

**Energy Transitions: The Case of South African Electric  
Security.**

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## Abstract:

Modern civilizations have evolved to be highly dependent on electrical energy. The exponentially growing renewables market has signaled transitions in electricity sectors that have traditionally been dominated by fossil fuel electricity. Various theoretical debates have recently emerged surrounding the processes of socio-technical transition, focusing on the pathways of transition, the levers for radical change and path-dependencies within these systems. The Multi-Level Perspective on Socio-technical Transitions is one such theory. This perspective views socio-technical change as a factor of interdependent shifts between three analytical levels observed within the system: the socio-technical regime, the socio-technical niche and the landscape. In accordance with this theory, radical change is generally observed as originating at niche level. Irregularities within the dominant regime and landscape pressures allow for niche innovations to break through into the dominant regime in processes of socio-technical transition.

Toward understanding actor influences on energy transitions, considerable attention has been paid to actor's impact on governance processes through: patterns of consumption, the shaping of legislation and technical innovations, by socio-technical transitions theories. However less attention has been paid to the ways in which actors in renewable electricity markets are: forming networks toward the establishment of new regimes and governing processes at niche level, and consequently how actor governance has impacted the established perceptions and available pathways for realizing electric security.

This thesis, builds on the Multi-Level Perspective, through an exploration of how actors govern socio-technical systems at niche level, paying careful attention to the modalities of power giving and power taking that allow for the development of networks of people and things toward the stabilization of novel socio-technical practices, innovations and developmental trajectories. It does this through a networked analysis of how different actors with different interests cooperate to open up innovative social and technological pathways.

## List of Abbreviations:

ACDI	African Climate Change and Development Initiative
ANC	African National Congress
CCMSP	Climate Change Municipal Support Programme
COGTA	Cooperative Governance and Traditional Affairs
CSAG	Climate Systems Analysis Group
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
DOE	Department of Energy
DTI	Department of Trade and Industry
ECB	The Electricity Control Board
EDI	Electricity Distribution Industry
EEDSM	Energy Efficiency and Demand-Side Management
EOP	End-of-Pipe
ERIC	Electricity Restructuring Interdepartmental Committee
ESCOM	the Electricity Supply Commission
EXG	Electricity Working Group
GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IDP	Integrated Development Plan
IPP	Independent Power Producer
ISMO	Independent System Market Operator
MBIPPP	Multi Base-load Power Producer Program
MLP	Multi-Level Perspective
MTPPA	Medium Term Power Purchase Agreement
NCCRP	National Climate Change Response Policy
NER	the National Energy Regulator
NERSA	National Energy Regulator of South Africa
NPC	National Planning Commission
NUMSA	National Union for Metal Workers
PNCP	Pilot National Cogeneration Programme
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PV	Photo Voltaic
RDP	Reconstruction and Development Program
REDs	Regional Electricity Distributors
REFIT	Renewable Energy Feed in Tariffs
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SAIREC	South African International Renewable Energy Conference
SALGA	South African Local Government Association

SANCOOP	Transitions to Sustainable Energy Systems in Emerging Economies: South Africa Focussed Comparative Project
SANEDI	South African National Energy Development Institute
SAPVIA	South African Photo Voltaic Industry Association
SAREC	South African Renewable Energy Council
SARETEC	South African National Energy Technology Centre
SAWEA	South African Wind Energy Association
SEZ	Special Economic Zone
SNM	Strategic Niche Management
SSEG	Small-scale Embedded Generation

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## Chapter 1

### Introduction

Modern civilisations are highly dependent on electrical security. The way in which we consume the earth through forms of energy has become a central characteristic of humanness. As such, we have not only manipulated earth systems to enable the fulfilment of our needs, we have also created needs that, should they not be met, place the future of human life as we know it in jeopardy. The problem of electrical security should thus be viewed as a problem of human security.

The word ‘technology’ in laymen’s terms denotes gizmos and gadgets and human inventions that have become useful. In this common conception of useful artefacts, it might be easy to forget the human and social underpinnings that make them so. Technology would not be technology if not for the human aspect thereof. We made it and we found it useful. More importantly, it works. By this I do not mean that it lights up when it’s supposed to or spins in the right direction, as many a forgotten gizmo that technically ‘works’ has found itself abandoned. Rather, it adds value to our social lives, be it financial, physical or otherwise because it fits into our world. Lewis Mumford expresses quite accurately this interconnection between humans and technology, and the extent of humanness that becomes technology:

*Our age has not yet come to terms with the peculiar utilitarian bias that regards technical invention as primary and aesthetic expression and secondary or superfluous; and this means that we have still to acknowledge that technics drives from the whole man, in his intercourse with every part of the environment, utilizing every aptitude in himself to make the most of his own biological and ecological potentials (Mumford, 1966: 309).*

Artefacts and technologies do not produce societal functions on their own but rather are part of networks in interlinked elements that achieve these outcomes together. In a system with social and technical aspects such as energy production or transport, these clusters of elements are referred to as socio-technical systems (Geels, 2005b).

Socio-technical systems do not only produce ‘good’ societal outcomes. In fact, the negative externalities produced by these systems pose a mammoth risk to the survival of the human and the ecological systems that underpin human life. This thesis is contextualised by the need to transition socio-technical systems, such as energy, in such a way that it contributes to human and non-human security rather than diminishing it. This thesis studies the occurrences and peculiarities of socio-technical transitions by considering some of the incidences of change that have emerged in the electricity system of South Africa.

### 1.1 Background

The governance of energy holds significant implications for the organisation of society. Humans have learnt to harness the natural world that they are a part of and in so doing transformed both themselves and the natural world. We, as humans, have developed a ‘carbon metabolism’ that has formed the basis for certain habitual patterns of life; it is part of what defines us in the modern world and it delineates what we could and should do with the natural resources at our disposal (Urry, 2014: 6). We are essentially trapped by our intensive need for energy, and by the efficiencies that energy as a commodity has provided us. The ways in which we have been consuming the planet, together with our ability to efficiently develop has led to a globally interconnected world. This in turn has led to new risks and new harms. Processes such as climate change, the spread of disease and market fluctuations now challenge the way that we conceptualise the world. These shifts do not take place in a linear or scale-bound manner, rather, they involve complex systems that interact at different levels with one another. This has had a pronounced effect on scientific inquiry into society and politics (Duit & Galaz, 2008: 311).

Energy governance is troubling for social scientists because energy’s path-dependent nature is not subject to simple human intervention (Urry, 2014: 3). Globally, most electricity markets evolved within a vertically integrated monopoly that had control over generation, transmission, distribution and retail supply of electricity (Joskow, 2008: 10). The decentralisation of these systems through the adoption of new technologies and through the allowance for new producers and new ways of consumption, results in new active participants in the outcomes of these systems.

