenomenon within a real-life context (Yin 2009). An in-depth understanding of a complex phenomenon such as factors influencing implementation of decentralized solar power in

Kenya and how such developments are governed requires an *intensive* research design, which characterizes *the singular case study* chosen for this research.

According to Stake (2005), it is not possible to study a phenomenon outside its context. Studying a singular case allows treating the case as a combination of characteristics, and this makes room for capturing a variety of factors that shed light on relevant aspects of the research question (Cohen and Manion 1994). This makes it possible to study the case in itself, as well as examine the different dimensions affecting the case being studied. For the case study of decentralized solar power in Kenya, such dimensions can be different institutions or activities promoting or hindering the implementation of solar energy activities. Although the boundaries of a case are fluctuating, the researcher is to a certain degree left with the power to determine the limits of the case in the final presentation (Yin 2004).

3.1.2 The scientific value of qualitative case findings

Another question fair to ask when conducting a case study is how to make the case findings "disciplinary" (Widerberg 2010). According to Gomm et al. (2000), a case study can be valued for its uniqueness as "the case in itself", or valued for being part of a general category as "a case of something". The focus on generalization within the qualitative tradition has increased awareness of the importance of structuring qualitative studies in a way that enhances the implications of findings for the understanding of other situations (Gomm et al. 2000). Yet, concerns has been raised that case studies do not allow for generalization beyond the particular case studied, considering that the purpose is to optimize the understanding of one particular case, as opposed to generalization (Stake 2003:135). According to Thagaard (2009), data obtained using qualitative methods do not provide a basis for statistical generalizations, but may provide a basis for transferability. The concept *analytical generalization* refers to one way of transferring findings from qualitative case studies in order to increase the scientific value of contextual knowledge. The main contribution of case findings here lies in the possibility of linking contextual knowledge together with wider theoretical propositions, such as general phenomena or categories, where one is able to make, or at least suggest, analytical generalizations based on a case study (Yin 2009). This implies that qualitative case findings can contribute to the development of theory. Another way of transferring qualitative case findings into a wider context is through the concept of *naturalistic generalization*. Transferability of case findings is here explained as a "vicarious experience" provided through the eyes of the researcher (Gomm et al. 2000). The power of

interpretation is here left with both the researcher and the reader (Valentine 2005), which is similar to general reader-interpretation. However, scientific value will largely rest on the quality of the research findings and the ability of the researcher to describe the case and the research process in a transparent way in order to lay a solid foundation for reader-interpretation (Hammersley and Atkinson 2007; Thagaard 2009). Together with the research questions we ask and participants we involve in our studies, the ways the researcher ensures thoroughness of the work need is important in any dependable research (Bradshaw and Stratford 2010).

3.2 Data collection

The thesis relies on data collected during a fieldwork that was conducted in Nairobi between April and June 2010 within a time span of six weeks. The thesis will thus be focused on the situation and ongoing processes in this period, even though significant changes have occurred since then.

3.2.1 Interviews, informant selection and access to the field

My prior knowledge of the solar energy field in Kenya was limited. An explorative research method with qualitative interviews therefore became suitable. Qualitative interviews are well suited to receive informants' knowledge, stories and understandings of a given subject (Widerberg 2001). I conducted so-called semi-structured interviews, which I expected would give me relevant insights in the research topic. The semi-structured interview is planned in advance, but also flexible (Thagaard 2009; Schoenberger 1991). In addition to a list of general topics and questions under each topic, the openness also guided my focus towards issue areas that would be rewarding to look closer into. This allowed me to make adjustment along the way and ask more detailed questions based on the informants' answers, background and area of expertise.

To achieve a qualitative study, the thesis includes in-depth interviews of 9 people in total. These people were part of the various activities in the solar energy field, but in different ways. I therefore describe them more thoroughly here so that the views and experiences they expressed can be seen in relation to what they tried to achieve. The informants for this thesis were the following:

The *Renewable Energy Consultant* worked for an organization that provided advisory services for African governments and institutions on clean energy, including the creation of energy policy frameworks, placing funding, and collaborated with local companies to develop

small to large scale renewable energy projects in remote locations. I received contact his information before arriving in Nairobi. I contacted him by email and further scheduled meetings with him after leaving Oslo.

The *Energy Policy Advisor* worked for an intergovernmental organization or development research think tank oriented towards strengthening the capacity of African countries and institutions to harness science, technology and innovation policies for sustainable development. This informant was especially interested in bio-energy and solar energy. However, he had much experience with renewable energy projects from different countries, including decentralized solar power, and had experience on interacting with the national authorities on renewable energy matters. He provided me with contact information about relevant people to interview.

Two of my informants worked for an NGO that were partly rural energy companies and partly NGO initiatives supported by international donors, including the British government. The NGO provided commercially based solutions and technical and financial support for families and communities. I refer to them as a Solar NGO Staff 1 and Solar NGO Staff 2. The Solar NGO Staff 1 was a practitioner with educational background as an accountant, but now worked with installation, training and maintenance of solar systems in rural areas. *The Solar NGO Staff 2* was an engineer and also worked with installation of solar systems in private households and communities. They carried out "micro" projects provided individual families with cheap solar products for basic services, including lighting and charging cell phones. These involved training of women in the rural areas on how to market and sell low cost solar goods to increase their status as well as the income of their families. They also cooperated with and supported local entrepreneurs through training and financing. They also carried out "macro" projects that targeted whole communities by installing solar system in public hospitals and schools. The Informant in *Advocate Solar NGO* was involved in information campaigns and a co-editor and author of a solar magazine that addressed key issues within the solar energy sector. The magazine was distributed to people free of charge. The Informant working in the *Solar Business* was hired by an international solar company stationed in Nairobi selling solar energy-related equipment and providing technical expertise on solar PV solutions in the African region. I met him at the Lighting Africa conference and interviewed him once. The *Manager in the Rural Energy Company* had diverse expertise within the renewable energy industry and was a manager in a Kenyan-based renewable and rural energy

company that provides technical and advisory services on clean energy access in the energy sector. The *Solar Entrepreneur* was an engineer worked as an independent contractor. He had background as an architect and worked with multiple self-initiated solar projects alongside his main work within construction of buildings, such as hospitals and health clinics. He promoted the use of solar power and was eager to increase the integration of solar PV technology in his work. The *Government Official* was an educated engineer, working in a governmental electricity company. This person helped me get in contact with other relevant actors. He was a "mixed actor" between the established electricity regime and the solar PV niche because he was working within conventional electricity supply at the same time as he was promoting solar energy activities. He was an atypical solar energy actor, since the majority of solar energy actors in Kenya worked outside the conventional energy sector.

Some of the informants provided me with contact information about relevant people to interview. The mentioning of the previous contacts that had suggested them as relevant people to interview helped me recruit new informants. Further, I got in contact with informants by searching on the Internet, and during social gatherings and conferences during my stay in Nairobi. Gaining new contacts through my previous informants was an effective way of recruiting relevant informants under the circumstances of working within a limited time frame and being in a unfamiliar context. This speeded up the process of collecting data, especially in the second half of the fieldwork. This way of recruiting informants is also described as "snowball sampling" (Valentine 2005; Thagaard 2009). A weakness of such sampling is that it may have affected the variety of the collected data (Valentine 2005). This is because people tend to have contacts and recommend people with similar worldviews and perceptions as themselves (Thagaard 2009).

In qualitative studies, the selection of informants can be seen as a strategic selection based their relevance for the research question and on their ability to provide information about the case. Hence, a credible research requires that the informant selection is reasonable (Thagaard 2009). The informants were selected for the purpose of learning about factors influencing the implementation of decentralized use of solar power in Kenya and the kinds of governance that play a role in such developments. The informants are considered national-level actors, although some of the people I interviewed also worked with solar energy activities "on the ground". While gaining direct local insights would have added to my understanding of local-level factors, the informant selection has provided me with broader information about local

factors than by doing a local study in one or a few chosen villages within this time frame. It has provided data from different places instead of "first hand" data from one village. Hence, the informant selection was purposeful for providing useful information about the opportunities and challenges that the solar energy actors face, also through their knowledge and experiences with activities at the local level.

In addition to the interviews, I had several informal conversations with people who I met randomly throughout my stay in Nairobi. I also learned a lot about historical and societal conditions in Kenya from the people I was surrounded by on a daily basis through their sharing of opinions, beliefs and experiences. This gave me the opportunity to learn more about contextual aspects that would be of relevance to my case. Together with the conducted interviews, I therefore gained information about the research topic and important actors involved in the field through informal conversations and observations. This influenced my ideas and focus during the fieldwork.

I met some practical and social hindrances that slowed down the process of recruiting informants and the amount of conducted interviews. First of all, my informants were busy people. It is therefore fully understandable that it was challenging for some of them to make time to meet a master student. Many of the people I had planned to interview also had much unpredictable travelling, which in some occasions hindered them to make an appointment or forced them to cancel or reschedule the meeting when we had agreed on meeting. I was not able to reschedule all of the meetings that got postponed. However, when I first was able to meet the informants in person, most informants were not reluctant to offer me a second interview and many of them offered to follow up answers by email.

Some of the social hindrances for gaining access to the field were also related to my personal features and background. Being a young female student from Norway automatically made me an outsider at the fieldwork. I felt this worked as a disadvantage for getting in contact with people from the policy and business community, which was highly business-oriented and male dominated. Moreover, I did not have a "business card" or formal contact information to deliver out, which seemed to be common and considered important among many of the people of relevance to my study. I gradually learned that this could have had practical and social benefits in the process of recruiting informants.

The concept of positionality is related to the negotiated status of the researcher and may influence the data collection. According to Mohammad (2001), the effect of the constructed

roles of insider and outsider positions change according to subject and context. My position as an "outsider" did not appear so obvious when talking with those informants that were linked to the same research project I had contact with. Having connections with the same research project as some of the key informants may have influenced what type of information that was made available. Although not similar to an "insider" position, this mutual connection increased my access to the field and seemed to increase the level of confidence. Furthermore, it might have provided a bias in my presentation of the data, since relationships of confidence tend to go both ways.

Due to these social and practical hindrances of doing fieldwork in an unfamiliar context, I did not get to meet all of the people I had hoped, or maybe expected, to interview within the timeframe of six weeks. Although my informants provided me with rich and useful information about the case, a weakness of the study is that I did not get the opportunity to interview people from all of the organizations and government agencies that seemed relevant for the case and was mentioned by the informants. Other people that could have been interesting to interview were people working in the Ministry of Energy and The Ministry of Environment, Kenya Renewable Energy Association, and the Rural Electrification Authority. Their perspectives would have been an interesting complementation in terms of "answering to the claims" made about some of them. This has contributed to fewer nuances in the information I have received, and this is made explicit in the analysis.

3.2.2 The interview situation and limitations

According to Thagaard (2009), the relationship between researcher and informant can affect the information that is made available to the researcher because the researcher is in direct contact with the source in a subject-subject relationship. The researcher inhabits different physical and personal characteristics that will impact how the informant perceives the researcher, some of which may be made actively use of when carrying out qualitative interviews. It is therefore important to clarify this.

Thagaard (2009) underlines the issue of whether the informant says what he or she *believes* that the researcher wants to hear in the interview situation. This is however more likely to happen when the researcher is in a situation of power, which was hardly the case in these interviews since most of my informants were selected due to their expertise in the field. Nevertheless, it is possible that that my background as a social science student might have lead to expectations among some informants of what I was interested in to hear and

influenced what they told me. It is also likely that my background lead to certain presumptions of the informants' based on their professional position or background, which may have resulted in some leading or biased questions. This may again affect the data collection.

The location of the interviews can also influence quality and content of the data, including the type of information being shared during interviews. An advantage of having the interviews at the informant's office was that the informant seemed more focused on answering the interview questions I had prepared. Informants seemed to take more control in the dialogue when the interview was conducted at their office opposed to interviews at cafés or in their homes. At the same time it is possible that the information that was shared at offices or at lunchrooms was different than what was shared when being away from their office and their colleagues. When the informant's office was far from the city centre or when the informant already was in town for meetings, it was sometimes more convenient to find a place to meet near the city centre. Challenges with conducting interviews at a public place such as a café was that sometimes the informants knew people passing by or sitting at the neighbouring table, which interrupted the dialogue. Noise from people sitting nearby also posed disturbances on the tape recordings. In two instances it was more convenient for the informant to meet up at their home. The interviews that were conducted at the informants' homes often tended to slide into less relevant conversations and disturbance from family members or visitors of the informant coming by their house.

The choice of whether or not to use a tape recorder is another factor that could have influenced the data collection, both the quality of data in terms of how details of the answers are remembered and quoted, and what was shared in the actual interview. In the beginning, I chose not to use a tape recorder because I had an idea that this would make the situation uncomfortable and make the informant more reluctant to share information. I therefore mainly took use of notes on important details during my first interviews and brainstormed after the interview. This worked well in the beginning of the fieldwork when I had few interviews, but it is always possible that this way of working has given room for the loss of details. It also reduced the ability to make further use of what Cloke et al. (2004) refers to as "verbatim quotes". Gradually when the amount of interviews increased, I felt the need to record the conversations to reduce the risk of losing details of what was being said. I did not use a tape recorder when the informant did not prefer it. This only happened once. The visibility of the

tape recorder on the table somehow made the interview situation become more formal, especially in the beginning of the interview, but in some occasions, this eventually became an advantage by creating a clear distinction between the actual interview and the overall meeting. Yet, I cannot fully disclose that the use of tape recorder may have influenced the information that was shared.

3.3 Interpretation and data analysis

Interpretation of the data starts during the data collection and continues during the transcription of interviews and field notes. Interpretation and analysis of the data is therefore in the hands of the researcher.

During this research, I have used theory to explain and highlight patterns in the data. This can be described as a *theoretically informed case study* (Thagaard 2009), meaning that theoretical ideas are used as instruments to inform the empirical material and provide a form of structure to the data collection and analysis. I have moved back and forth between ideas and data by continuously revisiting transcripts, field notes and theoretical perspectives. Such logic of reasoning is described as "abductive" reasoning, and entails a dialectic relationship with flexible and diffuse stages in the researcher's travel between theory, methodology and the empirical data (Thagaard 2009). The analytical framework has therefore developed in parallel with the process of interpreting data. This flexibility has allowed the empirical material to gradually form the research focus I stand with today and contributed to shape the final result and presentation of the case study.

According to Hammersley and Atkinson (2007), the knowledge of the informant is both a resource and a topic when conducting a fieldwork. Thagaard (2009) separates between person-focused and issue-focused analysis of qualitative data. To be able to go deeper into the different aspects of the case, I have mainly used what is referred to as an *issue-focused* analysis to present my empirical material. This analytical mode of procedure involves a comparison of the information from all the informants according to specific issues that is subject of analysis (Thagaard 2009). Further, I wanted to get a deeper understanding of how the informants worked, how they perceived their own role and the role of others within the field of decentralized solar power. In this way, there are also some elements of person-focused data in the analysis.

The processes of making sense of the data has involved categorization and classification of the empirical material. In the search of an overview, I started the process of analyzing the

transcribed interviews and field notes by making a broad categorization of issue areas where I placed the informants' statements and opinions according to the topics elaborated on and according to the informants' background in order to sort out any continuity or possible contradictions in the empirical material. I have thereby sorted and compared statements and perspectives of the informants according to what I have found to be relevant for answering the research questions.

3.3.1 Quality of the data

The quality of the data also concerns how the collected data are used. There are two important criteria of credibility in relation to quality of the data. *Reliability* refers to minimizing errors and biases in the data and analysis so that it can be possible to reach the same results if the research procedures are repeated (Yin 2009). *Validity* of the data involves that the researcher is being critical to own interpretations and that the interpretations are well documented to enable other researchers to verify the interpretations (Thagaard 2009). Both presume that the various factors that may influence the collected data have been accounted for. An extended notion of validity is often used when discussing the scientific value of qualitative case findings (Kvale 1996). Internal validity is closely related to the transparency of qualitative case findings and external validity is closely related to the transferability of quality case findings (Thagaard 2009).