Various efforts at sustainable change have been implemented at different scales in a growing number of countries in the world. For developing nations like South Africa, the implementation of these efforts take place within a development focussed context where policy-makers and sustainability advocates have to contend, not only with the historical relevance of an existing centralised system, but also with socio-economic and socio-political issues that shape social and technical systems.

Socio-technical systems can change or transition when the outcomes of these systems produce enough negative externalities or problems for the societies in which they exist. Because of the embedded nature of these systems in the social world, the occupants of socio-technical systems, especially those that benefit from or contribute to the outcomes of these systems, often become blind to the negative externalities produced by the systems. A pre-requisite for systems change is thus the recognition of an outcome of the system as a problem by the occupants of the system and the availability of a possible solution to the problem.

Within systems such as electricity, the advocates of change, or the actors that have observed the negative externalities of existing regimes are constantly contesting the social and economic trade-offs that go hand in hand with sustainable transitions. One example of such a trade-off in the electricity context is promotion of further concentrations of wealth and the consequent growing inequality between the wealthy system occupants that can afford alternative methods of electricity and the low-income groups that cannot. This contestation between global ideals of sustainability and different local ideals gives sustainable transitions its inherent political characteristic (Raven et al., 2016: 102). What is more, these social, political and economic trade-offs are amplified in the developing world because of the intensity of existing social, political and economic issues in these contexts.

Change in systems demands fundamentally altering components of a system or a structure within a system that leads the system to behave in an unacceptable manner. In a complex system such as electricity, these components and structures are not only currently complicated by the political struggles of sustainability advocates but are also embedded in layered networks of cause and effect that are the result of historical

occurrences. These systems are made up of historically embedded rules and their outcomes are generated through these rules around their social, political and physical contents. Thus isolating a particular problematic system component or structure and changing this component or structure is impossible without sending a ripple effect throughout the entire system.

Over the past decade, debates around change in complex systems have emerged in various forms. In the field of socio-technical transitions, there have been groundbreaking reorientations that move away from a linear conception of system change toward an appreciation of the increasing complexity of these systems, taking account of the multi-layered aspects of the system that function in a non-linear fashion to produce system outcomes and system change.

One such reorientation is captured in the Multi-Level Perspective (MLP) on Socio-Technical Transitions. For this thesis this perspective was chosen and built upon because it embraces the complexity of sustainable systems change and views the problems created for human security by the functioning of socio-technical systems as a defining factor in socio-technical transition in the modern day (Geels, 2010: 495). This perspective views the evolution of socio-technical systems as change occurrences on three inter-related analytical levels: the regime, landscape and the niche.

The regime is understood as the relatively stable sets of rules that originated out of the action and occurrences that shape and reshape the system. These rules generally undergo cycles of incremental adjustment rather than radical sporadic change. The recurrence of action along specific developmental trajectories of the regime creates stability within the regime and makes it difficult to counteract the path-dependent rules of the system resulting in system lock-ins. The landscape level is the physical context that structures the socio-technical system. It encompasses those realities surrounding a socio-technical regime that are difficult to change, for example the availability of coal in an electricity system. The niche level is the incubation room(s) where radical innovation emerges. The MLP considers three core niche processes: the articulation and adjustment of expectations, the formulation of social networks and the processes of further articulation and learning (Geels, 2005a, 2010b; Geels &

Schot, 2007). If one considers the regime as a stable set of rules that historically guide action, then the niche can be considered as the primary location for the formation of new rules.

The re-orientation of the analysis of complex socio-technical systems was primed by a noticeable shift in the nature of socio-technical system change in the world. There is a clear shift away from centralised command control governance modalities toward a noticeable dispersion of power and agency between actors, around artefacts within the system and within the physical context in which the system functions (Smith, Stirling and Berkhout, 2005). Globally, one of the prominent factors in this type of change has been the political awakening to the risks posed to humans and non-humans by climate change. Much of this relates to human dependence on fossil fuel sources of energy that produce high levels of carbon dioxide emissions and irreversible damage to the environment. Socio-technical transitions to sustainability demand not only new technologies but also critical changes to the ways that markets for these technologies function.

Scholars of socio-technical transitions have used the notion of protective spaces, or niches, to study how innovations and radical system changes emerge. Raven, Kern, Smith, Jacobsson and Verhees have summarised three different ways in which protective spaces have been conceived of in the literature (2016: 103). The first perspective captured in the evolutionary understandings of innovation and socio-technical transition argues that incumbent selection pressures impede path-breaking innovation and therefore, radical innovations require temporal protection from these forces, which are primarily made up of a collection of shielding forces.

The second is the relational perspective, which centres around actor-networks and analyses ways in which actors themselves draw the boundaries for development. According to the relational perspective, protective spaces are constituted by the dynamic interactions between actors, network flows, artefacts and the contestation that emerge from these interactions. In this perspective, the boundaries of the protected space easily become blurred. Thirdly, institutional perspectives highlight the process through which institutions are constructed relative to socio-technical transition. In line with this perspective, protected spaces are constituted by alternative

framings and institutional arrangements that are required for the development and implementation of alternative technologies.

The MLP argues that change occurs at system level once a niche is stable enough to break through into the dominant regime, once the niche-level practices are able to consolidate and progress in a manner that challenges the wider institutional setting of the regime. Such an analytical framework is best captured as a combination of the evolutionary and the institutional perspective because the emphasis is placed on the shifting institutional arrangements in the system during transition. I argue that these three perspectives do not necessarily contradict one another and that the groundwork done by the MLP can be elaborated on by considering interactions at niche level from a relational perspective.

Very few studies have considered how these protective spaces are constructed and there has been an outcry within the literature for a nuanced relational investigation of not only the ways in which emerging niche systems are interacting with politically powerful incumbent regimes, but also around their counter claims to the dominant regime and bargaining processes over the redistribution of risk and rewards as consequences of sustainable transitions (Smith, Stirling & Berkhout, 2005b; Smith & Raven, 2012; Raven et al., 2016). Crucially there has been a serious disregard of how these systems of innovation shape themselves and their development.

Socio-technical transition scholarship has begun to grapple with broader concerns of the gaps in analysis specifically relating to understanding the role of actor agency in bringing about socio-technical transitions. Various scholars have explored modalities of governance and agency in socio-technical systems and have found that agency is captured in the ways that actors are able to articulate the balance of selection pressures and coordinate the distribution of resources (Smith, Stirling & Berkhout, 2005: 1503). Agency plays out in various ways in protected spaces including the alignment of other actors (*ibid.*) and the strategic linking up or networking of actors and through the negotiation of protective spaces via discourse and framing (Martin, 2016). In recognition of the gaps in the literature, Smith and Raven (2012) have analytically deepened the conception of socio-technical niches by conceptualising three specific features of protective spaces: shielding, nurturing and empowerment. In

addition to this, substantial work has been done toward understanding the developmental trajectories of the niche that lead to the three core niche processes considered by the MLP (Schot & Geels, 2007). Some authors have also suggested that, in order to better understand the interaction between actors at niche level, we have to understand the differences between actors through more nuanced actor categorisations (Avelino & Wittmayer, 2016).

However, there is still a serious lack of substantive and integrated analysis of how agency can be interpreted at niche level as contributing to the formulation and outcomes of the niche environment. It is exactly this paucity of analysis that this thesis aims to address. This type of analysis requires an appreciation of the political setting described above and a nuanced conception of the redistribution of risk and reward within the niche environment before it is ready to 'break through' into the broader socio-technical system. Smith and Stirling argued that there is a need for greater appreciation of the 'internal' methods of governance that moves away from top-down management. Moreover, the artificial removal of the governance subject from the unsustainable object (the socio-technical system) provides a simplified explanation for the functions of governance that neglects to engage with the more reflexive role of actor agency in communally constituting socio-technical systems (Smith & Stirling, 2007). This type of analysis also requires an appreciation of the nature of actions and reactions and differentiates between first order reflexivity (the unintended consequences of action) and second order reflexivity (the critical responses to action that evoke agency and direct reaction) (Grin, 2012). Lastly it requires a pluralised understanding of the dispersion of power between actors that does not search for command control chains of causation in the flow of events but rather considers the reactive, counteractive and unpredictable nature that the exertion of agency can assume within a socio-technical system and especially within the niche setting.

This chapter lays the groundwork for this analysis and introduces the theoretical terrain for analysis. In what follows, I continue this discussion through the introduction of the contextual arena in which this analysis took place: two niches within the electricity market of South Africa. This will be followed by an outline of the main questions answered in this thesis.

## 1.2 Introducing the Context

In South Africa, the addition of the global sustainability narrative is difficult to contend with as it competes with local issues such as the need for industrial growth and job creation, the unequal distribution of resources and a crucial connection between fossil fuel-based energy sources and the accumulation of wealth. The story of the South African electricity sector is one of increasing complexity in which positional relationships have translated into power and governance issues, interlinked with the addition of sustainable development goals, and thus an excellent terrain in which to observe the implications of sustainable socio-technical systems change.

The availability of technological alternatives to fossil fuel-based sources of electricity have spilled over from the global market, however in South Africa they have been used to counteract more than the harmful effects produced by a carbon dependent electricity system. They have been used to counteract the negative externalities produced by the electricity system and to guard against the failures of the system, including increasing electricity prices and sporadic faults in the system resulting in interrupted supply. The growing instability of the dominant regime has produced new tensions within the system and has also added to the existing social, political and economic tensions that exist in the broader South African context. This complex of problems has resulted in windows of opportunity for sustainable electricity developments and some of the problems with which the advocates of these developments have to contend.

### 1.2.1 The Centralised Procurement of Renewable Electricity

Various efforts at diversifying the electricity mix of South Africa and increasing the amount of sustainable electricity technologies within the system has emerged in policy and practice since the late 1990s. This type of deliberate governance, guided by the normative goal of sustainability through policy, has received a lot of attention in recent years (Unruh, 2002; Nill & Kemp, 2009; Geels, 2014; Raven et al., 2016). These studies have shown that the cognitive, normative and regulative routines of the regime sets boundaries for the development of the niche (Rip & Kemp, 1998). The

response of niche actors to the effect of the routines of the dominant regime has either been to fit-and-conform to the selection pressures at play, or to stretch-and-transform their own selection environments (Smith & Raven, 2012). These two niches within the South African electricity sector are examples of these two different responses to regime routines.

Fit-and-conform responses are studied by looking at the way in which actors have shaped the development of the Renewable Energy Independent Power Producers Procurement Programme. Despite various failed policy attempts at the inclusion of independent power producers and alternative sources of electricity into the South African energy mix, the procurement programme proved to be successful. This thesis tells the story of the niche that formed as a result of the procurement programme between 2014 and 2016. The Independent Power Producer (IPP) office is viewed as fit-and-conform response empowering actors, as the success of the programme required that it exist parallel to the dominant regime. The timing of the programme was telling to its success - amidst global sustainability debates and local electricity shortfalls, the actors within this niche were able to utilise a window of opportunity, a temporary pardon from the dominant regime. This case study reveals insights about the necessary misalignment within the dominant regime that created the windows of opportunity for the niche to exist. It also provides insights into the interplay between policy and regime actors. Crucially this case study sheds light on the types of alignment that need to happen for fit-and-conform empowerment to succeed. Studies in this regard have suggested that diversification of the electricity mix of a country that has for a long time functioned as a centralised electricity system should include long-term planning rooted in the goal of carbon reductions rather than short-term concerns about the introduction of competition into the market (Woodman & Baker, 2008). To a certain extent this has been captured in the policy landscape of the South African electricity transition, however these normative goals have not necessarily translated into the longevity of efforts, like the procurement programme for the country because of the different levels of appreciation that exists between actors in the system.

### 1.2.2 Local Level, Decentralised Sustainable Electricity Developments

The organisation and influence of various actors and decision-makers at local levels of government have become a critical focus in sustainability studies. There is a growing consensus among policy-makers and sustainability advocates that embedded, bottom-up solutions potentially hold more affective sustainable potential than top-down, centrally focussed solutions because the former include the reformulation of cultural, economic and social practices captured in the everyday lives of consumers and producers (Fudge, Peters & Woodman, 2016: 2).

The selection pressures associated with sustainable energy transitions have mobilised local authorities to become active participants in the processes of energy and electricity governance. Findings from studies conducted in the United Kingdom (UK), for example, have highlighted the dynamics around the creativity, innovation and agency that lies with local authorities captured in different aspects of low carbon agendas within the country. These dynamics suggest an ever more complex relationship between the niche and regime level than that observed by the MLP (Fudge, Peters & Woodman, 2016: 14). Fudge, Peters and Woodman found that the role played by local level government in the UK in energy governance derive mainly from enhancing the services that they are already delivering, enhancing the strategic role that they are already playing in the energy landscape and in interfacing with national government towards the successful implementation of standards set by national government. In this way, they view the role of local government as an intermediary actor between local and national government (2016).