The challenge of processing and presenting the data obtained from interviews is that the information is easily taken out of its original context (Thagaard 2009). Due to personal reasons explained previously in the introduction chapter, I was away from the study for an extended period of time. This might have influenced the analysis and final presentation of the data. However, since all of the field notes and recordings was thoroughly transcribed together with the informants' background and perspectives as well as a draft text for the empirical chapter before this period, it has been possible to come back to the analysis and get into the details of the data material.

Moreover, it is important to be aware of how the informants' views on a situation will be influenced by their background and "dedication to one's own field". This also concerns the role of the researcher (Thagaard 2009). It might be possible that some informants have exaggerated weaknesses of other actors, and adjusted their own. The quality of the data may also be decided by whether or not the information that is given is reliable. According to Berry (2002), interviewers must always keep in mind that it is not the obligation of a subject to be

objective and tell us the truth. Sources of data may sometimes be unreliable, but simultaneously an important contribution for developing an understanding of why actors act the way they do or say what they do. In other words, the purpose and intentions of political actors are important, but they do not provide sufficient basis as sources for interpretation of for instance policies and policy-making. In the pursuance of assessing the credibility of the data, and provide a solid foundation for reader interpretation, I have made efforts to place the informants' statements and citations with the question asked or themes elaborated on, and their professional background in order to safeguard the informant's perspective and reduce the likelihood of misinterpretation by the reader. It might also be easier to reveal hidden motivations behind informants' statements by having an idea of their background. I have also complemented some of the interview data with secondary sources. Still, the final presentation and conclusions is influenced by my own worldview and background as a social science student.

Thus, transparency in this thesis is strived for by openly reflecting and accounting for the various factors that may have influenced the data. Transferability of the findings from this study will be discussed in the final chapter of the thesis.

3.4 Ethical considerations

As stated by Denzin and Lincoln (2008), the conducting of qualitative interviews is first of all a tool to be able to tell one's own story on behalf the story told by others, which is subject to several ethical considerations. In the previous sections I have reflected on how my position as a researcher may influence the interpretation and presentation of this story. Ethical aspects attached to presenting such a story will therefore have to be dealt with continuously throughout the entire research process, from the interview situation, interpretation of the data and in the final presentation of the data (Thagaard 2009).

First of all, being in a position of having the possibility to conduct a fieldwork in another country and present social realities as a foreigner can in itself be considered an ethical dilemma. Moreover, the people I interviewed had important jobs and a busy work agenda to abide and some of them also had a family to take care of, which not only made it personally challenging, but also ethically challenging to be taking up their time in sole errand of being able to conduct a personal study.

Other important ethical dilemmas and considerations concern the issue of informed consent and anonymity of informants (Thagaard 2009). The issue of protecting informants may

become a dilemma for the researcher because anonymity may weaken the foundation for interpretation and credibility of the data. Obviously, the informants had the choice of participating. Furthermore, they had the choice of withdrawing from the interviews at any time if they felt it was necessary, which I made explicit before and after the interviews. Although most of my informants expressed that anonymity was not necessary, some of the issues could be regarded controversial. Thus, the informants are described in more general terms according to their professional background because this is important for the interpretations of their perspectives and knowledge about the case. If I wanted to use any of the statements I interpreted as being subject to controversy, I asked the informant by email if I was allowed to use it. Due to practical challenges with communication of conducting fieldwork in a foreign country as well as the time span between the data collection and the final presentation, it has been difficult to keep in touch with all of the informants to discuss statements in detail in the aftermath of the fieldwork. The choice of writing the thesis in a mutual secondary language enables the inclusion of informants and the ability to share the final result with them.

3.5 Summary

The purpose of this chapter has been to describe and reflect upon the process that has led to the final result of the study, including the study's limitations. The chapter has shown that the researcher has certain normative power throughout the entire research process, and I have reflected upon what this means for the collected data, analysis, and the final conclusions of the study.

Chapter 4: Factors influencing the implementation of decentralized solar power in Kenya

This chapter presents findings on the factors that influence the implementation of decentralized solar power in Kenya. The chapter has seven main parts. The first part gives an introduction to the established energy sector and the solar energy niche in Kenya. The second part presents the role of the international work on climate change for government priorities of decentralized solar power in energy sector plans. The third part explains the impacts of weaknesses in existing electricity infrastructure for implementation of decentralized solar power. The fourth part describes the role of vested economical and political interests in the energy sector, and the fifth part looks at how the Kenyan pioneer status on solar energy is influencing implementation of decentralized solar power, including the government's motivation. The sixth part analyses the role of government policies and regulations of the solar PV sector for the solar energy actors' work. Finally, the last part analyses broader governance processes that play a role for the progress on implementing decentralized solar power in Kenya, including socio-cultural and institutional conditions.

4.1 An introduction to the Kenyan energy regimes and the solar PV niche

This section gives a brief description of the Kenyan electricity sector and established energy regimes as well as the solar PV niche at the time of my fieldwork.

4.1.1 The Kenyan electricity sector and central actors

The Ministry of Energy (MoE) is the main policy setting body on all energy matters and is responsible for the management and regulation of electricity in Kenya. The MoE has a separate department for renewable energy, both off-grid and grid connected. The Energy Regulatory Commision (ERC) is an independent regulatory body for technical and financial regulation of the energy sector in Kenya, including law enforcement, licensing, approval of power purchase and tariff setting[1] (Nyoike 2002).

The electricity regime both in Kenya and most other sub-Saharan countries have been largely influenced by reform processes over the last decades based on conditions set by the World Bank for giving development assistance. The reforms started in the 1980s and have focused on privatization, deregulation and commercial operation. This has had a strong impact on the current organization, functioning and structure of the Kenyan electricity sector.

[1] www.erc.go.ke (Official website)

In 1996, the Government of Kenya (GoK) officially liberalized its national power generation, and in 1997, the state power utility was divided into corporate entities for generation, transmission and distribution (Haanyika 2005). The national power companies are owned by a combination of the state and the private sector and operate according to commercial principles. They are responsible for managing the central grid at different operating levels. Kenya Electricity Generating Company (KenGen) is the leading generating company and the main supplier of electricity to the national grid. At the time of the fieldwork, KenGen accounted for about 75 percent of Kenya's total installed capacity for electricity generation from various energy sources, including hydropower, thermal, geothermal, oil, wind and diesel[2]. There were also four Independent Power Producers (IPPs) that generated about 18 percent of Kenya's total electricity supply, mainly utilizing fossil fuels (oil and diesel). Kenya Power is the utility that distributes and sells the electricity to the users and is responsible for ensuring adequate line capacity across the country[3].

The Rural Electrification Authority (REA) was established by the MoE as a corporate body to act on behalf of the government in planning, organization and financing of rural electrification, previously done by Kenya Power and the MoE (Haanyika 2005). Its main task is to manage the "Rural Electrification Program Fund", develop and update the rural electrification master plan and promote the use of renewable energy sources[4]. REA receives funds directly from the MoE, and from the Rural Electrification Program Fund based on funds from tax on electricity consumption.

Kenya Power operates the electricity grid, including so-called "isolated power grids" or large, commercial mini-grids in remote counties. These were financially supported by a redistribution of taxpayer income from grid customers. At the time of my fieldwork, there were 13 isolated grids. KenGen owned the generating equipment in two of these isolated power grids, while the other 11 were owned by REA (Government Official). 9 additional grids were under construction. All of these produced electricity with diesel generators. However, Kenya Power was also experimenting with combining the use of solar panels together with wind and diesel in some of these public grids. At the time of the fieldwork,

[2] www.kengen.co.ke (Official website)
[3] www.kplc.co.ke (Official website)
[4] www.rea.go.ke (Official website)

Kenya Power had developed four hybrids using solar and diesel, and one combining solar, wind and diesel (Government Official).

Only 19,2% of the total population had access to electricity in 2010. Only 6,2% of the rural population had access to the grid line electricity (IEA 2010). The use of traditional biomass and charcoal for cooking and heating as well as the long-established use of kerosene and dry cell batteries for lighting were conventional off-grid energy solutions that dominated among rural households in Kenya. Diesel generators was also common conventional off-grid solutions, but less institutionalized than the electricity grid (Solar NGO staff 2). Such off-grid practices can be seen as traditional or conventional energy regimes that have existed in Kenya for decades.

4.1.2 The solar PV niche in Kenya

As explained in chapter 2, decentralized solar PV technology can be seen as an emerging socio-technical system for electricity provision. The solar PV niche can also be seen as part of a wider off-grid renewable energy niche, including wind, biofuel and small-scale hydropower.

Kenya has been and still is a regional pioneer on the use of solar PV technology in sub-Saharan Africa. This "solar success" in Kenya is a private sector based market for solar home systems (SHS) in Kenya. SHS replace traditional energy solutions or conventional off-grid solutions such as kerosene lamps, paraffin candles and diesel generators (GTZ 2009). Small privately owned SHS or single, portable lights with small solar panels and batteries (solar lanterns) were the most widespread types of solar PV systems in Kenya at the time of the fieldwork. NGO support, improved quality and price reduction on solar cells and batteries on the world market also contributed to increased demand. The demand was mainly from people belonging to a relatively prosperous non-electrified rural middle-class with ability to pay. This had led to a strong consumer chain for SHS in populated areas (Duke et al. 2002). SHS were used by 1.2 percent of households in Kenya in 2010[5]. These were primarily used for basic electricity services such as indoor lighting and for powering appliances such as radios and television sets. A growing number of people owning cell phones had also spurred the market with support from companies from the telecom sector.

There were also other ways of using PV technology, implemented at different scales. There were different kinds of village-scale systems, still in experimental phases, including solar

[5] www.erc.go.ke (Official website)

charging centres, energy centres for renting of portable solar lanterns, and mini-grids. The Kenyan government had gradually become engaged in the solar energy field, and installed Solar PV systems on public buildings, such as health care centres, public offices and schools. Together with NGO support, this had led to around 220 schools using solar panels. The MoE, under the Rural Electrification Programme, was responsible for the installation of PV systems in educational and health institutions in arid and semi-arid areas (Government Official). According to one of the NGO Informants (NGO1), the government had taken measures to promote solar electrification through creating energy centres such as one named Jamuhuri Energy Centre. Some NGOs, together with community-based organizations (CBOs) also worked on household systems, including solar lanterns. The aim was to replace kerosene lamps with solar PV systems. Despite the ongoing solar energy activities, solar power was still a very small part of the overall electricity generation in Kenya. However, the technology had started to become a competitive alternative to traditional and conventional energy sources outside the grid.

Solar PV technology was promoted by a wide range of actors, including private sector companies, NGOs, government units and donors. Some of the solar energy actors were involved in research and practical activities on the ground, installation and technical support in projects, lobbying and other political engagement to create positive perceptions of solar technology and other renewable alternatives. Typical private sector actors were employees in solar companies, independent business entrepreneurs or local contractors involved in sales, advertising and technical installation. There were organizations and business associations supporting the private sector that were involved in training, awareness creation and funding of renewable energy activities, such as Kenya Renewable Energy Association (KEREA). KEREA is an independent non-profit association formed in 2002, dedicated to promote the interests of the renewable energy industry[6]. Various NGO initiatives was important for the establishment of local training programs, technical support and financing of solar energy activities, for instance through UN development programs. At a more local level in rural areas, retailers, technicians and operators, community representatives in projects and the end-users were the typical actors. Some of the actors were engaged in more experimental activities beyond the market for SHS such as demonstration projects or "pilots" at the village-level as part of efforts to broaden the use of solar power. Practical projects on different delivery

[6] www.kerea.org (Official website)

models for solar power supply can be viewed as socio-technical experiments in the solar energy niche.

The main motivation among the actors that I interviewed was the advantages of off-grid solar PV in contexts where the majority of people have little or no access to electricity. While some activities were mainly commercially motivated, other activities were highly motivated by aims of meeting social needs. Improving education and health conditions, especially in rural areas, was highlighted as important in this regard. Social equity was another crucial motivation for many of the people I interviewed, by improving livelihood conditions for families and rural communities, and creating productive opportunities including increasing employment rates for young people and women (Solar NGO staff 2). It was difficult to separate between NGOs and energy companies since both were motivated by social aims and many NGOs were involved in commercial activities in order to make solar power supply more profitable.

Thus, the Kenyan solar PV field was a typical socio-technical niche where engaged actors worked in order to strengthen alternatives that could solve some of the problems that the regime could not solve, especially to provide electricity to those outside the reach of the grid. As explained in the methods chapter, my informants were part of the various activities happening within the solar PV niche presented above. The following sections presents factors influencing the struggles of such "niche" actors and their achievements.

4.2 The role of the international work on climate change and national plans of greening the economy

At the time of my fieldwork, renewable energy had started to become a buzzword in the Kenyan electricity sector. The Kenyan government wrote in optimistic ways about renewable energy in national plans and had officially started to announce obligations towards exploring "green energy alternatives" for making the energy economy more environmentally sustainable. Together with international financial support, the Kenyan government embraced green energy in its Climate Change Response Strategy launched in 2006 (Advocate Solar NGO). This is an economic development plan to follow up an earlier plan, the Economic Recovery Strategy for Wealth and Employment Creation.

Financial support through the international work on climate change seemed to influence the government to plan in new directions for the energy sector. There had been an increase in donor funding from the World Bank and other development partners towards clean electricity

access, and Kenya had recently received a $330 million loan from the World Bank to expand electricity access and increase investments in green energy electricity (Solar NGO staff 1, Government Official). These financial flows improved the economy in the Renewable energy department. In addition to foreign financial support for green energy investments, the Kenyan government had announced plans for allocating resources from the domestic budget towards green energy investments to help spur the development of renewable energy technologies, including decentralized solar power.

> To show that they mean what they say – the government in cooperation with other development partners, are encouraging the use of renewable energy for both commercial and domestic use and the government itself is putting 8 billion USD behind it (Solar NGO staff 1).

Public announcements of financial budgets during budget negotiations also indicated a dedication towards "greening the economy". The Minister of Finance, then Uhuru Kenyatta, expressed that although this issue is usually considered an environmental concern, the Government of Kenya was committed to allocate 34.1 billion KES (approximately 420 000 USD) in development expenditure from Ministry of Finance to the Ministry of Energy for diversifying the energy sources used for power generation (Solar NGO staff 1). However, official announcements made by the Minister of Finance during budget negotiations had not specified any commitments of investing in specific types of renewable energy (Solar NGO staff 2), but increasing national investments in cheap and reliable energy. These allocations of funds from MoF to the MoE might reflect a necessary cost-efficiency strategy to secure domestic power supply, as the energy sector was pointed out as one of the most important sectors for the national economy. However, it could also indicate that national political authorities started to see renewable energy as important for establishing a stable and sustainable power supply in order for the economy to grow.

Some informants questioned the motivation behind the government's activities to lead the energy economy towards a "green energy path". One informant gave a rather sarcastic comment saying the government's engagements in the renewable energy field were not reflecting a proactive government with concerns about climate change or plans of making the energy sector more environmentally sustainable. "The government is reacting – not acting", he said (Renewable Energy Consultant). He saw the recent government engagements in the renewable energy field as response to the major droughts that had hit the country during the recent years, including the one in 2009. One informant emphasized that government

motivation does not always matter for the consequences as long as things are carried out and renewable energy technology is part of what is done.

> Climate emission measures *in themselves* are not a priority for most people or for the government of Kenya. However, large amounts of financial support enrol through the government that can be targeted integrated solutions that increases electrification in the country. This is a good thing (Renewable Energy Consultant).

The focus on clean energy technology had opened up to many new international players in the Kenyan electricity sector, including environmental experts, organizations and business associations with resources and competence on renewable energy. The Energy Policy Advisor believed that the international work on climate change was an indirect driver for the implementation of several renewable energy technologies, including decentralized solar energy. Still, it seems that the government did not prioritize decentralized solar power as part of these plans.