The Western Cape province is a South African example of where local-level government has actively become involved in the governance of electricity. This case study comprises two chapters of this thesis, one focussing on the 'steering governance' that takes place within this niche (Chapter 6) and one focusing on the 'rowing governance' that takes place within this niche (Chapter 7). The developments within this niche are stretching-and-transforming the rules of the dominant regime. Boundaries are created for niche actors by the path-dependent rules of the dominant regime, however the activity that takes place in the spaces between these boundaries is one of the main issues dealt with in Chapters 6 and 7. These chapters, especially Chapter 7 also considers the role that intermediary actors play in socio-technical niche development.

### 1.3 Outline

This chapter sought to introduce the study that is presented in this thesis. The thesis is divided into eight chapters and proceeds as follows: in line with Chapter 1, the background for the study is dealt with in Chapters 2, 3 and 4. Chapter 2 lays bare the theoretical underpinning of the research by first considering the work that has been done from the Multi-Level Perspective and considering the main areas of interest and elaboration for this research. The overarching question that this research aims to address is: **How is agency constituted in the niche environment of a transitioning socio-technical system, which enables the establishment and strengthening of alternate developmental pathways, and what are the implications for socio-technical transitions?** This question is rooted in the observation that the socio-technical transitions literature does not examine or offer a nuanced explanation for the role of human agency in the processes of transition. Further, the sub questions as shown below and as discussed in Chapter 2, explore areas that have been touched on in the literature, however, that have not been explored in depth in a developing nation. The sub-questions are identified in Chapter 2 as areas for elaboration and research toward answering the main research question. The sub-questions are as follows:

- 1) At niche level, which are the categories of actors that can be differentiated?
- 2) What methods do actors use in niche environments to exert power?
- 3) Under what conditions do actors contribute to the formulation and strengthening of developmental trajectories within niche environments?
- 4) What are the conditions for ‘rowing’ and ‘steering’ within the niche environment?

A heuristic framework of agency typologies is developed in Chapter 2 toward answering sub-questions 2 and 3. For the rest of the sub-questions, this chapter introduces the theoretical progress that has been made in attending to these questions. Often these conceptualisations of different concepts and issues have been regime bound or considered to be system wide occurrences. One of the objectives of this study is to consider these occurrences with particular reference to the niche and to compare my findings with that of more generalised studies.

Chapter 3 focuses on the methodological process that this research followed. The study is qualitatively orientated and utilises a combination of adaptive theory and collective case study methods. This chapter also discusses the difficulties of case selection and procedures of data gathering and analysis.

Chapter 4 provides a background for the selected case studies. It engages with the historical relevance of electricity in South Africa and considers politico-economic trends that have emerged from the South African electricity market, such as the minerals-energy-complex. It also tells the story of the struggle of introducing new participants and new forms of technology into the electricity market of South Africa and considers various political and regulatory shifts that have taken place in this context. This detailed historical background proves to be incredibly relevant toward understanding the interaction of actors in and around niches today.

Chapters 5-7 provide the substantive analysis of the research questions posed. The substantive chapters each focus on a different modality of governance. The first two substantive chapters focus specifically on two modalities of ‘power giving’, or ‘steering’: fit-and-conform empowerment (Chapter 5) and stretch-and-transform empowerment (Chapter 6). The final chapter focuses on ‘power taking’ or ‘rowing’ governance (Chapter 7). Sub-questions 1-3 are posed in each of the substantive chapters toward a comparative analysis of the differences between governance in stretch-and-transform and fit-and-conform niches. These differences are then further contextualised by addressing sub-question 4 in each substantive chapter, specifically focusing on ‘steering’ governance in Chapters 5 and 6 and ‘rowing’ governance in Chapter 7.

Chapter 8 draws together the findings of this thesis and reflects on the broader implications of these findings for socio-technical transitions literature. This chapter also revisits some of the broader theoretical debates in the literature first brought up in this chapter and in Chapter 2. Various studies that precede this have concluded grand narrative explanations for how change takes place in socio-technical systems. This thesis challenges the explanatory power of these neat frameworks of change in complex systems. As such the findings presented in the substantive chapters of this thesis and in Chapter 8 fail to give a complete account of how change takes place in

socio-technical systems. It does however fill in some gaping holes that have been consequent oversights of holistic type theorising. Some of the proponents of the Multi-Level Perspective are challenged, such as the problems of large categorical boxes for the actors within socio-technical systems and the *lacuna* that exists for analysis of the formation of niche level rules. One of the most important challenges that this thesis poses to the Multi-Level Perspective lies in pulling apart the perceived dichotomy between niche and regime environments. I show that there are a multitude of niche reactions and interactions that take place beyond the interactions of the niche with the regime, and that often the regime merely provides the boundaries of action for the niche. The Multi-Level Perspective has engaged with the ways in which the niche contests or acts around this boundary, however it has neglected to take account of the interactions and outcomes that take place in the spaces left untouched by the regime boundaries.

## Chapter 2

### A Theoretical Understanding of Agency in the Niche Environment

#### 2.1 Introduction

There are a variety of theories that provide insights into how change in socio-technical systems might occur. Historical parallels are frequently drawn in the literature, for instance, both between the ‘big’ transitions, such as the Industrial Revolution (Leggewie & Messner, 2012; Schmitz, 2016) and the Neolithic Revolution (Leggewie & Messner, 2012) and to a lesser extent, from ‘small’ examples, such as concerns with cultural appropriation. Studying change in complex systems requires that the observer pay careful attention to the relationships between objectives of the various aspects and actors of the system as a whole; rather than empirically ‘dissecting’ segments thereof.

This idea has been developed in modern transition theories, theories of evolutionary change and theories of systems change. The central analytical framework built on by this study will be the Multi-level Perspective on Socio-Technical Transitions, which was developed to aid understanding the shifts in regime structures of large systems toward transitions (Geels, 2002, 2005c). The Multi-Level Perspective (MLP) has been applied in various studies that centre on transitions within electricity sectors (Geels, 2002; Geels & Kemp, 2007; Verbong & Geels, 2007).

Perhaps before delineating the basis for my enquiry into complex socio-technical systems it might be good to establish some of the known limits in any study of complex systems or their elements. A complex system is more than the sum of its parts, it cannot be reduced to analytical integers or to its constitutive parts, and as such, all of the parts of a complex system cannot be known. Thus, as the subject is not independent of the whole, not a free-agent making decisions irrespective of the whole, it too can be regarded as a complex phenomenon in itself (Cilliers, 2002: 80).