Solar NGO staff 1 was concerned that solar energy investments would be sidelined by the government compared to other renewable alternatives for combating climate change. This was because solar power was not competitive in the short-term from an emission and financial perspective. He explained that there were still "loopholes" that not only made it possible, but also preferable for the government to prioritize green investments that was compatible with large-scale electricity production. This unified the government's need to receive immediate financial rewards both from large-scale power production *and* through international financial support of green investments (Solar NGO staff 1). Investments in geothermal technology both qualified as a green investment for international climate change funding and were financially profitable for the government. The Government Official confirmed that the planned government activities on renewable energy were not earmarked to solar energy, one reason being the high costs of solar technology:

> You see the funding available is not for solar only. It is for renewable energy. It is going to be used for wind and for geothermal, which is very promising. So I know that most of it, ¾ of it, will be spent on geothermal. And that will be for the grid. It has a lot of potential. It is cheaper per kW. Of course we have a lot of potentials, so I know that a lot will also be spent on wind. I know the amount that will go to solar is a bit low, because of the high cost of solar (Government Official).

Geothermal electricity generation had received high priority in government plans, and to some extent wind power. At the time of my fieldwork, Kenya Power was already a large investor in geothermal energy and worked on plans for three new geothermal power plants over the following few years. By the loan from the World Bank for Kenya's green energy

development strategy, the government invested over 1 billion USD in the power sector. The target areas were mainly grid extension and expansion of geothermal power generation for the grid (Energy Policy Advisor).

4.3 The impacts of the established energy infrastructure

Weaknesses of established energy systems may create windows of opportunity for the emergence and growth of niche technologies, as described in the socio-technical systems literature.

The conventional, centralized electricity provision in Kenya has weaknesses that open up windows of opportunity for the solar PV activities in Kenya. At the time of my fieldwork, the Kenyan energy economy was largely reliant on imports of expensive fossil fuel resources, such as oil and diesel, and was therefore influenced by price fluctuations in the world market. However, the most important vulnerability facing the Kenyan power sector was that it suffered from restricted installed generation capacity and weak grid infrastructure. The established electricity grid in Kenya suffered from frequent blackouts and peak load problems (Renewable Energy Consultant). Moreover, there was no reserve margin for instability factors such as droughts or plant breakdowns[7]. According to the Solar Entrepreneur and the two informants from the Solar NGO, many grid clients were unhappy with the services they received. Moreover, demand was increasing due to the growing number of manufacturing companies in the country, in combination with urbanization. Continuous droughts created huge production deficits in the power sector and increased electricity prices for the grid customers (Renewable Energy Consultant). It also caused the national power companies to lose a lot of revenue.

> In 2000, when drastic power rationing was imposed, Kenya Power lost around USD 20 million, and the national economy had the worst performance since independence (Solar NGO staff 2).

As mentioned in the former section, the continuous droughts had influence on the government's interest in greening the economy. The availability and competitiveness of renewable energy alternatives has also increased in recent years and become more competitive in substituting existing power generation. The Kenyan government usually dealt with electricity shortages through temporary contracting of so-called "emergency power producers" to fill the continuous gaps between supply and demand (Solar Business).

[7] www.erc.go.ke (Official website)

Karekezi (2002) has found similar crises faced by power utilities in African countries together with the economic burden of import dependency on oil, coal and natural gas, to be important drivers for renewable energy investments on the African continent. However, as argued by Unruh (2002), niches do not necessarily replace existing configurations, but can be complementary. Decentralized solar PV was most relevant for small-scale, basic electricity provision, although it is possible to change this if there will be enough initiatives, funding and facilitation from different actors including the government. The use of decentralized solar power had mainly emerged as an alternative in areas "off the grid", where it had started to replace traditional energy technologies such as kerosene and traditional biomass. It was not replacing the use of grid power. Potential large-scale grid-connected solar PV would demand extensive policy incentives and infrastructural changes, including a restructuring of grid lines in order to create opportunities to return generated surplus electricity and feed this into the grid (Renewable Energy Consultant).

Weaknesses of the established energy regime had increased the government's focus on centralized power production. Various solar experts told me that decentralized solar PV was not financially competitive compared to other technologies in a short-term planning perspective and was therefore not given much attention in a recently updated plan called the Least Cost Power Development Plan. One reason was the high up-front costs of investing in solar PV technology (Government Official).

The Renewable Energy Consultant said that the government could not prioritize differently because of the "real challenges" the energy sector was facing. He was referring to the national energy crisis in electricity supply creating huge deficits in national budgets. This led the government away from long-term planning and structural changes in the power sector. According to the Energy Policy Advisor, national priorities were largely driven by pressure from the modern sector, including industry. High rural-urban migration had increased the focus on improvement of infrastructures, such as transportation and road networks. The government was already investing billions of Kenyan shillings to construct highways and repairing roads (Solar NGO staff 2). Moreover, large sums of funds and loans channelled through the government from large international financing institutions, such as the World Bank. These funds were largely focused on building up the central grid in Kenya (Energy Policy Advisor). This did not open up for small-scale renewable energy in energy sector plans. The Solar Business informant said that investments in solar PV could also become

interesting for the government if the energy is used in other central infrastructure, rather than create new power to the grid or in remote areas because the will to pay among companies and industry is greater than for households. In contrast, investments in geothermal technology had high potential for large-scale electricity generation for the grid. This would not, however, contribute much to giving access to electricity for people living in areas far from the central grid.

The restricted reach and capacity of the grid were, however, important motivation for donors to support activities on decentralized solar PV and funding from the international donor community had increased towards the development of sustainable energy systems. Such support was mostly given for sales of small-scale solar panels and household systems for people who could afford to pay for such systems (Solar Entrepreneur). Health risks and other risk factors associated with traditional energy sources such as the use of biomass and kerosene for heating, lighting and indoor cooking also motivated the work of solar energy actors. Such weaknesses did not seem to have any significant influence on energy sector plans.

4.4 The role of the vested interests

The socio-technical system perspective explains how vested economical interests, values and routines deeply embedded in established regime structures work as barriers to niche development. Within political geography, vested interest networks are also described as potential conflict systems for new actors and interests in the energy sectors.

As mentioned in the previous section, decentralized solar power was not in direct competition with the conventional grid activities. Resistance or market competition from other renewable energy technologies was regarded as a minor concern among the informants because solar energy could not cover the same kind of needs. Decentralized solar PV technology mainly replaced wood fuel and kerosene, and off-grid diesel generators. The Renewable Energy Consultant stated that he usage is limited and it therefore becomes different niches.

Based on statements from several of the informants, I find that some of the powerful actors within the conventional regime might work against renewable energy niches. Despite the power sector reforms, the government had retained its commanding position in the power sector through the partly state owned companies Kenya Power and KenGen. The national grid company continued to have a strong position within the administration of electricity provision through its grid monopoly. This was pointed out as an institutional barrier for the entrance of

new energy suppliers in the sector. One informant believed that a potential detachment of the grid monopoly was regarded a threat to the income of the national utility because competition could bring down electricity prices.

> The big players in the energy sector are doing everything in their power to discourage competition. For example, Kenya Power reap huge profit from the public, and competition, at times, may result in price reductions on electricity, which again may affect the type of revenue they earn (Solar NGO staff 1).

Sales of electricity through the grid utility represented an important source of income for the government. Some informants believed that the position of the grid company had contributed to a bias in government support and political priorities in decision-making procedures.

> I honestly believe that the government doesn't favour off-grid options, since they are doing little if nothing to support these types of solutions. This is simply because "the big fish" especially in political circles, benefits when the grid company takes huge profits from the sale of electricity. Some of them are shareholders in power industries. Therefore the monopolizing power generating companies only makes matters good for them (Solar NGO staff 1).

The Energy Policy Advisor also said that there had been incidences of selective distribution of subsidies to influential power producers in the power sector. Another informant kept a milder tone when referring to the position of the grid utilities, stating; "The big players in the power sector are naturally prioritizing expansion of the central grid. This is their market" (Renewable Energy Consultant). I was told that there was a thin line between business and politics in Kenya. It also looked like there were political alliances in the power sector and that these had slowed down many efforts involving decentralized renewable energy. The Energy Policy Advisor and the Solar Entrepreneur said that it was not uncommon for politicians to have personal interests in conventional energy industries, which, according to an informant in Solar Business, had provided stakeholders in oil and diesel companies with powerful influence in political circles. The Government Official responded to the claims about political alliances between national decision-makers and conventional stakeholders by questioning whether this necessarily had negative implications for national priorities of renewable energy activities. He said that even if there are people with financial interests with influence on policy and planning, the grid company is to a larger extent than other companies subjected to follow official targets.

> There may be people in the government that may have more resources to pursue their personal interests. But working in the government there is also targets that must be followed that implicate moving from diesel to renewable energy (Government Official).

He explained that some government officers might become caught in a struggle between *private interests to pursue* and *official targets to pursue* in planning and policy procedures. As

a partly state owned company, Kenya Power has more responsibility to comply with official targets than private power companies in the sector.

The grid utility was in the beginning of the plans to initiate off-grid activities with renewable energy. This included a pilot project where they were developing a 30 kW grid connected to a solar hybrid generation plant in one of their isolated diesel-operated grids funded by the MoE. This was not due to official targets, but due to an initiative from one person (the mixed actor) who was able to inspire the government to use solar PV as part of their conventional activities. This person was inspired by examples from outside his company. He expected that the pilot would be followed up by a rollout of similar solar-hybrid electricity generation in 19 other off-grid plants of bigger capacity. Yet, replacing or supplementing diesel with solar PV in larger diesel generators such as these isolated power grids was a different type of niche activity than implementing small-scale decentralized delivery models. Moreover, different solar PV models also have different price levels, especially when combined with storage (Solar Business). The use of solar power in the public isolated power grids led to savings on diesel for the generators, but this potential does not exist where the government is not running generators. The example shows that important niche activities with solar PV also happened within what can be described as the conventional regime, which in this case contributed to resolve rather than maintain a conservative mindset in the government sector. The mixed actor had experienced some headwind when he suggested the project, both from the Ministry of Energy and within his own company, but he managed to convince them and get approval.

The Solar Entrepreneur told me that although the government is starting to look towards renewable energies, the state "oligopoly" in the power sector represented a strong source of competition for new players, including independent power producers to enter the energy sector on fair terms (electricity tariffs etc.) in order to create an effective up-scaling of private sector investments in the renewable energy industry and eventually bring down the prices on electricity, including electricity generated from renewable energy sources. The Renewable Energy Consultant used the telecom industry as an example to illustrate the importance of resolving the monopoly in the power sector. He explained that the reason why almost everybody owns a cell phone in Kenya today was that the resolution of the monopoly in the telecom sector made these affordable. Multinational companies, such as Nokia, were driving the cell phone industry in Kenya. He further said that if more solar companies and other renewable energy companies got a better chance to enter the Kenyan electricity market, this

would increase opportunities for the same thing to happen within the renewable energy industry.

4.5 The impacts of Kenya's pioneer status and market success on solar energy

As mentioned, Kenya was internationally known as a regional leader in market development for SHS. This pioneer status seemed to increase the political attention towards solar energy activities at the national level, but my informants had different opinions about this. Some informants argued that it had motivated the government, and that the government would wish to sustain the leading role due to international recognition. The Energy Policy Advisor believed this provided reason for political decision-makers to increasingly include solar energy in national plans. Yet, he also emphasized that a government that wants to take part in a market success is not the same as a risk-willing and proactive government that arranges for innovative activities and makes it attractive for private sector companies to invest in the solar PV sector. An informant working in a solar company described the government as a *follower* rather than a *promoter* of solar energy activities in the country.

Many private sector initiatives in the solar PV sector were strongly supported by donors and the majority of the activities in the renewable energy field in Kenya externally financed. The Solar Engineer believed the high presence of donor-funded activities made the government less interested and more reluctant to make own investments and make arrangements for the solar PV sector. He therefore questioned the positive influence of the present solar success on the government's role. He explained that the strong link between decentralized solar power and donor-funded activities on rural electrification had strengthened perceptions of solar energy use as a "low-tech" poverty market, which again reduced the government's interest in decentralized solar PV activities.

The private sector success of the off-grid solar PV had attracted foreign solar energy industry actors, including big investors from China. Solar power was central in planned renewable energy investments mentioned during the *Forum for Africa-China Cooperation* (FOCAC) (Rural Energy Company). Such large initiatives could have a positive influence on other private sector investments and even government investments by pointing towards potential investment opportunities in decentralized solar power.

The increased availability of solar PV technology had created new opportunities for local entrepreneurs to initiate small businesses such as mobile charging stations by the use of solar

PV in areas without grid power access. There were also international business conferences and forums on green energy investments that increasingly focused on decentralized solar PV. The *Lighting Africa* conference, an initiative established by The World Bank group, is a conference on off-grid electrification held every year, and I participated in it during my fieldwork in Nairobi. Its main agenda was to strengthen the possibilities of providing ”green lighting” alternatives to a larger part of the population, especially small solar PV products with LED lights, and reduce the use of kerosene lamps. A solar entrepreneur I met during the conference argued that hosting this kind of large international events could have a positive effect on a country’s government policy. The next section analyzes the role of government policies and regulations for the efforts of actors working with the implementation of decentralized solar power supply in Kenya.

4.6 The role of national policies and regulations of the solar PV niche

The current government policies and regulations play a relatively modest role for the progress in the decentralized solar PV sector. According to theory on socio-technical change, niche technologies have a lower level of maturity compared to established systems of energy supply, including high costs. They often depend on government support to “come out of the niches” (Geels 2004). Government policies can protect renewable energy niches by providing a more favourable and predictable investment environment for investors, implementers and end users (Schot et al. 1994; Geels 2004)

In Kenya, the policies had different consequences for different kinds of solar PV systems. The informants largely focused on sales of small solar systems, but they were also concerned about new ways of using the technology and they therefore referred indirectly to enabling and constraining policy conditions for different kinds of systems beyond the market for SHS and single solar PV lights, including village-scale charging stations and mini-grids.

4.6.1 The role of feed-in tariffs, tax-breaks and other policy incentives

During the fieldwork, some of the government’s official plans on renewable energy had recently been translated into policy. *Feed-in tariffs* (FITs) had been implemented for wind, biomass and small-hydro supplying electricity to the grid and it was introduced for grid-connected solar power in 2010[8] (Ministry of Energy, 2012). Feed-in tariff means that an independent power producer receives a higher tariff for electricity generated from renewable

[8] *The Small-scale Grid connected RE Framework update (2012).*

energy sources than from electricity from fossil fuels. The government purchases electricity that is fed into the national grid. This is not relevant for off-grid solar activities.

According to the Solar Business informant, feed-in tariffs had so far led to few investments. There were only a limited number of independent power producers, especially producers of renewable energy. It was also difficult for solar power suppliers to fulfil production requirements according to the standards set by Kenya Power, and it was not possible to compete with electricity prices offered by the main grid.

> In theory, Kenya Power allows integration of independent producers by purchasing power to feed into the grid if they prove to meet the standards set by Kenya Power, but in practice, this is difficult. The demands are very high (Renewable Energy Consultant).

The government had reduced import duties and given tax breaks on regional imports of solar equipment, and this was regarded as promising for the solar PV industry. The Government Official stated that there was now a free flow of goods and zero import duties on the technical equipment imported from Kenya's neighbouring countries. "Because of the East African Community, we are not talking about import anymore. It is now just a question of moving across the border", he said. This measure could be positive for the solar PV market in Kenya since it was largely dependent on imported equipment. Yet, two informants underlined that although import duties on solar PV panels, solar water heaters and solar pumps were zero-rated in practice, they still attracted a 16% Value Added Tax (VAT) (Renewable Energy Consultant, Advocate Solar NGO). Further, there seemed to be some challenges regarding institutionalization of the recent policy on zero-rated taxes on solar equipment. Lack of clarity in policy guidelines and regulations had created a lot of frustration for the informants working in the Solar NGO. When I asked the Solar NGO staff 1 to elaborate on what he referred to as lack of clarity in tax policies and guidelines, he answered:

> When I talked about lack of clarity I meant, the bureaucracy plus the double standards that are involved in the whole process. For example, the law says zero-rated import duty on the solar products but we ended up paying a lot of money meant for taxation. The officers at the border are also not aware of the contents of the law. For example, one of the officers demanded that we pay an additional 25% of the cost of goods sold for a document called PEV (Pre Export Verification Certificate).

It took a lot of extra time and effort, but they ended up paying less than 5% for the PEV in the end. The Solar NGO staff 2 said that the cash flow process on solar equipment was affected because it took a lot of time for the goods to reach the final consumer. His organization incurred lots of costs in terms of storage charge, waiting charge issued by the shipper, security and insurance cost, among others. When all the costs were shared between his organization

and potential customers, the equipment ended up being quite expensive and less attractive to the customers. ”To get the goods from Tanzania to Kenya took us about two weeks, how long do you think it will take us to get goods from Australia, England, China or Japan?” (Solar NGO staff 2). Additionally, some of the products also got destroyed due to lack of charging as instructed by the manufacturers. This made the whole process of importing equipment tedious and expensive.

The government’s policy provides directions for investors and consumers. Two informants, one from the Solar NGO and one private sector actor told me that the government had not developed any specific policy guidelines or support regime for solar energy at all. When discussing factors influencing decentralized solar power under the heading *policy framework,* the Renewable Energy Consultant told me “there is no policy framework for solar”. REA had defined strategic objectives primarily targeted to off-grid solar PV and wind systems, but these objectives had yet to be put into policy. He said the government was working on launching bio fuel and wind policy, but solar PV developments continued in a “policy vacuum”.

Efforts to attract private sector investments in the off-grid solar PV sector were sometimes presented synonymous with increasing rural electrification, by my informants. This was because of the large potential of decentralized solar power in rural areas. The informants were especially concerned about the lack of policies and regulations that could encourage private sector companies to invest in rural areas:

> Lack of solar-specific targets and regulations is especially challenging where the need is dire, like in rural areas, because of the costs of distributing solar products and access to finance by potential contractors. This makes investments unpredictable, and potential investors are feeling discouraged, resulting in minimum growth in the area (Solar NGO staff 1).

As with grid-extension, private sector investments in rural areas were still considered a business risk rather than a business opportunity. High poverty levels among people living in rural areas were an important reason for this. Off-grid power stations are often more expensive to implement and power generation often lead to high expenses for customers. The informant in the Rural Energy Company stressed the need for policy that attracts devotion from serious agents as capital investors to cover the up-front costs of off-grid power plants or charging stations, because investments in rural areas were not necessarily big business. He said this could be the government or private sector investors, preferably in cooperation.

“Creating demand is one thing, but creating opportunities to get the supply there in the first place, is essential”.

4.6.2 Regulation of price and quality performance of solar products

Price reductions and quality improvement on solar panels and batteries on the international market had been important drivers for solar energy developments in Kenya, especially for the SHS market and sales of small panels with single lights (Jacobson 2007). However, there were ongoing challenges related to quality issues. Several informants saw the high diversity of products available in the Kenyan solar PV market as a challenge to quality regulation. The large influx of cheap products flooding the Kenyan solar PV market, mainly from China, had mostly been of poor quality and led to unhealthy competition in the smaller component market (Solar NGO staff 2). This made it difficult for the government to implement a national standardization on solar PV components and modules. The Renewable Energy Consultant was concerned about the lack of a national control organ and regulatory board to monitor and secure a proper quality control of the type of solar PV modules and batteries getting into the Kenyan market. Kenya Bureau of Standards (KBS) had recently started to implement and enforce minimum performance standards for PV modules, which according to Jacobson (2007) represents a positive step towards the institutionalization of quality insurance for products in the solar energy market. The government had no legal authority to address quality issues by prohibiting sales of modules that fail to meet minimum quality standards. KBS did not have the legal rights to enforce its standards (Duke et al. 2002). The Informant in the Advocate Solar NGO told me that, in theory, the Bureau had developed minimum standards and guidelines for solar PV equipment and solar installations. These were largely adapted from international standards. However, he also underlined that solar equipment is not the only product this bureau is dealing with. He ended the conversation about this topic by saying that he did not wish to deliver out any scepticism towards his own country. The point I believe he was making was that it takes time for the government to get an oversight to monitor and control new markets before implementing guidelines. The manager in the Rural Energy Company also questioned whether it was realistic to regulate such a diverse mass consumer product. While systems installed for government projects were required to follow minimum standards developed through KBS, the bureau had little oversight and recourse with companies that had already brought in equipment that did not meet international standards. Private installations mostly occurred outside of any code or standards in Kenya and there were no standard procedures for inspection of PV systems (GTZ 2009). The two informants

working in the Solar NGO had also experienced challenges regarding differences in guidelines between the Tanzania Bureau of Standards (TBS) and the KBS with the import of solar equipment from Tanzania. This contributed to the delay in the importing process of solar equipment since the TBS did not require much documentation like their Kenyan counterpart:

> One good example is a document called Certificate of conformity that was a nightmare to us. To the Tanzanians this wasn't a necessity but to the Kenyans it was a necessary, resulting to delay the process (Solar NGO staff 1).

According to the Solar Entrepreneur, it was especially difficult to balance price and quality performance in low-income markets. For a majority of the owners of solar systems, small systems had been the most common type of purchase, because many people could not afford large systems:

> Trying to balance quality and purchasing power especially in the rural areas is difficult because in some of these places majority of the people live below the poverty line. In some areas the situation is even worse with as high as 70% percent of the population can't afford a dollar in a day (Solar Entrepreneur).

Private sector actors described "rural customers" as extremely cost-conscious, often at the expense of quality. The Solar Entrepreneur said that the situation of the poor had forced many solar companies to reduce prices on their products or sell low quality goods to make the technology affordable. A solar entrepreneur told me that many people in Kenya tended to choose the simplest and cheapest solutions because this was what they could afford. Some manufacturers took advantage of customers that opted to sacrifice quality for price (Solar NGO staff 2, Solar Business). Agents selling low quality equipment were in several instances referred to as "offending agents". This is because they challenged decent agents on low quality goods with low prices to sell to people. The issue of "fraud labelling" by local retailers on sales of solar batteries and modules was brought up during several conversations about quality failures in the solar PV market. This challenge was also addressed in the media during my fieldwork. A newspaper article revealed frequent coincidences of retailers selling old equipment and changing labels on solar equipment showing a higher number of Watts than those supplied by the manufacturer. "Say, if the sticker on the product says ten Watts, it is actually only five. No wonder they break down" (Solar Entrepreneur). This type of fraud had increased scepticism among potential customers of solar PV products, especially customers buying smaller panels. "If you see your neighbour's equipment breaking down, you are not so eager to go out and buy one yourself " (Advocate Solar NGO). In addition, there were no consumer rights for buyers or warranties on the products after purchase. "After the products

are paid for, the retailers are no longer in charge. The consumer has no rights if the product is outdated or breaks down" (Solar NGO staff 2). The weak link between producers, retailers and brands also made it difficult to trace corporate responsibility and hold someone directly accountable for the product quality or expose those retailers who sold sub-standard equipment.

> The main challenge is that solar products can now be bought everywhere in Kenya, from super markets to small stores along the road. No one is held directly in charge of the quality of the products (Advocate Solar NGO).

According to the Solar entrepreneur, sales of low quality goods in "the lower end of the market" and cases of "fraud labelling" had tainted the image of the solar industry in a negative way by creating a reputation that could potentially undermine the solar industry in the region. Although the government's removal of regional import duties might, to some extent, curb the influx of sub-standard imports from Chinese and European markets, the government had done minor efforts to prevent exploitation of consumers. Due to a lack of punishment for "offending agents", many local importers had worked together to prevent offending agents from importing sub-standard equipment because the invasion of low quality goods had become destructive for the market as a whole (Solar Business).

4.6.3 Information to the public about renewable off-grid potentials

According to Schot et al. (2004), informing consumers can be regarded as a type of regulation. Information can increase people's awareness of different renewable energy potentials, including its long-term financial, environmental and social rewards. Information that makes consumers aware of their rights as well as knowledge about technology, standards and maintenance might also be important (GTZ 2009).

The previous section showed that lack of legislation and quality regulation had permitted a spread of "low quality markets" in the solar PV sector. Lack of sufficient information about technological options among customers also seemed to contribute to the spread of low quality products. Some informants also saw the sales of low-quality products as exploitation of people who did not have sufficient information differentiate between high quality and low quality products. This strengthens the risk of solar PV technology becoming viewed by potential customers as a "second class technology" (Advocate Solar NGO). It was difficult for private sector actors to influence people's perceptions:

> Selling solar products is a challenge in the rural area because some of our potential customers have had previous bad experience with low quality solar product. Convincing them to

> purchase your products is also an uphill task that is costly in terms of marketing and erasing the old perception (Solar Business).

This reinforced the challenges of attracting serious private investors in rural areas. Why invest when people cannot even differentiate between all the products coming in every day? (Rural Energy Company). There were also rumours, supposedly from suppliers of kerosene, about the restricted potential of solar PV technology (Advocate Solar NGO). In areas far from the grid, kerosene had been the major light option with infrastructure in place for several decades.

The informants working directly with implementing solar systems were mostly concerned about the lack of information among customers on how to use the technology to prevent "misuse" of technical equipment among customers. "People need sufficient information on how to use the products, or else they will destroy it" (Solar Entrepreneur). Some informants had experienced that the lack of qualified information among customers contributed to people having unrealistic expectations of solar technology, which made equipment maintenance difficult. The informant in the Advocate Solar NGO emphasized that commercial branding was not giving sufficient information about the technology.

According to the solar energy actors I interviewed, there had been few efforts by the government to support consumer education. The MoE had set up some information campaigns on SHS, but non-state actors had been more active to initiate such activities (Renewable Energy Consultant). KEREA was involved in training and awareness creation on renewable energy, including decentralized solar PV. The government had provided information on solar PV through the implementation of the Jamuhuri Energy Centre, which offered training, demonstrations and promotions of renewable energy sources. However, the government had yet to play a central role in facilitating workshops or campaigns to inform the public about the long-term financial benefits of solar PV technology (Solar NGO staff 2).

> If people would turn things around and begin to see that the use of solar energy will be an economically reasonable choice in the long run, this would help. The technology may be expensive because of the high up-front costs, but the energy is free. This is not the case with conventional energy sources (Renewable Energy Consultant).

Additionally, there had been few efforts by the government in providing information that could increase public awareness regarding the importance of renewable energy for preserving the environment:

> The Ministry of Energy and the Ministry of Environment could for instance have worked together to create awareness among the locals on the importance of preserving the environment. For now, this is yet to be realized (Solar NGO staff 2).

He further said that environmental concerns were not interesting enough for the Ministry of Energy. Among several of my informants, environmental concerns seemed to have awakened more interest and increased concern. According to the Energy Policy Advisor, people were talking about the impacts of climate change and some had also observed impacts themselves. They were especially concerned about impacts such as the melting ice on Mount Kenya, changes in vegetation and weather conditions leading to droughts, and the spread of malaria through changes in temperature that allows mosquitoes to survive in higher altitudes. However, the informants did not think that environmental awareness was an important driver for people's choice of energy sources and thus not for the implementation of decentralized solar power.

The Solar Energy Entrepreneur told me that many people were not aware of the range of solutions available for off-grid power supply. According to the Government Official, people tended to think that it is cheaper and safer to be connected to the main grid than investing in off-grid solutions. People living in areas closer to the grid had high expectations of becoming connected to the main grid eventually (Solar NGO staff 2). Both of the informants from the Solar NGO believed that the main problem was lack of information from the government on the likelihood of decentralized energy solutions to become a permanent solution for many people in Kenya due to long distances, costs and dispersed settlements. The Solar Entrepreneur said that the unclear signals from the government had contributed to withhold what he saw as unrealistic expectations of local communities or households in becoming connected to the grid. This hindered the solar energy actors' work on off-grid activities, because it strengthened perceptions of off-grid activities as something that was only "temporary". While most informants saw decentralized activities as a realistic future alternative for many Kenyans, the informant in Rural Energy Company said "Even if we are talking eventually, it may be 10-15 years before many people will get electricity. So it is a question of what we can do for them now".

One reason for the lack of information among rural people was that it could be very expensive to inform them, especially in remote areas where illiteracy levels are high. This also affected information on operation and maintenance of solar PV systems (Energy Policy Advisor). Some solar energy actors questioned their own strategies for informing all segments of the population. The Advocate Solar NGO was self-critical on the usefulness of handing out magazines, and organizing meetings and campaigns in the city about solar PV. This was not

always the right way to reach the people that need it the most, he said. There were several workshops and conferences that increased social learning between different stakeholders in the off grid sector. Some of the people I talked to during the Lighting Africa conference, were concerned about the lack of local representatives from rural areas attending such large informative events. However, some private sector participants I spoke with during the conference argued that such events would have indirect positive effects for rural people because it increased the focus on developing good quality options adapted to different electricity consumers.

4.6.4 Affordability of solar PV for people

During interviews, the issue of affordability was brought up in relation to the restricted ability of people to afford the up-front installation costs of investing in private systems, maintenance costs of operating the systems or to afford user fees and renting costs for charging services of solar lanterns in so-called "hire-purchase agreements".

Many people living in remote areas could not afford to invest in solar PV technology or other electricity services without government support. Dispersed, low-income consumers and low demand for electricity mainly characterize rural electricity supply systems (Haanyika 2005). Informants from the NGO sector and private sector often referred to these potential customers as "the lower end of the market" or "the bottom of the pyramid" (BoP);

> The main barrier to the growth of the solar PV electrification sector is that there is not a policy environment targeting the bottom of the pyramid. No one is telling the government to prioritize differently (Solar NGO staff 1).

The Energy Act had not explicitly favoured the use of subsidies to make electricity affordable to the poor (Solar NGO staff 2, Karekezi and Kimani 2002). The informant from the rural energy company emphasized the lack of creative financing. "For example, the government could choose to remove duties, or use taxes to fund extension of different programs". There was only some cross-subsidization between central areas and isolated power grids within Kenya Power's own supply (Government Official). This had received mixed reception among central grid customers because it had increased their bills. Some informants showed a discontent towards to the regulatory role of the ERC in terms of tariff setting. The Solar Entrepreneur claimed that the ERC had failed to protect both new suppliers and consumers in terms of the regulation of electricity prices in general. The Solar NGO staff 2 stressed that subsidies should at least reflect tariffs and customer bills rather than being a safety guarantee for the government companies remaining profitable.

Thus, there were ambivalent feelings among the informants concerning policy efforts that specifically targeted rural consumers. Although some informants regarded government subsidies for households as an acceptable stimulus to make quality solar products affordable to a larger part of the population, others regarded the use of targeted subsidies as a potential barrier for the development of "self-going" markets. One informant argued for a development where solar technology market should be as un-interrupted as possible, even if it meant that the market would not reach the poor in the starting phase. He argued that the solar energy market must eventually compete for the customers' money without subsidies (Solar Business). He said a scale up could have positive consequences for price and quality to eventually reach the poor at a later stage.

> Today systems below 100 W give very limited use. It is preferable to generate income. The iPad illustrates a good example on a technological breakthrough. It needs less power. I believe the capacity will increase for solar equipment as well. Then it is starting to get interesting – also in poor contexts of Kenya (Renewable Energy Consultant).