*Meaning* then is created through dynamic interaction between the elements of a complex system, it is not something complete or abstract but rather is historically

created through open systems. That is to say that meaning is created across the boundaries of systems and only exists in specific times for specific contexts. This is important because if one considers that an infinite number of interactions have to be considered in order for something to have meaning in a complex system, then the production of meaning would be indefinitely postponed.

But this is not the case; meaning is generated in real time, only through the consideration of some components as opposed to others. Reducing complexity by limiting the boundaries through which we establish meaning is the only method at our disposal for understanding complex systems and the reactions that take place within them (Cilliers, 2002: 80). This realisation does not mean that attributing meaning in the study of complex systems is a useless exercise, rather that we must face the limitations of such a study and presuppose that, extracting meaning from the elements of a complex system by setting limitations to the number of factors considered could also have been considered in light of other factors and new limits. As Cilliers explains: *“The study of complexity, in other words, is not going to introduce us to a brave new world in which we will be able to control our destiny; it confronts us with the limits of human understanding”* (Cilliers, 2002: 77).

This chapter will begin with a review of the MLP on Socio-Technical Transitions, with the first section highlighting the important aspects of the theory upon which this dissertation aims to build. This will be followed by a discussion of the work that has already been done towards elaboration and refinement of key concepts and conceptualisations toward better understanding the role of actors in governing niche spaces. The chapter will end with a discussion of questions of ‘power giving’ and ‘power taking’, and the creation of rules in the niche space.

## 2.2 Key Concepts of Regime Change in the Multi-Level Perspective on Socio-Technical Transitions

Geels defines a socio-technical system in its functional sense, as a system depending on the linkages between elements necessary to fulfil societal functions. Social groups maintain and reproduce the elements and links within the socio-technical system while rules guide actions of social groups and actors (Geels, 2005a: 449). The groups

within a socio-technical system have relative autonomy and share specific characteristics, such as language (jargon), problem agendas, norms and preferences. Thus there is coordination within the social groups that exist in a socio-technical system.

The configuration of social groups in the socio-technical system is the product of historical processes of differentiation. The chains of social groups lengthen over time. In the last two centuries, production and consumption are not as close together as they used to be. Knowledge, capital and labour were often situated in a single producer, which is often not the case today due to efficient low-cost transport and mass production methods. Different groups form networks of interdependencies which means that they need to give up some of their autonomy and align themselves with other groups (Geels, 2004: 901).

The MLP looks at shifts that take place within socio-technical systems by considering change on three conceptual levels (Geels, 2005: 449): The niche; the socio-technical regime and the socio-technical landscape.

This perspective emphasises that the elements and linkages of the socio-technical system do not exist autonomously. They are created and perpetuated by the actions of social groups and the environment within which the socio-technical system functions. Actors align themselves according to specific rules and established practices within the system. Rules are cognitive routines that are either reinforced or changed through action. A semi-coherent set of rules is a regime (Geels, 2005: 449). Technological regimes have a coordinating effect and because of this, function with relative stability. This is however not stationary as incremental advances are to be expected along the established technological trajectory of the regime.

### 2.2.1 The Regime

Nelson and Winter (1977) first referred to technological regimes in reference to the cognitive routines of a shared community of engineers that guided their research practices and activities. The term was used to indicate the search function that guided development in a specific socio-technical system. Rip and Kemp broadened this

definition of technological regimes by including not only the cognitive routines but also a wider sociological category of rules. According to them, a regime is a rule set embedded in practices and institutional environments. They are the outcomes of previous changes and subject to change in the future (Rip & Kemp, 1998). This coherent set of rules materialises in the form of production processes, technologies, user practices and search heuristics.

This conception of the regime has been extended under the Multi-level Perspective to include broader social and institutional systems that are intertwined with technological systems as the socio-technical regime. In terms of the Multi-level Perspective, socio-technical regimes are viewed as the so-called semi-coherent 'deep structure' that holds in place a stable socio-technical system (Geels, 2011: 27).

Conceptualising the rules of a regime as semi-coherent indicates the distinction between a complicated system and a complex system. If a system can be dismantled and re-assembled to function in exactly the same way (for example a motor vehicle with various complicated interacting parts) then the whole is the sum of its parts. When considering the functionality of a complex system, such as a regime, the whole can never be considered to be the sum of its parts. This, as I indicated at the beginning of this chapter, is why the rules, or meaning, ascribed to such a system can never be considered as completely coherent, all-encompassing or complete.

This semi-coherent set of rules is Geel's delineation of the parameters of a complex system within its context, in such a way that it can be studied. It places the regime in focus as the meso level of a socio-technical system (Geels, 2005a: 450). And this enables scholars to view the technological trajectories that are created by this level. These technological trajectories are the result of cognitive routines between various actors within the socio-technical system (Geels, 2002a).

Regimes remain in place because of constant reinforcement and the strengthening of pathways. Strengthening of existing socio-technical pathways happens through the legally binding contracts, laws, routines, best practices, life style and user preferences, institutional arrangements and regulations, social relationships, market control, political lobbying, investments and established capabilities. Interdependent markets

form when regimes become established and mutual role expectancies are created. The multitude of stabilising factors that contribute to the prosperity of a regime makes it hard for radical innovation to take place because stable regimes are characterised by ‘lock-ins’ (Geels, 2011: 27). The lock-ins mean that innovation occurs incrementally with micro readjustments that lead to stable developmental trajectories over time.

#### 2.2.1.1 Regime Dynamics and Interaction

Geels distinguishes between the types of interactions that are to be found in socio-technical systems, between actors and institutions/rules that guide actors (Geels, 2004: 902). Actors reproduce the elements and the linkages in a socio-technical system. Perceptions and interconnections of actors are guided by rules. However, actors are not powerless in the process of rule production. Rules are reproduced and enforced by the actions of individuals, companies, other actors and other elements within the socio-technical system. Rules can also be embedded in the nature of artefacts. Technologies have a certain hardness that is difficult to bypass, as they cannot be shaped at will (Geels, 2004: 904). There are three inter-related analytic dimensions: rules or institutions, the socio-technical system, and actors.

Geels proposes viewing the function of institutions as rules, to avoid confusion between institutions and public organisations (Geels, 2004: 904). He distinguishes between regulative, normative and cognitive rules: regulative rules are explicit formal rules such as state law; normative rules are values, norms, and role expectations; cognitive rules are the way we make sense of the world through mechanisms such as symbols and ideologies.

Rules do not exist autonomously, they are organised into rule systems. Regimes can be viewed as semi-coherent rule systems that are linked together. It is hard to change one rule without affecting other rules. This alignment is what gives stability to regimes. Societal groups consist of actors that share a set of rules for a regime. As different groups share their specific rules, we may distinguish different regimes (technological, design, policy, science etc.) (Geels, 2004: 905).

The dynamic interactions between rules-regimes, actors and systems can be observed between rule-regimes and actors in two feedback loops: first, social learning, meaning the sociological and institutional dynamics and the reproduction or transfer of cognitive, normative and regulative rules. Secondly, actor structuring can be observed as the interactions between actors affecting their positions and relationships. (Geels, 2004: 908). The dynamics between actors and systems are more circular as socio-technical systems are maintained and changed by the activities of the actors that inhabit them; conversely, the actions of these actors are also shaped by the system. Social interaction in the system is not necessarily harmonious but most often requires some level of bargaining or anticipation of the other parties' 'next move'.

#### 2.2.1.2 Core Alliances within the Regime

In his later work, Geels (2014) introduced concepts of politics and power into the MLP by looking at the resistance of incumbent regime actors to deep structural changes in socio-technical systems. This, in reaction to three core criticisms of the perspective: first, the MLP was criticised for not giving enough attention to the role of power and politics in socio-technical transitions; secondly, as most transition scholars focus on green innovations, existing regime actors are given less attention and are often viewed as barriers to overcome; and thirdly, the stability of existing regimes are conceptualised as path dependencies and lock-ins, and characterised in studies as factors providing inertia. This portrays their stability in a somewhat automatic light, which neglects the finer nuances of fluid regime functioning (Geels, 2014: 23).

In relation to the issue of politics and power being under-theorised by the MLP, Geels suggests borrowing some insights from political economy studies. The main argument here is that policy-makers and incumbent actors can often be seen to form 'core alliances' at the regime level specifically aimed at maintaining the status quo of the dominant regime. The power of actors in maintaining regime dynamics have been studied by other theorists, most notably by Gregory Unruh (Unruh, 2000, 2002; Unruh & Carrillo-Hermosilla, 2006). He conceptualised various shapes that these alliances could take including: the techno-institutional complex and carbon lock-in. The techno-institutional complex represents the linkages found between technological systems and institutions feeding off one another in a self-reinforcing cycle. These

complexes come about because of the coevolution in socio-technical systems that provide increasing returns, which results in techno-institutional infrastructure and provides incentive structures that guide the development and focus of the market (Unruh, 2000: 826). Carbon lock-in represents the self-reinforcing barriers created by the techno-institutional complex that inhibit policy action toward sustainable development, even in the face of solid scientific counter arguments relating to price, performance or the harmful effects of carbon-heavy fuel sources (Unruh, 2002:319).

Policy-makers and central regime actors tend to become reliant on one another. Governments support the shaping of a socio-technical system but also determine the rules of exchange and determine corporate structures by setting the boundaries of legal corporate action. Geels suggests that there are at least three ways in which companies influence policy-makers: first, through the close interpersonal relationships that are born out of the networks that exist between big business and senior policy-makers, secondly, through the frequency of contact that exists between large firms and policy-makers might lead policy-makers to internalise the ideas and interests of industries. Lastly, firms use corporate political strategies in order to influence policymakers. This can include direct approaches, such as litigation strategies and lobbying or more indirect strategies such as financial investments and organised pressure.

### 2.2.2 Tenacity of the Regime

There is general consensus over the axiomatic structure of lock-in creation. Central to this understanding is the role of historical occurrences in creating developmental trajectories within socio-technical regimes. Theorists of path dependency have reached consensus on the fact that contingency and small events culminate at a critical juncture where positive feedback loops are created in the system (Arthur, 1989). These positive feedback loops are reinforced over time and are viewed as path dependent, which locks a system into a specific developmental trajectory. Systems are also stabilised because they are embedded in society and have become part of the alignment of heterogeneous elements (techno-institutional complex and techno-economic network concepts highlight this). This make them 'blind' to the possibilities of pursuing developmental avenues (Geels, 2011: 27).

The lock-ins mean that innovation occurs incrementally with micro readjustments that lead to stable developmental trajectories over time. Radical change usually takes place outside of the regime level, at the niche level according to the Multi-Level Perspective. The tenacity of regimes complicates the process of introducing new technologies, even when the regime has deteriorated to a certain extent or significant landscape pressure has resulted in windows of opportunity.

One of the ways in which regime members actively resist change is through the adoption of different types of framing. Geels distinguished three framing dimensions (Geels, 2014: 29): diagnostic framing determined by the identification and definition of problems; prognostic framing moves toward solutions for problems, while motivational framing sets forth a rationale for action. This indicates that the structural, financial and habitual dependencies that form in a regime are not the only factors preventing change, but rather that regime actors actively resist change and exert their power in this way.

## 2.2 The Socio-Technical Niche

The primary space for radical innovations to develop within the socio-technical system, according to the Multi-Level Perspective, is the niche environment (Geels, 2005: 449). Niches are the incubation rooms in which innovations that go against the grain of the dominant regime can grow. Niche developments have low technological performance and development within a niche tends to be slow and costly (Geels, 2002: 1262). The term ‘niche’ does not denote the development of a technology or practice in secret, away from the dominant regime, but rather conditions in which the time and funds have been created for novelty. At its core, a niche allows actors to act in ways that contradict dominant market trends, and in so doing develop what could become a successful new market or ultimately alter an existing one. Look for example at the rise of Airbnb. A simple internet application allowed actors to utilise space and skills that they already had, toward the alteration of an existing market. The business model has become so disruptive that it has started becoming a major source of competition for hotels and existing bed and breakfast establishments. The Airbnb service providers were able to develop their product in relative isolation of existing

industries as they offered a new product, that was at the start, not in direct conflict with existing businesses.

During the early phase, there is little stability to be found within a niche as the niche level lacks the supporting infrastructure, regulatory backing and consumer backing enjoyed by the stable regime (Geels, 2011: 27). There are three core processes in niche developments: first a process of articulation and adjustment of expectations of the niche actor through which external funding for early development is sourced. Secondly, the process of formation of social networks in order to expand the resource base of the niche development. Lastly, there is a process of learning and articulation (Geels, 2011: 28). The alignment of different developments between different levels is greatly emphasised by the multi-level perspective. This is important for the conception of the niche because it determines the types of outcomes that will be generated by a niche. If landscape pressures come about at a time when niche innovations are not developed to a critical point, the outcome of niche-regime-landscape interactions will look different from the interactions that could come about if the niche has reached a level of stability and development (Geels & Schot, 2007: 405). Geels and Schot argue along the lines that there are some indicators of stabilisation of viable niche-innovations, making them ready to break through: 1) A dominant design has been crystallised through the stabilisation of learning processes. 2) Powerful actors form part of the network that support the innovation. 3) Price and performance improvements have occurred and there are further improvements expected. 4) The innovation is used in market niches, which amount to around 5 per cent of the entire market (Geels & Schot, 2007: 405).