The Renewable Energy Consultant and the Energy Policy Advisor also said that an important reason for the lack of government support in "the rural PV electrification sector" was that the government wished to protect poor people and avoid "locking them into solar" before the technology was more mature. Technical improvements in the solar energy sector had already occurred with a lot of smaller modules and panels, but for now, they believed that the so-called "top of the bottom of the pyramid", meaning the rural middle-class, was regarded by many informants as the most suited market segment for off-grid solar PV. A solar entrepreneur said that people's preferences, especially people living in rural areas, tend to be underestimated regarding their willingness to pay for modern energy services. When discussing this matter with the Solar Entrepreneur, he stated; "People already pay for cell phone charging, why not lighting"? He further said that kerosene was not free of charge either. Several informants also highlighted that there was increased demand for services that needed more generation capacity than lighting, such as television sets, computer, fridges, etc.

> The initial costs of solar equipment are high. The batteries must be replaced occasionally, and low-power appliances may be more expensive than "standard" ones. But when we look at the cell phones, this market has spread beyond the power grids, and solar PV is in many ways the lowest-cost method of charging for customers excluded from the grid (Renewable Energy Consultant).

The lack of ability to pay back loans was brought up as a barrier for the ability to invest in solar equipment. The Renewable Energy Consultant said that the government was concerned

about making people dependent on loans when investing in solar PV equipment, since there is no direct link between the ability to have light and the ability to generate income.

> For many people beneath the poverty line, it is a big decision to take up a loan to invest in equipment. They become dependent on long-term maintenance of the equipment, and it can be difficult to go back once they have made the up-front investments (Renewable Energy Consultant).

Solar NGO (staff 1) was concerned with leaving the poor in debt because the government did not protect people from banks that were charging extremely high interest rates. "The government is doing little to prevent exploitation of the public". The informants' perspectives were divided during discussions of policies and market potentials for decentralized solar power, including affordability and the issue of timing. Some regarded lack of policy support of solar PV investments as a protection of "low-income consumers" before the market was more mature. Others considered lack of government support as a deprivation of opportunities for adapted electricity services for people living in areas with no or little access to electricity. These informants believed that rural customers would receive the highest social rewards from solar PV technology. Solar NGO (staff 2) said that the government could arrange for a solar PV market that divides the affluent and less affluent by facilitating increased sales of products, or helping the poor, by reducing it to an issue of energy poverty: "for the greater good, it is not only about who can pay without support. It is also about finding the most suited technology to reduce energy poverty in the population".

4.7 The role of the socio-political context

This section analyzes how features of the broader societal and political context in Kenya influence the implementation of decentralized solar power in Kenya, including solar energy actors' space for manoeuvre. Institutional and organizational features of the public sectors, state-society relations, political accountability mechanisms and networks, both formal and informal, all play a role. From the perspective of political geography, such broader political and socio-institutional framework conditions are part of niche actors' political terrain for action and what Turner and Hulme (1997) have described as the general or macro environment.

4.7.1 The institutional environment of the public sector

According to Turner and Hulme (1997), all organizations exist in an environment consisting of several elements, including a complex cluster of economical, demographic, political and

cultural features. This section shows how such organizational and institutional features of the public sector in Kenya influence the progress of implementing decentralized solar power.

Most of the informants said that institutional and administrative features of government units highly discouraging. Several practitioners working with renewable energy and rural electrification expressed frustrations regarding the slowness and complications of dealing with the government's bureaucratic administrative procedures when initiating new projects on renewable energy. "The government is ineffective, which is difficult regarding the breakthrough of new solutions" (Solar Entrepreneur). The processes of seeking approvals and licenses were described as time consuming, expensive and highly unpredictable. "It takes a lot of time and there are no guarantees for getting permission when applying" (Energy Policy Advisor). Lack of transparency in the public sector also seemed to have influence on the informants' efforts. Public officers and administrators were well known for their appetite for "Chai", according to the Energy Policy Advisor. Chai referred to the use of bribes.

> Corrupt officials are just a menace because they slow down, and in some cases, stop development. This is a challenge to society because it results in misappropriation of funds hindering the development of new energy solutions (Solar NGO staff 2).

This informant told me that poor accountability of public funds had challenged the operational sustainability of several projects that the government itself had implemented, including what he described as "good projects". "In addition to inadequate funding and lack of a strategic planning, corruption has resulted in poor accountability of funds that has allowed a lot of money to disappear", he said. Two solar energy actors from the private sector told me that there had been similar challenges with poor liability of government funds through the work of REA due to corrupt management officials. One of them said that these funds had profited the management officials more than the actual results. I was not able to confirm this by other informants or other types of sources. Corruption had also created practical hindrances for solar energy actors that were dependant on imports. The two informants working in a solar NGO called attention to the challenge of corrupt officers at the Kenyan – Tanzanian border, since this had recently troubled them in their own work. Corrupt government officers had created practical hindrances for several solar implementers that depended on import of equipment and system modules:

> It took us almost two weeks to import solar product from the Kenya - Tanzania border (3hrs from Nairobi) with the help of corrupt officers who are always asking for bribes. We were compelled to pay huge tax for the imports which something that is against what the law states. Right now we are thinking of getting reimbursement, but then this will force us to go through

> tedious paperwork, which is time consuming and does not always guarantee us that we are going to receive our money.

In this incident, weak institutionalization of tax policies, in combination with underpaid and corrupt officers expecting to receive bribes in exchange for permission to cross the border, had both slowed down and added costs to the import of necessary equipment. Although this did not seem entirely unexpected on their part, they were highly frustrated about this. The government red tape was also experienced as time consuming, unfair and unpredictable, to the extent that it hindered these actors to make a formal complaint about unfair treatment even when the law was broken. During conversation about import taxes and rule restrictions for "imports by the container", one informant told me that not all companies needed to follow the same rules. "There are some companies that have convinced the government" (Renewable Energy Consultant). I was not able to get a clear idea of whether this personalized "rule distinction" was based on having a special connection with the border officers, or the central government, or whether it was based on a more concrete situation in terms of using bribes.

According to the informant in the Solar Business, corruption continued to flourish freely in Kenya because the individual consequences by acting corrupt are too small. This contributed to obtain a public system where personal privileges become primary to developments that gain the society as a whole. The Energy Policy Advisor told me that the problem was not necessarily a lack of transparency in the public sectors. He said most people in Kenya were aware of what was going on and how the public system worked. The media tend to address issues of corruption in an open manner. However, it affected the ambitions of public officials and politicians in making positive changes:

> Everybody's dream is to be a public officer, a representative of a project or a politician, more than often because of the economic privileges associated with the status than having ambitions of making positive changes in society (Energy Policy Advisor).

The appetite for chai was not unique to the governmental sphere, but seemed to be an accepted part of both everyday life and the political life in Kenya. Yet, the official state apparatus had become a powerful arena for officials to strategically utilize public resources for personal gain. Such informal networks seemed to be highly transcending the state.

> Corruption and nepotism are two major evils that face the Kenyan society. Some regions have even been punished in terms of development due to different political ideologies, which was one of the reasons that caused the country to experience the post election violence (Solar NGO staff 1).

In the theory chapter, such tendencies are described as neo-patrimonial governing structures, which is a typical characteristic of post-colonial democracies and thereby governance. This can be seen part of a politicization of critical infrastructures. According to Pierre and Peters (2000), past practices and the strength of societal organization and networks influence present capacities to govern and the trust in the ability of governments or market forces to achieve efficient resource allocation. The public sector was an arena where supplementary privileges had been and still were provided to certain people or groups based on personal connections and ethnic belonging. Some of the informants' statements suggest that electricity provision was a politically tense area:

> Corruption is also a common aspect that the current electricity system faces, especially in the parastatals. I can say that the rate at which the system reaches an area depends on who you know in Kenya Power. To get things moving sometimes one is forced to part with fees. They call it chai (Informant 1 in local NGO).

Ethno-political considerations and privileges seemed to influence decisions and priorities made around the provision of critical infrastructures and social services, including electricity provision. While the management of rural electrification, was mostly entrusted to the Rural Electrification Authorities, their activities were budgeted from the central government. Decisions of regions to be electrified were made by the MoE and Kenya Power. Demographic factors such as population density and income levels were an important part of the government's considerations for targeting new areas and communities for electrification. When I asked the government official about criteria for choosing the next village to get supplied with electricity, he answered: "Choosing villages to get access to electricity is a political matter - I mean an administrative matter". Based on other conversations I had with people during the fieldwork, social privileges and access to resources had been largely influenced by ethnic background. Using the term "political matters" seemed to be charged with references to the more or less "inflamed" history of ethno-political struggles in society and could therefore be interpreted as less neutral than administrative matters. Hence, it could be possible that the government official spontaneously regretted his choice of words by to avoid letting the statement become exposed to undesired interpretation. Economical and geographical feasibility nevertheless played a role for selection of areas for extension. In remote areas, it was regarded highly unprofitable, and sometimes even unfeasible, from a cost-efficiency perspective. Geographical factors such as difficult terrain or long distances between households led to expensive electricity generation in rural areas.

> The road network in many places in Kenya, are impassable, making it unattractive for the Electricity Generating Company to implement projects. Some areas in the country are considered being so remote making it difficult to even carry out feasibility studies (Solar NGO staff 2).

Further, the cable and generator vandalism had caused Kenya Power to lose a lot of revenue. This was mainly caused by a high demand for copper wire, especially in the informal sectors, according to the Solar NGO (staff 1). Such factors could be regarded as a constraint to grid extension. These difficult conditions also say something about the opportunities of making private sector investments in decentralized electricity services profitable, and one could expect that the off-grid potential of decentralized solar power would create support for private sector investments in such areas.

4.7.2 People's expectations towards the public system and its services

Changes in people's consumer patterns have led to increased demand for modern energy services in the Kenyan population, while people's expectations towards the government in providing such services had remained moderate (Solar Entrepreneur). The Energy Policy Advisor told me "a system serving people's rights is not a matter of course in Kenya. The same applies to a system answering their needs". Many people tended to express a feeling of hopelessness towards the possibility for change in the society by somehow accepting that "this is Africa". High poverty levels in the population could probably explain why many people felt their situation as hopeless and had minor or low expectations towards the public system and its services. According to the Renewable Energy Consultant, many people also had low expectations towards donor initiated projects due to previous experiences. However, as I observed in the news during the parliaments negotiations of the new constitution, many people in Kenya were highly engaged in politics, also people living in high poverty because the stakes were much higher for them (Solar NGO staff 2). Although he was mainly referring to poor people living in urban areas of Nairobi, this contradicts the statements above on the lack of expectations in the population. The Government Official stated that people have gotten skilled at forgiving the system by thinking "next time it is our turn to get a piece of the pie", indicating some systemic forgiveness or acceptance towards how the political system works. He said people were very forgiving in Kenya. "If they see the neighbour village getting chosen, they think they are next".

4.7.3 The role of local institutions and infrastructures for off-grid electricity provision

The local realities are presented from the solar energy actors' point of view, not from the perspective of local consumers, since I have not conducted fieldwork in rural villages, only

experts present in the capital city. According to Geels and Schot (2007), a less established infrastructure can make it easier to replace existing configurations and user practices. Yet, modern energy services distinguish themselves from traditional energy services by entailing more knowledge intensive forms of technology, which largely rely on a specific competence, training, implementation, regulation and maintenance (Brew-Hammond 2009).

There were still challenges associated with the technology, such as the need for replacement of batteries and other types of maintenance. Both civil society actors and local entrepreneurs working with implementing solar PV systems "on the ground" faced several institutional challenges, especially in areas where there were previously little or no access to electricity. Some of problems were similar to those of the conventional electricity supply in these areas. There was a lack of local expertise and management. "Although system failures are usually a result of poor design and installation of solar systems, it is also a common result of lack of technological know-how to handle the technology" (Solar Business). Solar NGO staff 1 told me that even professional installers and local sale engineers did not always have sufficient training. Geographical distance and high illiteracy levels were common barriers to training of local management personnel on operation and maintenance of solar PV systems (Solar NGO staff 2). Another barrier was that training of local people was more expensive in rural areas.

> In the villages, it is very difficult to identify polytechnics and colleges that offer courses on how on to maintain the systems. This becomes very expensive when organizations that are keen on maintenance are forced to send the locals to urban areas for specialized training (Solar NGO staff 1).
>
> The illiteracy level in rural areas is quite high making it difficult for us to teach the locals on how to effectively use the maintenance logs. What we do is take random trips to the different areas to make sure that the systems operate as intended, and do repairs when necessary (Solar NGO staff 2).

International and local NGOs had provided financing and technical expertise in the decentralized solar PV field for over a decade, but many civil society projects on rural energy had only survived for a temporary period of time (Energy Policy Advisor, Solar NGO staff 2). Such initiatives were constrained by the struggle to achieve certain results within restricted timeframes in order to legitimate financial support of their activities and were therefore questioned by some of the informants. They found it important build up local institutional frameworks. According to Solar NGO staff 2 and the Renewable Energy Consultant, the main problem was that external initiators had left many projects too early, before properly teaching the local end-users on how to manage and sustain the technology:

> There have been too many projects initiated by international donors that has been abandoned too early, leaving people unable to sustain them and sceptical of new ones. Though it is better than doing nothing (Renewable Energy Consultant).

Due to the lack of local institutional frameworks for implementing off-grid electricity systems, the Government Official wished to create untraditional opportunity spaces for decentralized solar power in rural areas by integrating solar PV based charging services and solar lantern renting with existing, trusted institutions such as schools. He hoped that this would provide incentives for families that needed their children to look after their livestock to rather send some of them to school. However, he acknowledged the challenges of such integrated electricity services might cause for people not attending school and for people that moved, such as nomads.

4.7.4 The public-private dialogue on off-grid electrification

Despite the financial risks associated with bureaucratic procedures and corrupt government officials, several solar energy experts argued that the government should be an active supporter of off-grid electricity generation to ensure their survival. One reason for this was the partial economical and political control by central authorities over electrification in the country. One of the informants weighed money disappearing in "the system" as a minor risk up against the risk of not securing a further follow-up and political support for initiatives.

> There is no doubt that money will disappear by involving the government. However, it is crucial that the government is included in the process to get ownership to new ideas and initiatives. Initiative takers have to choose between the sustainability of the project and their own pride.

Solar energy experts attempted to capture government interests and attention However, it was not straightforward to get support for pioneering activities from people working in the government sectors.

> It is difficult for one to access a minister's office. One would joke that for you to enter a minister's office "you have to be special", because they are usually deemed as the "special ones", something that I will attest to (Solar NGO staff 1).

Narrow political gateways were put forward by several informants as a barrier for new players to have a constructive dialogue with government administrators and decision-makers. The Solar Entrepreneur had frequently been undermined in dialogue with the government and received limited support for his projects, despite his history with successful projects. He believed his Indian descent could be part of the explanation for some of the challenges he met. The Renewable Energy Consultant and the informant in Advocate Solar NGO believed the government wants recognition for successful activities. It was therefore important that the

government got involved in project activities at an early stage so it could "count for their success". As with the MoE, the management staff of REA was also frequently criticized by solar energy experts, especially for being highly conservative towards experimenting with new ideas for off-grid electrification. One of the informants had experienced unwillingness among the management staff in REA to get involved in activities or acknowledge proposals and ideas that could be seen as less conventional. Another informant said that REA did not appreciate others telling them what to do, despite increasingly acknowledging the advantages of several renewable energy technologies.

Two informants from the private sector viewed local elites at the village level more willing and interested in getting involved and cooperate on new activities than the central authorities. The Solar Entrepreneur had better experiences with achieving progress on his activities by having a good dialogue with Members of Parliament (MP) in the districts. The relationship between local elites and the central government was also mentioned as decisive for the interest and willingness of local elites to cooperate. The Energy Policy Advisor stated that the MPs educational background could influence their political interest and will to cooperate. "The MP's area of expertise will determine how interested they may be", he said. This informant had earlier experienced that the educational background of a politician had influenced priorities of one renewable energy technology project over another. One informant believed it was best for engaged individuals, organizations or companies to take these matters in their own hands in order to prove to the government that "it works" and be able to convince government units and administrators to get on board. He found it reasonable to take some "short-cuts" around formal procedures to avoid some expensive and time-consuming bureaucratic procedures. "You have to demonstrate that it works, then earn forgiveness". He said that this was the most efficient way to ensure that similar activities and projects would be replicated. He said this could also influence the government's policy.