### 2.3 The Socio- Technical Landscape

Wider aspects of society that impact on socio-technical systems have been termed the landscape (Geels, 2005: 451). These are the material aspects of society (such as infrastructure) and those things that are beyond the immediate control of the actors within the system. The socio-technical landscape forms gradients along which action is forced to happen. The relevance of landscape pressures is twofold: first it impacts on the stability of the regime and it shapes the developmental trajectories of the regime. Secondly, landscape pressures could make it easier for niche innovations to

break through as these external landscape pressures can cause cracks in the regime that cannot be dealt with through incremental re-adjustments.

## 2.4 Pathways of Transition

The term *Socio-technical Transition* denotes deep structural changes involving reconfigurations of policy, technology, infrastructure, social behaviour and scientific knowledge within a system such as water, energy or transport (Geels, 2011: 24).

Earlier work on the multi-level perspective considered transition in a somewhat linear fashion (Geels, 2005: 451). Geels and Schot (2007) later discussed different transition pathways in more detail, slightly deviating from the deterministic, somewhat linear process described in earlier works. They found four types of transition pathways: transformation; reconfiguration, technological substitution and lastly de-alignment and re-alignment. They suggested in this work that different types of alignment lead to different transitional pathways, and formulated this typology based on combinations of timing and the nature of multi-level interactions to reflect this phenomenon.

### 2.4.1 Transformation

When moderate landscape pressure is exerted at a time when niche innovations are not yet sufficiently developed, the regime will respond through the modification of the direction of developmental paths and activities regime (Geels & Schot, 2007: 406). The main actors involved in this transitional pathway are usually regime actors and external groups such as social movements. External actors voice criticism about the problems of the dominant regime and incumbent regime actors adjust the rules of the regime in response. Landscape pressures can only exert an influence on the dominant regime if they are observed and acted on by regime members. Often, regime actors are blind to negative externalities produced by regime problems. Here outside actors are important: they translate and draw attention to the landscape pressures involved and in so doing force regime actors to respond. This is however not an immediate response and usually involves contestation and power struggles. Therefore, social institutional dynamics and evolutionary dynamics are important: regime actors

use their adaptive capacity to change developmental trajectories. Technical variations then occur and the regime is changed from the inside out, based on the best fit among the novel mutations. Thus the social and institutional changes and evolutionary changes reinforce one another and new regimes grow out of old regimes through cumulative readjustments. Here niche innovations tend to add to the regime rather than disrupting its internal architecture.

#### 2.4.2 Reconfiguration

When symbiotic innovations, which are developed in the niche, are initially adopted to solve problems within the dominant regime, subsequent adjustments are triggered in the architecture of the regime (Geels & Schot, 2007: 411). The main actors involved in this transitional pathway are regime actors and suppliers. Regime actors use component innovations developed by new suppliers, which creates competition between new and old suppliers. The adoption of symbiotic innovations into the dominant regime are usually based on economic considerations and they usually end up solving small problems, leaving most of the rules of the regime intact. When the advances result in the general architecture of the regime remaining unchanged over time, then the transition happens along a transformation pathway rather than a reconfiguration pathway. However when the changes snowball into new elements in the regime as actors learn more about novelties over time, then it can be considered as a reconfiguration of the dominant regime. Transitions are not caused by the breakthrough of one technology but rather by the breakthrough of various component innovations.

#### 2.4.3 Technological substitution

When larger landscape pressure takes place at a time when niche innovations have sufficiently developed, the niche innovations will break through and replace the dominant regime (Geels & Schot, 2007: 409). The main actors involved in this type of transition pathway are incumbent firms and new firms. New firms develop novelties that compete with existing firms. Here radical innovations have been developing and stabilising for some time in niches but could never break out because of the existence of a stable regime. Without the presence of landscape pressure, this becomes merely a reproduction process. Reproduction occurs when a regime remains stable. Problems

may exist but regime actors have confidence in the ability of the regime to solve these. Niche innovations might also exist but the regime is too strong for them to be a threat. Only once disruptive change occurs, will a window of opportunity be created for niche innovations to break through. If a new technology replaces an old one, this leads to knock-on effects and wider regime changes, thus wider evolutionary processes follow technological substitution along this transitional pathway.

#### 2.4.4 De-alignment and Re-alignment

If larger landscape changes occur suddenly and in a divergent manner, then increasing regime problems cause regime actors to lose faith in the dominant regime, which leads to de-alignment within the dominant regime. If niche innovations are not developed sufficiently at that point in time, there is no clear substitute. This type of situation often results in the creation of multiple niches that co-exist and compete and eventually, one niche innovation becomes dominant, forming the basis for the re-alignment of the new regime (Geels & Schot, 2007: 408). The main actors involved in this type of transitional pathway are the new niches actors. Here divergent landscape pressures lead to the hollowing out of the regime and eventually leaves a vacuum as the rules of the regime begin to erode, research and development stops and support of the regime disappears. It is this lack of rules that leads to the exploration of multiple niche-innovations. Broad evolutionary processes either precede or co-occur with technological change.

#### 2.5 The Role of Agency in Different Transitional Pathways in the Multi-Level Perspective

In later works, Geels, Berkhout and van Vuuren recognised that this typology still pays little attention to agency and institutions. The influence of landscape developments depends, for example not only on the timing factor but also on the interpretation and mobilisation of actors. Another inconsistency that they found was in the characterisation of niche-innovations as disruptive or symbiotic - as this depends not only on the technological characteristics of the innovation but also on how such innovations are institutionally embedded (Geels et al., 2016: 897). Based on this they reformulated the typology, using the existing conceptual categories from

previous works: actors and social groups, rules and institutions, and lastly technologies and the wider socio-technical system. One of the aims of this reformulation was to develop alternate understandings for the way in which shifts between transition pathways occur, which they say depend less on external landscape pressures and more on shifting actor coalitions, the adjustments of rules and actor struggles. This also built on previous work under the MLP banner that delineated the assumptions about agency held within this theory. MLP allows for two strands of the ways in which the ground-level logic of inter-personal relations between actors can be related to the macro MLP logic. The first elaboration is found in the metaphor of socially embedded games and the second example is found in the link made between agency and field-level trajectories (Geels et al., 2016: 897).