This chapter has presented the empirical results from Kenya, providing insights related to research question number one: "Which factors influence the implementation of decentralized off-grid solar PV in Kenya?" Chapter 5 will discuss research question number two on what kinds of governance that were important in this case and why, by looking at the descriptions above through a lens of the governance concepts presented in the theory chapter.

Chapter 5: The modes of governance influencing the progress of decentralized off-grid solar PV in Kenya

Several of the factors described in Chapter 4 are related to governance processes, and I find it useful to discuss the role of governance separately for the sake of readability and clarity. This chapter will therefore discuss how the findings presented in the previous chapter can be seen from a governance perspective, based on the second research question: "What kinds of governance play a role for the implementation of decentralized off-grid solar PV, and why?"

As explained in the theory chapter, governance of energy involves complex political processes, including political decision-making, development planning and administrative changes in contexts of historical energy activity. The role of governments in governance is put into light both within the socio-technical systems and the political geography literature. Two main forms of governance were thus presented in the theory chapter. Governance perspectives in the socio-technical systems literature focus on strategies for how technological change can be managed or steered by different kinds of actors, including governments. Critical perspectives within this literature go beyond objective management to also view governance as reflexive politics that take place both internally and externally to emerging socio-technical systems.

In political geography, there is a more distributed view on governance, called stakeholder governance, and the political system is seen as a complex of unstable dynamic entities of formal and informal arrangements (Pierre and Peters 2000). Here, the potential role of the government is mainly in its opportunities to set the ground principles in governance (Kjær 2004). An important point in the theory chapter was also the analytical divide, made by Hyden (1999), between the formal activities of public organs on the one hand, and regime politics, meaning the facilitative or impeding institutional framework managing the rules in which policy is made on the other, meaning the political "rules of the game". These influence how governance works. The following sections will identify and discuss the different forms of governance observed in the field of off-grid solar PV in Kenya, both the activities conducted by the national political authorities and more distributed forms of governance.

5.1 Governance as management in the decentralized solar PV niche in Kenya

According to the theories on transitions towards sustainability, governments can play an important role to regulate, facilitate and participate in the development of renewable energy

niches. Especially, governments can help creating so-called “protected spaces” for niche technologies through policies and formal regulation. Networks of niche actors use these spaces for experimentation, learning and innovation. Critical scholars within the literature have still argued that niche developments are not necessarily consciously driven and rarely actively managed in practice and that one should therefore not overemphasize the manageability of such governance processes.

The findings on governance as management in Kenya support some of the suggestions in the literature on strategic management. Lovell (2007) argues that increased liberalization of the energy sectors may reduce the government’s interest and power to strengthen niches. This can lead to lack of long-term policy frameworks and innovative government strategies. Although the energy sector policies in Kenya were largely adapted to centralized structures, the government began to play a role in the field of decentralized solar PV, but the solar PV field had largely developed without specific policies as drivers. Except for the reduction of taxes on regional import of solar PV equipment, the few policy incentives for the solar PV sector had so far not been important drivers. Moreover, there were institutional challenges of translating policies into practice, as shown in the example of tax rules. The Kenyan government had started to show interest for of their own decentralized solar PV projects, and plans seemed to gradually emerge within the policy documents. This indicates that they started to take a managerial role in the solar PV field. However, the government’s plans of implementing decentralized solar PV were mainly integrated in other sector plans, such as the education and health sector.

Smith et al. (2003) argue that governments do not necessarily have the political will and ability to make strategic decisions about innovative system changes since they tend to be deeply embedded within existing socio-technical regimes. This makes the government mostly aimed towards encouraging incremental and conservative innovations, such as gradual improvements of existing socio-technical systems. Economical interests are here central. These aspects played a role for the government’s managerial role for the decentralized solar PV niche in Kenya. The role of the government in governance of small-scale solar PV was strongly influenced by its embeddedness in existing socio-technical regime, including its grid monopoly, vested economic interests and previous infrastructure investments. Moreover, some politicians were said to have personal economic interests in conventional energy industries and large energy sector players to have influence on government priorities. In line

with Painuly (2001), such networks seemed to be further strengthened by weak boundaries between shareholding and policy formulation in decision-making procedures. This discouraged the solar energy actors, who were mainly new players in the energy sector. There were, however, also powerful actors within the renewable energy industry, especially international lobbyists and expertise. While the findings did not provide sufficient information about potential informal alliances between these interests and politicians, their influence might as well become strengthened by weak boundaries between shareholding and policy formulation in the energy sector.

In addition, the government's embeddedness in the conventional socio-technical regime seemed to be influenced by international actors such as the World Bank. Such external actors exerted resource-based power over priorities in the energy sector through their financial resources. However, several international NGOs provided funding towards sustainable energy solutions including decentralized solar PV. International loans and funds channelled through the government sector focused more on grid extension. Loans to large projects of grid extension dominated, and international finance institutions were still steering the energy sector in the opposite direction than a distributed power future, maintaining and further strengthening the centralized trajectory.

The Kenyan government's interest and capacity to strategically manage and support decentralized small-scale energy activities was also indirectly constrained by the weaknesses of the established energy infrastructure and regime described above, including the national energy crisis, because they needed to focus on attracting industry and generate large-scale electricity for the grid. These financial and political factors contributed to sustain a situation of *path dependency* of the existing energy regime, as described within the socio-technical systems literature. However, the Kenyan government's demonstrated a problem solving capacity and political will to deal with challenges and for translating plans into action in their response to the supply crisis in the power sector before my fieldwork. The crisis contributed to national investments in large-scale, grid connected renewable energy niches, supported by international funding due to climate change.

Moreover, Bridge et al. (2013) state that energy policies tend to rest on assumptions about the geographical scale regarding which energy systems should be governed, and that it may not necessarily be convenient or suitable for conventional actors to bear the responsibility to implement and manage decentralized energy systems. The governance of the electricity sector

in Kenya can be seen as related to scaling, where the construction of scale influences how the value of an issue is defined (Bridge et al. 2013). They argue that energy issues are usually scaled as a national concern, which was the case for electricity provision and energy security in Kenya. They argue that such scaling of energy issues is defended by the risk of failure in domestic energy supply, and that energy policies tend to rest on assumptions about the geographical scale energy systems should be governed. The Kenyan government's policies and priorities were based on and legitimized by a national-scale energy system and discourse where national energy investments were evaluated in terms of how technology could provide value for the national economy. It could, however, make sense to scale the national crisis in the electricity provision and energy security differently, in a more distributed way, since Kenya is predominantly rural. If scaled this way, the widespread lack of access to electricity in the population could be regarded as a national crisis in energy supply too, although a more silent one. In this way, some electricity for the many people without electricity access in Kenya would increase the national energy security. Still, the lack of energy security and electricity access at the household or village-level did not represent an equally urgent threat to the national economy as the national-scale supply crisis. The scaling of electricity provision as a national concern became a barrier for national priorities of decentralized electricity solutions, including off-grid solar PV. Moreover, as mentioned by Bridge et al. (2013), it may not necessarily be convenient or suitable for conventional actors to bear the responsibility to implement and manage decentralized energy systems. Furthermore, there was also an urban bias in energy sector plans, partly because rural areas were dominated by informal economic activities of minor importance to the national economy. However, Kenya's positive reputation internationally as a solar success and as a regional pioneer in the market for solar home systems in Sub-Saharan Africa could also be regarded as a national concern. This contributed to motivating the government to take part of the following success in the sector.

Moreover, socio-institutional factors contributed to impede the government's policy and managerial role in the solar PV field. The government's capacity to provide social services such as electricity in rural areas was limited, and many villages were therefore largely left to themselves and NGOs for provision of electricity. Such societal conditions seemed to contribute to reduce the government's motivation and capacity to take a managerial role in the field of decentralized solar PV. Many civil society organizations were well established in the Kenyan society, and they had provided financial and technical expertise for off-grid solar PV over several decades. In this way, the international civil society therefore played a managerial

role in the solar PV field. Increased development aid and funding towards the development of sustainable energy systems was important for the solar energy market in Kenya. However, there was a tendency of external initiators leaving the projects before properly teaching the local end-users on how to manage and sustain the technology. Such "temporary" governance challenged the creation of visions and expectations for stakeholders in the solar energy field, and contributed to perceptions among conventional actors of solar PV as a "low-tech poverty market". This could be de-motivating, while the government's work on decentralized solar PV in public schools and health centres suggests that a link between solar energy and social services increased the government's interest in solar power.

In line with critical perspectives in the socio-technical transitions literature, the governance of the decentralized solar PV niche in Kenya is understood as an inherently *political*, rather than a purely *managerial* process. The Kenyan case of decentralized solar power shows that there were other governance processes than formal policies and regulations that were important for progress in the field, and these are described and discussed below.

5.2 Distributed governance and the negotiation of progress on decentralized solar PV

According to theories on distributed governance, power to influence societal processes relies on resources and collective interests rather than legal authority, and is distributed among a wide range of actors involved in networks based on the reciprocity of stakeholder benefits (Swyngedouw 2005; Shirlow 2009). As opposed to top-down planning, such networks permit inter-organizational interactions of exchange, concerted action and joint production in a more or less formal manner (Keeley and Scoones 1999). This allows the involvement of a wide range of actors to participate in decision-making and processes of change at different governance levels. However, when such modes of governance increasingly arise, new kinds of challenges tend to arise.

Viewing the processes in Kenya from this broader governance perspective, all of the actors described in Chapter 4 took part in governance. The entrepreneurs, energy consultants, energy policy advisors, lobbyists, private sector actors, civil society actors, engineers, retailers, owners of solar home systems, and others, all participated in various ways. Chapter 4 has shown that the governance of the solar PV niche was mainly in the hands of private sector actors in collaboration with technical and policy experts. Solar energy actors worked together with like-minded actors, including international lobbyists and expertise within the renewable

energy industry, and participated in various stakeholder forums and workshops that provided solar energy actors with opportunities to get inspired by other examples and get relevant knowledge that they could further build on. Their participation in these stakeholder networks created progress on decentralized solar power. However, there were also differences in visions, principles and internal conflicts within the Kenyan solar PV niche, here between serious and less serious actors in the solar PV industry. One example of this were the efforts of private sector actors working together to prevent sales of substandard and outdated equipment by various retailers due to lack of sufficient government regulation in the solar PV sector. Such informally regulated activities are examples of distributed modes of governance.

The regional pioneer status on decentralized solar PV inspired stakeholders. Moreover, the widespread lack of electricity access merged interest among civil society actors and private sector actors in the solar PV industry in Kenya, which provided important resource networks for implementation of decentralized solar in the area of rural electrification. Renewable energy experts such as policy advisors, private sector consultants, solar companies and rural energy companies were involved in off-grid project activities on solar PV. The system innovation within the Kenyan solar PV niche included socio-technical experiments in different localities received support from civil society actors and renewable energy experts. Such resource networks, described as alliance systems for the solar energy actors' political space by Klandermans (1991), are in the transitions literature seen as networks formed within socio-technical niches through experimentation, learning and alignment of expectations. The transnational knowledge networks of technical and policy experts and research teams within the renewable energy industry, reminds of what Haas (2011) describe as epistemic communities with political legitimacy to participate in governance based on normative objectives. Such networks appeared to have a positive influence on decentralized solar PV in Kenya. International development discourses on "pro-poor clean energy technology" seemed to increase the political legitimacy of decentralized solar PV activities.

The political influence of regime actors, strengthened by weak boundaries between politics and shareholding, narrowed political gateways at the national level for new players in the energy sector, and can in such ways be regarded as conflict systems Klandermans (1991) for some of the solar energy actors. However, the Kenyan solar energy actors had freedom to experiment more freely in renewable energy niches because of the government's constrained capacity on off-grid electricity provision and the wish to make things happen on solar PV.

This reminded of Ulsrud et al. (2011) and Bridge et al. (2013) claiming that an energy regime under pressure can create windows of opportunity for actors to experiment with alternative solutions more freely. However, without policy support, private sector actors had been reluctant to make up-front infrastructure investments and experiment with different types of solar PV electricity provision in rural areas. Although these actors pointed at inertia and loss of money when dealing with government officers, findings indicate that that it was important for the Kenyans solar energy actors to establish good relations with government actors. It seemed this would reduce the risks involved with implementing pilots and the risks of projects becoming temporary, increase the political significance of their ideas. Several solar energy actors' therefore attempted to negotiate ways to collaborate with the government and increase curiosity and attention of government officials.

The actors' room for manoeuvre can be seen as their political space, and as mentioned in the theory chapter, political space has institutional, discursive, and social/ practical aspects. For the Kenyan solar energy actors, *institutional aspects* of political space, such as institutional channels and political rights, played a role. These were visible in relation to how established forms of interaction and network alliances within the government apparatus hindered the actors from formal access to government entities. This seemed to influence the actors differently. Some solar energy actors had worked together with local elites and MPs in the districts due to narrow political gateways at the national level. Some of the actors had contacts and past experience in the energy sector. The "mixed actor" had one foot in each camp (niche and regime) and had better opportunity to enter the table of negotiations in the energy sector and to convince the energy authorities, as they already had knowledge of his previous successful activities. This provided him with the opportunity to present his ideas and examples outside his company and convince the MoE. In addition to his inside position and capacity, his political space was influenced by his experience with how the political system works, for example that the energy authorities wanted to be the ones to take responsibility and be able to deal with energy matters themselves.

Some *discursive aspects* of political space also appeared important for the Kenyan solar energy actors' work, through discourses on rural electrification, development and clean energy access, which seemed to increase the legitimacy of the work on decentralized solar PV. Moreover, the informants' descriptions of the government as a "follower" of successful activities could be interpreted as an discursive aspect of their political space since it

influenced how they emphasized the importance of involving government employees and focused on demonstration in order to persuade these. Together with the national authorities' wish to make things happen in the field, successful initiatives by non-governmental actors seemed to be receiving the government's attention. Another example that showed the role of discursive aspects of solar energy actors' political space was their perceptions of the importance of the government's "feeling of ownership" to new ideas in order to make progress on new activities in the solar PV field. Some of the solar energy actors emphasized the importance of involving the government in early phases of project implementation. It is not unlikely either that the "insider" position of the mixed actor could have provided a greater feeling of ownership for the government in order to officially own the idea for the solar hybrids that he had proposed together with the lack of progress on activities by REA.

I also observed that the role of *social and practical experience* influenced political space for the solar energy actors in Kenya. The typical solar energy actors had faced formal and informal bureaucratic obstacles in past encounters with the energy authorities. Knowledge about how the public system works helped them to overcome some of these obstacles. Some of the actors used informal strategies to experiment with new ideas, including "shortcuts" outside formal procedures in the early phases of implementing new projects in order to get a chance to prove to the government that "it works" and thus be able to earn the government's support. The strategies to negotiate political space reminds of processes described within political geography where spaces of opportunity are negotiated by actors committed to change based on the actors' own preconditions and the contextual circumstances. Further, this example shows that the actors' own interpretations of the political opportunities that exist are important for the actors' choice of strategies and where they choose to work, in line with Klandermans (1997) and Törnquist (1999). The Kenyan solar energy actors seemed to work inside the formal realm as far as this was perceived possible. Further, in line with Miller (1994) and Marston (200), their strategies were influenced by their perception of what it is possible to influence and what is appreciated and where there are opportunities to achieve results.

Even though this study has not focused on how political marginalized groups participate in governance of decentralized solar power, I will reflect on it briefly based on my data. Distributed governance does not necessarily mean more inclusive governance, as argued by the literature from political geography. An observation made in the field was how people

living in rural areas seemed to be listened to by the Kenyan solar energy actors through the ways in which the solar energy actors focused on local needs and were working closely together with local people and communities in their practices and on different projects. Further, while not directly being involved, local people might indirectly benefit from the gathering of private sector actors, politicians, researchers and other energy experts in different stakeholder forums focused on finding easily adaptive and user-friendly solutions. Some of the successful projects possibly functioned as a form of democratic bottom-up pressure to the established policy structures. Furthermore, the increased role of civil society initiatives and transnational knowledge networks in projects might represent alliance systems for people in different localities to engage in providing their own electricity without depending on government intervention. Such actors tend to focus more on how to respond to local conditions and demands. It is still likely that there are imbalances between intentions of empowerment and public education in practice, as argued by Stirling (2008) as well as within the political geography literature. There is a democratic risk of external actors indirectly governing local decisions, as argued by Miraftab and Wills (2005).

Chapter 6: Conclusion

The objective of this study has been to investigate conditions that facilitate or impede the implementation of decentralized solar PV in Kenya, including what kinds of governance that have an impact on the progress of such implementation, and why. These issues have been explored using a qualitative case study approach. A theoretical framework based on perspectives and concepts from the literature on socio-technical systems and political geography has guided the research process. This final chapter will summarize the main findings and comment on the theoretical framework that has been employed, before reflecting upon the transferability of the findings to other cases.

6.1 Conditions that facilitate or impede decentralized solar PV in Kenya

The first research question was: *Which factors influence the implementation of decentralized off-grid solar PV in Kenya?*

An important factor impeding the implementation of decentralized off-grid solar PV in Kenya was the lack of a policy framework for the solar PV sector. Despite some good strides on the policy front, including tax breaks and FiT for solar, private sector actors still faced challenges due to lack of policies for the solar PV sector. Further, the limited policy efforts constrained incentives for private sector actors to invest in rural facilities due to high costs and low-income customers with little ability to pay. Policies did not address the lack of affordability of decentralized solar PV based electricity services among large portions of rural people. Another problem was the lack of sufficient quality regulation in the solar PV sector. This permitted sales of sub-standard and outdated solar equipment by less serious actors in the solar energy sector, which was harming the reputation of solar PV among customers.

The conventional electricity system in Kenya had weaknesses that influenced the implementation of decentralized solar PV. According to the socio-technical systems literature, such weaknesses of the socio-technical regimes create opportunities for niche development. The restricted grid capacity in Kenya motivated donor-supported activities on decentralized solar power and was an important driver for the sales of solar home systems in Kenya. For the Kenyan government's role, however, this situation was complex and it was not an option to make a shift away from the established regime structures. Continuous droughts had led to a national energy crisis in supply of electricity, which seemed to hold back the national focus on decentralized solar PV because the supply crisis strengthened and legitimized the focus on

energy solutions that could generate revenue to the national economy as quickly and cheaply as possible. Solar power was not a quick solution to these kinds of challenges. Economic interests defended the dominance of large-scale electricity generation for the grid in national plans, also within the framework of greening the economy, and large-scale electricity provision was of course important for the country. The lack of energy security and electricity access at the household or village-level did not represent an equally urgent threat to the national economy as the national-scale supply crisis. Thus, weaknesses of the established grid infrastructure were not a game changer for national authorities to make arrangements for implementing alternatives to grid extension.

Kenya's positive reputation internationally as a regional pioneer in the market for solar home systems in Sub-Saharan Africa and the international focus on providing "clean energy access for all" seemed to increase the government's motivation for working on solar PV implementation, and they had already started to install solar panels in public hospitals and schools.

Support from the international civil society to the solar PV activities in Kenya increased the implementation through various actors, including NGOs, provided financial and technical expertise for off-grid solar PV. The World Bank acknowledged the importance of decentralized electricity provision, but mainly supported the central grid in Kenya. Thus, it supported both the grid extension and decentralized solutions, but the latter in much smaller ways. This indirectly constrained the opportunities for decentralized solar power to become important. Such support to both the established regime and the emerging niche shows that the analytical boundaries between the niche and regime activities were diffuse in Kenya. Moreover, the high presence of donor-supported private sector activities on decentralized solar PV also had a slightly negative impact on the government's perceptions of decentralized solar PV as "low tech poverty markets", according to my findings.

Socio-institutional and socio-cultural factors played a role for the implementation of decentralized solar power in Kenya, including informal routines and systemic corruption in the public sectors. Solar energy actors sometimes had to deal with circumstantial administrative procedures and unpredictable costs when they interacted with public officers in different application processes and imports of solar equipment. Further, there seemed to be weak boundaries between policy and shareholding in the energy sector in Kenya, which tended to be a barrier to the entrance of new players in the power sector, including the solar

energy actors. Such factors contributed to path dependency for the conventional electricity regime.

Moreover, some leaders seemed to use their political or public position to distribute and accumulate resources based on personal connections, interests and ethnic belonging. This narrowed political gateways for some of the solar energy actors. Such state-society relations influenced the relationship between people at the local level and people in central positions and seemed to hinder public efforts for changes that could gain the society as a whole. People's expectations towards the public system seemed to be divergent and for the majority mostly low due to an unstable political regime and unfulfilled promises, which could contribute to delay or hold back an effective collective pressure for change. Some of the findings also suggest that people had a hope for change. People's low expectations towards the government in providing basic electricity services represented opportunities for decentralized solar PV, because it increased people's needs and interest in energy solutions that would make them less dependent on the authorities. However, there were expectations among people of becoming connected to the grid eventually, due to government promises.

The ongoing solar energy activities in villages were largely dependent on external support and management. Many people had mixed experiences and scepticism towards such civil society initiatives due to examples of temporary involvement where initiators had left without making sure that people could sustain the activities. In Kenya, long distances, high illiteracy levels and high costs of training of people in rural areas constrained efforts of establishing local expertise and management. People in the villages were also reluctant because they had been treated unfair for a long time. Hence, the factors that influenced implementation of decentralized solar PV in Kenya went deeper than the lack of political will and capital, which is often highlighted as key requirements in energy transitions in the Global South.

6.2 The governance of decentralized solar PV in Kenya

The second research question was: *What kinds of governance play a role for the implementation of decentralized off-grid solar PV in Kenya, and why?*

The thesis has shown that different kinds of governance processes influenced the implementation of decentralized solar PV in Kenya. The Kenyan government had not been engaged in creating a "protected space" that actors could use for experimentation, learning and innovation. However, such a space was created by other factors, as explained above.

Thus, the Kenyan achievements on off-grid solar PV was not a result of government strategies, but did motivate the government to take part in the sector. The decentralized solar PV niche in Kenya was to some extent strategically governed, but mostly by civil society actors and less by the national government. The progress on decentralized solar PV in Kenya was largely characterized by more distributed modes of governance, including informal regulations and struggles among a wide set of stakeholders. These were influenced by the success in the market for SHS, the government's capacity and motivation, and international efforts on rural electrification.

The Kenyan solar energy actors, and international actors that drove the growing use of decentralized solar PV in Kenya, constituted a stakeholder network that took part in the solar PV niche. The system innovation within the Kenyan solar PV niche included socio-technical experiments in different localities and stakeholder networks that increased social learning and provided mutual inspiration among stakeholders. International development discourses on "pro-poor clean energy technology" seemed to increase the political legitimacy of decentralized solar PV and were therefore important alliance systems for the Kenyan solar energy actors' political space.

The Kenyan solar energy actors' political space seemed to be contested and challenged, but also flexible and negotiable. An advantage of the government's relatively passive role on off-grid electricity provision was that private sector actors and civil society actors had more freedom to experiment with solar PV technology. The high focus among the Kenyan solar energy actors on convincing government entities nevertheless indicate that it was important for them to establish good relations with the government in order to reduce the risks involved with implementation and increase the political significance of their ideas. Knowledge about how the public system works helped them to overcome some of the obstacles they were facing, and they worked inside the formal system as far as this was perceived as possible to achieve results. The actors' own perception of possibilities and limitations influenced where they chose to work and what some of them managed to achieve, both within the formal apparatus and outside.

6.3 Reflections regarding the usefulness of the theories

This study has shown that progress on decentralized solar PV is shaped by social and political processes, features of established and new institutions, and actor positions and processes at

different governance levels, both formal and informal. The theoretical perspectives and concepts have helped to understand different framework conditions and governance processes that influence the solar PV niche in Kenya.

The socio-technical systems perspective has been useful for investigating the interaction between technical features, institutional features and the actors involved in the niche technology and socio-technical regimes. Governance perspectives inspired by political geography directs attention towards political and spatial aspects of technological change, and has helped to complement socio-technical systems theories by providing additional concepts that helped explain the different steering mechanisms underlying such processes.

Using the concept of political space, including formal and informal opportunity structures, has been useful to become more aware of how actors get access or become constrained in decision-making processes and for studying how solar energy actors create incremental changes and legitimacy in their work. Moreover, it has allowed investigating how the solar energy actors seek to change the current circumstances and the conducted policy and are able to negotiate processes of change by taking advantage of the formal and informal opportunity structures available.

Together with the analytical boundaries of niche systems and regimes, it has been helpful to understand the drivers and barriers to path creation through the concepts of conflict and alliance systems. I find the different ways of looking at supportive and opponent networks useful because the analytical boundaries between the niche and regime activities were complex and slightly diffuse in Kenya. The networks that supported and hindered solar energy actors cut across the analytical boundaries of niche and regime, as well as geographical scale. Moreover, the government was both a regime and niche actor, but the latter to a much smaller extent. New niche initiatives also arose through individual regime actors. The findings on the role of international support to both the established regime and the emerging niche are another example. In addition, the processes of socio-technical change taking place in the field of energy was influenced by informal steering principles that also crossed the analytical boundaries of niche and regime, and represented both opportunities and constraints for niche actors. There were also differences in visions, principles and internal conflicts within the Kenyan solar PV niche, such as serious and less serious actors in the solar PV industry. I therefore found these concepts helpful for my understanding of the supportive and constraining processes taking place in the governance of decentralized solar PV in Kenya.

Thus, both the governance perspectives presented within the socio-technical systems perspective and within political geography have been fruitful for investigating the complex governance processes that plays a role for progress on implementation of decentralized solar power in Kenya.

6.4 Transferability of the case findings

Decentralized electricity provision, especially with solar PV technology, emerges in many countries, and some of the findings from Kenya might help understanding the factors that influence such technological changes in other countries, especially in Sub-Saharan Africa. This depends on similarities and differences with the Kenyan situation and has to be considered through research in those contexts, but I will reflect upon factors that could be relevant.

A special feature of the Kenyan case is the country's status as a regional pioneer on solar PV. However, other countries, especially in Eastern Africa also have notable achievements. Moreover, similar strategies as the ones used by solar energy actors in Kenya, including international organizations' support, are likely to also work elsewhere. The findings from Kenya suggest that it might take time before the authorities' policy start to strategically govern the progress of decentralized solar PV, but that much can be achieved despite lacking government policies.

Several issues in connection to the management of energy sectors might be relevant in other cases. The Kenyan challenges with their electricity supply have similarities in other developing countries, as found by Karekezi (2002), and some findings from this thesis might therefore be relevant. In Kenya, international finance institutions had influence on the energy sector plans through the access to financial resources that the Kenyan government largely depended on. These both supported grid extension and decentralized electricity supply, but the latter in much smaller ways. Moreover, the international civil society played an important role for the progress on decentralized solar power in Kenya, mostly for the smaller component market. The large role of international civil society actors in development processes in the Global South is likely to have a large impact also in other countries in Sub-Saharan Africa, depending on how they choose to operate. These have the ability to influence in which directions energy sectors are steered. Further, it influences which actors who are provided with an opportunity to participate in governance. Still, how these will influence the activities of the actors involved will likely vary.

Furthermore, societal and political relations influenced how governance worked in Kenya. The findings from Kenya suggest that access to public resources and infrastructures, such as electricity, can be politically charged and influenced by complex societal and political struggles in a context of poverty and ethnic diversity. A decentralization of ownership and management of electricity supply may prevent that access to such infrastructure services become subject to strategic power struggle at the central level and gain customer groups that have not been politically prioritized. It could also create political tension between local and central parts of government. Governance is shaped by context, including a country's cultural and historical background. However, due to some common historical features and development trends in Sub-Saharan Africa and possibly other contexts, such socio-political factors are likely to be relevant.

In terms of policy implementation, the Kenyan case suggests that policy and regulatory frameworks in the solar PV sector will be important for future prospects for decentralized solar PV, including healthy market developments and private sector innovation. A challenge for the rapid increase in sales of solar PV in Kenya was that the regulatory framework was not able to develop in the same rate. The market therefore also permitted sales of low quality and outdated equipment. These factors could be relevant to keep in mind in other developing country contexts in order to avoid tendencies that could become disruptive for the further market reputation for solar PV.

Moreover, international trends and the SDG of providing electricity for all have increased the focus on the access component of renewable energy transitions among developing country governments. This looks promising for solar PV based rural electrification initiatives. However, a strong focus on the *numbers* of people gaining access to electricity might affect the focus on how to provide good quality electricity services that are operationally and economically sustainable. These are important issues to address in order for decentralized solar PV to create positive socio-technical change for the people living in dispersed settlements outside the reach of grid electrification and could be interesting to include in further research on the governance of energy transitions in the Global South.

References

Ahlborg, H. & Hammar, L (2011) Drivers and barriers to rural electrification in Tanzania and Mozambique – Grid extension, off-grid, and renewable energy technologies. Renewable Energy

Alanne K., & Saari, A. (2006). "Distributed energy generation and sustainable development" in *Renewable and Sustainable Energy* Reviews, Volume 10, Issue 6, December, Pages 539- 558

Araujo, K. (2014). The emerging field of energy transitions: Progress, challenges, and opportunities in *Energy Research Social Science* Vol.1, 112–121.

Arthur, W. Brian (1989). 'Competing Technologies, Increasing Returns, and Lock-In by Historical Events', *97 Economic Journal*, 642-665.

Beierle. T.C. & Cayford, J. (2002). Democracy in Practice: Public Participation in Environmental Decisions. *Resources for the Future Press*. Washington DC.

Berry; J.M. (2002). Validity and Reliability Issues in *Elite Interviewing* Vol. 53. Issue 4. pp. 679-682.

Berkhout, F. (2002). Technological regimes, path dependency and the environment in *Global Environmental Change* Vol. 12 (1), 1–4.

Berkhout, F. (2010). Reconstructing boundaries and reason in the climate debate in *Global Environmental Change* Vol. 20 pp. 565-569.

Bird, L. A., Holt, E., & Carroll, G. L. (2008). Implications of carbon cap-and-trade for US voluntary renewable energy markets in *Energy Policy* Vol.36, pp. 2063-2073.

Bozeman, B. (2000). Technology transfer and public policy: A review of research and theory in *Research Policy* Vol.29, pp. 627-655.

Bradshaw, MB. & Stratford, E. (2010). Qualitative research design and rigour, in *Qualitative Research Methods in Human Geography, Oxford University Press*, Hay, I. (ed), Ontario, Canada, pp. 69-80.

Brew-Hammond, A. & Francis Kemausour (2009). "Energy for all in Africa — to be or not to be?!" in *Current Opinion in Environmental Sustainability,* Vol. 1, Issue 1, October 2009, pp. 83-88.

Brew-Hammond, A. (2009). Energy for all in Africa — to be or not to be?! in *Current Opinion in Environmental Sustainability*, 1(1): pp. 83–88.

Bridge, G., Bouzarovski, S., Bradshaw, M. & Eyre, N. (2013). Geographies of energy transition: Space, place and the low-carbon economy in *Energy Policy*, Vol.53. pp. 331-340.

Büscher, B.E, & Dietz, T. (2005). Conjunctions of Governance: The state and the conservation-development nexus in Southern Africa. *Journal of Transdisciplinary Environmental Studies*, *4*(2), 1–15.

Chineke, T.C & Ezike, F.M (2010). Political will and collaboration for electric power reform through renewable energy in Africa in *Energy Policy* 38(1): pp. 678-684

Cloke, P., Cook, I., Crang, P., Goodwin, M., Painter, J. & Philo, C. (2004). *Practicing Human Geography*. Sage Publications. London

Cohen, L., & Manion, L. (1994). *Research methods in education* (4th ed.). London: Routledge

Crook, R.C (2003). Decentralisation and poverty reduction in Africa: the politics of local–central relations in *Public Administration and Developmen*t 23, 77–88. Institute of Development Studies. University of Sussex, Brighton, UK

Denzin, N.K., & Lincoln, Y. S. (2008). *Strategies of Quality Inquiry* (3rd ed.). Thousand Oaks, CA; Sage

Duke, R.D., Jacobson, A., & Kammen, D.M. (2002). Photovoltaic module quality in the Kenyan solar home systems market. *Energy Policy 30*. pp 477-499

Engeberg-Pedersen, L., & Webster, N. (2000). Introduction to political space. In: Neil Webster and Lars Engberg-Pedersen (eds.). *Contesting political space for poverty reduction*. London: Zed. 1–29

Gaarud, R. & Karnoe, P. (2001). Path creation as a process of mindful deviation in Garud, R and Karnoe, P. (eds.), *Path Dependence and Creation*. Mahwah, NJ: Earlbum.

Geels, F.W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study. in *Research Policy Vol.31, Issues 8-9, Pages 1257-1274*

Geels, F. W. (2004). Understanding system innovations: a critical literature review and a conceptual synthesis. Elzen, B., F. W. Geels & K. Green (eds). System innovation and the transition to sustainability: theory, evidence and policy. Edward Elgar Publishing Limited. UK.

Geels, F.W. (2005). Processes and patterns in transitions and innovations: Refining the co-evolutionary multi-level perspective. in *Technological Forecasting and Social Change. Vol.72, Issue 6, Pages 681-696*

Geels, F.W. & Schot, J. (2007). Typology of sociotechnical transition pathways in *Research Policy, Vol.35, Issue 3, Pages 399–417*

Geels, F.W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective in *Research Policy Vol.39*, 495–510. Science and Technology Policy Research, University of Sussex, United Kingdom

Gomm, R., Hammersley, M. & Foster, P. (2000). *Case study method: key issues, key texts*. London: Sage Publications

Giddens, A. (1984). *The Constitution of Society: Outline of the Theory of Structuration*. Polity Press, Cambridge

GTZ (2009). Kenya's Solar Energy Market - Target Market Analysis Berlin, Germany: Project Development Programme (PDP) East Africa. Deutsche Gesellschaft Für Technische

Zusammenarbeit (GTZ) on behalf of the German Federal Ministry of Economics and Technology (BMWi).

Haanyika, C. M (2005). "Rural electrification policy and institutional linkages" in *Energy Policy, Volume 34, Issue 17, November 2006, Pages 2977-2993*

Haas, P.M. (2011). 'Epistemic Communities', in *IPSA Encyclopedia of Political Science*, New York, NY: Sage

Hammersley, M. & Atkinson, P. (2007). *Ethnography: principles in practice*. 3rd ed. Routledge. London and New York.

Helm, C. (2008). Fair division theory and climate change policy. In *Environment and Development Journal. Vol.13, Issue 4,* Pages 441-455. Cambridge University Press.

Hesselberg, J. (2008). Samfunnsgeografi - faghistorie og kjernebegreper, I: Eivind Balsvik & Susanna Maria Solli (red.), *Introduksjon til samfunnsvitenskapene. En antologi*. Universitetsforlaget AS.

Hood, C. Rothstein, H. and Baldwin, R. (2000). *The Government of Risk: Understanding Risk Regulation Regimes*. Oxford University Press.

Hoogma, R., R. Kemp, J. Schot, & Truffer, B. (2002). Experimenting for sustainable transport: the approach of strategic niche management. London: Spon Press.

Hyden, G. (1999). Governance and reconstitution of political order. in *State, conflict and democracy in Africa*, ed. R. Joseph,179–97. Bouder: Rienner

IEA (2010). *World Energy Outlook 2010*. International Energy Agency. IEA Publications. Soregraph, Paris, France.

IEA (2012). *World Energy Outlook Special Report: Redrawing the Energy-Climate Map*. International Energy Agency, Paris, France

Jacobson, A. (2007). "Connective Power: Solar Electrification and Social Change in Kenya." *World Development 35(1): 144-162*

Karekezi, S. (2002). "Renewables in Africa—meeting the energy needs of the poor" in *Energy Policy, Volume 30, Issues 11-12, September, pp.1059-1069*

Karekezi S. & Kimani, J. (2002). "Status of power sector reform in Africa: impact on the poor" Energy Policy, Volume 30, Issues 11-12, September 2002, Pages 923-945

Kaundinya D. P., P. Balachandra & N.H. Ravindranath (2009). "Grid-connected versus stand-alone energy systems for decentralized power – A review of literature" in *Renewable and Sustainable Energy Reviews, Volume 13, Issue 8, October, Pages 2041-2050*

Keeley, J. & Scoones, I. (1999). *Understanding environmental policy processes: a review*. IDS Working Paper 89, Brighton: Institute of Development Studies, University of Sussex.

Kemp, R. & Loorbach, D. (2003). *Governance for Sustainability Through Transition Management*, paper for EAEPE 2003 Conference, November 7-10, 2003, Maastricht, The Netherlands.

Kemp R., S. Parto & Gibson, R. B. (2005). "Governance for sustainable development: moving from theory to practice" *Int. J. Sustainable Development, Vol. 8, Nos. 1/2, Interscience Enterprises Ltd.*

Kirubi, C., Jacobson, A., Kammen, D.M. & Mills, A. (2009). *Community-Based Electric Micro-Grids Can Contribute to Rural Development: Evidence from Kenya.* World Development, 73, 1208-1221.

Kjær, A. M. (2004). "Governance in Public Administration and Public Policy: Steering Inter-Organizational Networks", in *Governance Polity Press*

Klandermans, B. (1991). New social movements and resource mobilization: The European and the American approach revisited. *Rucht, D. (ed.). Research on Social Movements: The State of the Art in Western Europe and the USA*. Campus Verlag, Frankfurt am Main

Klandermans, B. (1997). *The Social Psychology of Protest*. Blackwell Publishers, Oxford, UK.

Kvale, S. (1996). *InterViews: An introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage.

Ley, D. & Corsair H. J. (2008). *The Role of Human Actors in the Institutionalization and Application of Technological Innovations for Energy-Based Sustainable Development Projects*. Accepted for publication at Realising the Paradigm Shift towards Energy Sustainability – Climate Change, Technological Innovation, and the Challenge of an Optimal Instrument Mix' by Lexxion Verlag Publishers, Berlin.

Lovell, H. (2007). The governance of innovation in socio-technical systems: The difficulties of strategic niche management in practice in *Science and Public Policy, Vol.34, Issue 1*, Pages 35-44. Oxford Journal.

MacKenzie, J. & Pershing, J. (2004). *Removing Subsidies: Leveling the Playing Field for Renewable Energy Technologies*. Thematic Background Paper. International Conference on Renewable Energies, Bonn.

MacKenzie, D. & Wajcman, J. (1999). *The Social shaping of technology*. 2nd ed. Open University Press, Birmingham, UK.

Markard, J. & Truffer, B. (2008). Technological innovation systems and the multi-level perspective: Towards an integrated framework in *Research Policy 37, Issue 5,* Pages 596-615.

Marston, S. (2000). The Social Construction of Scale. *Progress in Human Geography, Vol.24, Issue 2*, Pages 219-242.

Miller, B. (1994). Political Empowerment, Local-Central State Relations, and Geographically shifting Political Opportunity Structures. *Political Geography, Vol.13, Issue 5, Pages 393-406.*

Ministry of Energy, (2012) Feed-in-Tariffs policy on wind, biomass, small hydro, geothermal, biogas and solar resource generated electricity, 2nd revision, December, 2012

Miraftab, F. & Wills, S. (2005) Insurgency and Spaces of Active Citizenship. The Story of Western Cape Anti-Eviction Campaign in South Africa*, Journal of Planning Education and Research 25, p 200-217*

Mohammad, R. (2001). “Insiders” and/or “outsiders: positionality, theory and praxis’”. In *Qualitative Methodologies for Geographers*, Edited by: Limb, Melanie and Dwyer, Claire. 101–14. London: Arnold

Mol, A.J. (2001). *Globalization and Environmental Reform. The Ecological Modernization of the Global Economy*. Cambridge, Mass: MIT Press.

Ngar-yin Mah, D., van der Vleuten, J.M., Chi-man Ip, J., & Hills, P.R. (2012). Governing the transition of socio-technical systems: A case study of the development of smart grids in Korea in *Energy Policy 25, Vol. 45, Pages 133-141*

Nyoike P. (2002). “Is the Kenyan electricity regulatory board autonomous?” in *Energy Policy, Volume 30, Issues 11-12, September 2002, Pages 987-997*

Nye, J.S. & J.D. Donahue, J. D. (2010). Governance in a globalizing world.Washington: Brookings Institution Press.

Ockwell, D. & Byrne, R. (2017) Sustainable Energy for All: Innovation, Technology and Pro-poor Green Transformations, Routledge. Energy Research & Social Science,Volume 34, December 2017, pp. 37-38.

Oosterveer, P. (2009). Governing Environmental Flows: Ecological Modernization in Technonatural Time/Spaces. In *D. F. White & C. Wilbert (Eds.), Technonatures; Environments, Technologies, Spaces, and Places in the Twenty-first Century* pp. 35-62). Waterloo: Wilfrid Laurier University Press

Painuly, J. P (2001). “Barriers to renewable energy penetration; a framework for analysis” in *Renewable Energy, Volume 24, Issue 1, September 2001, Pages 73-89*

Peet, R. (1998). *Modern Geographical Thought*. Blackwell Publishing.

Perez, C. (2002). *Technological Revolutions and Financial Capital: the Dynamics of Bubbles and Golden Ages*. Cheltenham: Elgar

Pierre, J., & Peters, G. (2000). *Governance, politics and the state*. London: Macmillan.

Raven, R.P.J.M. (2005). *Strategic Niche Management for Biomass: A Comparative Study on the Experimental Introduction of Bio Energy Technologies in the Netherlands and Denmark*. PhD dissertation. Eindhoven: Eindhoven University of Technology.

Robins, S., Cornwall, A. & von Lieres, B. (2008). Rethinking 'citizenship' in the postcolony. *Third World Quarterly* 29 (6): 1069-1086

Rohracher, H. (2001). “Managing the technological transition to sustainable construction of buildings: a sociotechnical perspective”, in *Technology Analysis and Strategic Management*, Vol. 13, No. 1, pp. 137–150

Rohracher, H. (2009). Energy systems in transition: contributions from social sciences. In *Environmental Technology and Management,* Vol. 9, Nos. 2/3. 144-161.

Russel, S. & Williams, R. (2002). Social Shaping of Technology: Frameworks, Findings and Implications for Policy, with Glossary of Social Shaping Concepts. In *Shaping*

Technology, Guiding Policy: Concepts, Spaces and Tools. Sørensen, K. H. & Williams, R. (eds.). Aldershot: Edward Elgar, p. 37-132

Sawin, J.L. (2004). *Mainstreaming Renewable Energy in the 21st Century*. Worldwatch Paper. State of the World Library.

Schot, J., R. Hoogma, R. & Elzen, B. (1994). Strategies for shifting technological systems. The case of the automobile system. Futures 26, no. 10: 1060–76.

Schoenberger, E. (1991). The Corporate Interview as a Research Method in Economic Geography. *Forum and Journal of the American Geographer*, Vol 43, Issue 2, Pages 180-189

Shirlow, P., Mountz, A., Gilmartin, M., Dahlman, C.T., & Gallaher, C. (2009). *Key Concepts in Political Geography*. SAGE Publications

Smith, A., Stirling, A., & Berkhout, F. (2003). *Socio-technical regimes and transitions contexts*. SPRU, University of Sussex, Science and Technology Policy Research.

Smith, A., Stirling, A. & Berkhout, F. (2005). The governance of sustainable socio-technical transitions in *Research Policy 34 (2005) 1491–1510*

Smith, A. & Raven, R (2012). What is protective Space? Reconsidering niches in transitions to sustainability. In *Research Policy*, Vol 41, Issue 6.

Smith, A. & Stirling, A. (2006). The Politics of Social-ecological Resilience and Sustainable Socio-technical Transitions. In *Ecology and Society*, Vol.15, Issue 1, Article 11. Science & Technology Policy Research, University of Sussex

Stake, R. E. (2003). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Strategies of qualitative inquiry* (2nd ed.). London: SAGE

Stake, R. E. (2005). Qualitative Case Studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (pp. 443-466). Thousand Oaks, CA, : Sage Publications Ltd.

Stirling. A. (2008). "Opening Up" and "Closing Down". Power, Participation, and Pluralism in the Social Appraisal of Technology. In Science, Technology & Human values, Vol.33, Issue 2. pp. 262-294. Sage Publications, University of Sussex

Thagaard, T. (2009). *Systematikk og innlevelse. En innføring i kvalitativ metode*. Tredje utgave. Fagbokforlaget Vigmostad og Bjørke AS. Bergen. Norway. (11-24)

Turner, M. & Hulme, D. (1997). *Governance, Administration and Development: Making the State Work*. Kumarian Press

Stokke, K. (1999). *Politisk geografi*. Tano Aschehoug,Oslo.

Swyngedouw, E. (2005). Governance Innovation and the Citizen: The Janus Face of Governance-beyond-the-State. In *Urban Studies, Vol. 42, Issue 11.* Pages 1991-2003. Routledge

Törnquist, O. (2001). A Specific Analytical Framework. Appendix A in *Stokke, K. & Tornquist, O. Local Politics and Democratisation in Developing Countries. Proposal for Research Program*. Universitetet i Oslo, Oslo.

Ulsrud, K., Winther, T., Debajit Palit, D., Rohracher, H., & Sandgren, J. (2011). *The Solar Transitions research on solar mini--grids in India: Learning from local cases of innovative socio--technical systems.* Energy for Sustainable Development, 15 (3), pp. 293-303

Unruh, G.C. (2002). 'Escaping carbon lock in', in *Energy Policy 30*, Pages 317-325

Valentine, G. (2005). In Flowerdew, R & D, Martin (eds). 2005. *Methods in Human Geography.*

Webster, N. (2000). Local Organisations, Political Space and Poverty Alleviation. Universitetet i Oslo.

Widerberg, K. (2001). *Historien om et kvalitativt forskningsprosjekt – en alternativ lærebok*. Universitetsforlaget, Oslo.

Widerberg, K. (2010). Med samtalen som utgangspunkt. Om veivalg og kunnskap muligheter ved intervjuing. I D. Album, M. N. Hansen, & K. Widerberg (red.), *Metodene våre. Eksempler fra samfunnsvitenskapelig forskning* (s. 219-235). Oslo: Universitetsforlaget.

World Bank, Access to electricity Rural (% of rural population) https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS?locations=KE

World Bank & IEA (2013). Global Tracking Framework. Sustainable Energy for ALL: World Bank and International Energy Agency.

Yadoo, A. & Cruickshank, H. (2012). The role for low carbon electrification technologies in poverty reduction and climate change strategies: A focus on renewable energy mini-grids with case studies in Nepal, Peru and Kenya. Energy Policy, Vol. 42, pp. 591-602

Young, O.R. (2003). International Environmental Agreements: Politics, Law and Economics (2003) 3: 377.https://doi.org/10.1023/B:INEA.0000005802.86439.39

Yin, R.K. (2004). *The Case Study Anthology*. SAGE Publications

Yin, R.K. (2009). Case Study Research: Design and Methods. Fourth Edition. SAGE Publications. California