### 2.5.1 Strategic Games

Geels has likened the actions and reactions of actors in socio-technical systems to moves in a game, in which the rules are developed as the game is being played (Geels, 2004b: 908). The game is comprised of rules and regimes and played by a diverse actor set, with each individual actor and each group of actors having their own understanding of the game and their own aims within the game. This game is not a unilateral process with various rounds of development, including research and innovation, the introduction of technologies to the market and the development and altering of regulation and policy. This view of action and agency is similar to the Foucaultian notion of power and action. Power is seen as not only found in the relationship between people, it is also the way in which certain behaviours modify others. It is, according to Foucault, 'an action upon an action' (Foucault, 1982: 788). The relationship of power then is a mode of action, not necessarily aimed directly at others, but one that prompts a reaction from them. Foucault's conception of power is productive rather than being prohibitive; it enables us to view power and agency very broadly at various scales, secured in the notion of *micro practices* between social beings in modern society (Fraser, 1989:18). Power is then always understood in relation to knowledge as knowledge is the vehicle through which power is communicated and transmitted and in so doing frames the social world.

The socio-technical system is comprised of a number of these strategic games between actors and firms, between firms and firms, between firms and groups and

within groups and firms. And different groups and individuals have different levels of power in the transactions of the game (Geels, 2004b: 909). The relevant power that an actor holds in the game is derived from their resources and the way in which their interests are aligned with the interests of other actors. The moves that actors make have an effect on the rules of the game, i.e. they shape the sector. Because there are multiple games taking place at once in socio-technical systems, these games or strands of development co-evolve. This means that rule systems, actor groups, material networks and innovations all co-evolve.

### 2.5.2 Agency and Field-level Trajectories

A trajectory within a socio-technical system can be viewed as a sequence of events made up of four successive mechanisms: the structural conditioning of actors in the system by rules and institutions; other social interactions between the actors; structural elaboration where rules and instructional shapes are reproduced; and lastly the acceptance and retention of rules and institutions through externalisation. Thus the MLP takes account of the continuous efforts by actors in the reproduction of even seemingly stable developmental trajectories (Geels et al., 2016: 897).

### 2.5.3 Reformulation of the Multi-level Perspective's Conception of Transitional Pathways

Both the transformation pathway and the substitution pathway were reformulated and better differentiated based on possible combinations of mechanisms of change for actors, institutions and technologies. The reconfiguration pathway and de-alignment/re-alignment pathways were also slightly reformulated (Geels et al., 2016: 898).

Geels et al. proposed that actors should be further defined under the substitution pathway as including not only new firms that act in the Schumpeterian pattern in their struggle against existing firms but also from incumbents that are diversifying from other sectors. With regards to institutions, this pathway may follow one of two patterns. The first is when innovations outperform existing technologies and in so doing disrupt the system with little institutional change. This is also called fit-and-conform innovation (Smith & Raven, 2012). The second pattern is what Smith and

Raven call stretch-and-transform innovation. This is when institutional change occurs to support niche innovations.

For the transformation pathway, they suggest further differentiations of technologies, actors and institutions. First, they aim to move past the dichotomy often deduced from the MLP that incumbents are responsible for incremental advancements and new entrants for radical innovations. Instead they say that it is possible for incumbents to also reorient themselves strategically toward radical niche innovations and that these incumbent reorientations can differ in depth depending on the kinds of organisational elements that are adjusted. The organisational elements that can be adjusted are: search routines and operating procedures; economic positioning strategies and technical capabilities and lastly, beliefs, identity and the business models of institutions. With regards to technology, they include not only incremental change in the existing technology, but also: 1) competence additions (creative accumulations), which is the integration of new knowledge into existing regimes, and 2) reorientation, which could be a gradual shift toward new technologies, often through defensive hedging, diversification and later full reorientation. The speed of the process is dependent on the strength of socio-political pressure and market opportunities. The depth of reorientations is associated with the degrees of institutional change and often involves struggles between policymakers and industry actors.

To the reconfiguration pathway they added that new alliances between incumbent actors and new actors could be involved in the transitional pathway. They also added that niche innovations could initially be incorporated as add-ons to existing technologies but then result in unintended problems or opportunities that trigger innovation cascades (Geels et al., 2016: 899). Regarding the de-alignment and re-alignment pathway they noted that transitions research has not yet paid sufficient attention to the role of large shocks, such as wars, in bringing about socio-technical change. Overall, this collaboration of authors also took cognisance of the fact that transitions are non-linear processes that depend less on external landscape change (as suggested in earlier works) and more on endogenous enactment within a sector.

## 2.6 Actors, Networks, and the Co-evolution of Socio-technical Systems

The evolutionary approach to studying innovation and transition in large socio-technical systems, focussing on uncertainty and institutional complexity has been adopted by most modern theories of socio-technical transition and innovation. Examples can be found in: the Multi-Level Perspective on Socio-technical Transitions (Schot & Geels, 2007); Innovation Theory (Greenacre, Gross & Speirs, 2012); Carbon Lock-in Theory (Unruh, 2000); the Transition Management literature (Loorbach, 2010); Sectorial Systems of Innovation (Malerba, 1999) and the work on Strategic Niche management (Rip & Kemp, 1998). The central idea of Darwinian evolutionary theory maintains that variation takes place and is followed by selective retention. These three elements: variation, selection and retention form the basis for evolutionary theories of technological change (Schot & Geels, 2007: 609). Modern evolutionary economists have argued that firms innovate in order to fill new market niches, and that while coexisting niches focus on specific functionalities, they are all part of larger socio-technical regimes.

The influence of evolutionary theory on the MLP derives from the work of evolutionary theorists such as Nelson and Winter. Nelson and Winter, faced with the issue of understanding complex systems of innovation, said that if we wanted to incorporate seemingly disparate segments of knowledge about these systems into a single study, we have to take into consideration the evolutionary nature of innovation. This means taking account of the uncertainty and disequilibrium of the innovation process (Nelson & Winter, 1977: 49). Instability, in short, is a fundamental feature and functional requirement of a complex system.

Technological advances often seem to have a mind of their own, an inner logic. Often, action cannot be described as a fine-tuned response to demand and market pressures, especially in rapidly changing markets. Action often seems to follow a 'natural trajectory'. This natural trajectory does not fit neatly with economic logic; however, Nelson and Winter say that it is still possible to study this flow of events. These trajectories are most often specific to a particular technological regime, where the regime relates to the cognitive processes of the 'technician' about the feasibility and practicality of a product (Nelson & Winter, 1977: 57). Development and expectation

are the function of a dynamic relationship, itself understood within the parameters of a larger episteme, which is underwritten by the ontological idea of development as a positive occurrence.

These cognitive processes are part of the evolutionary logic, as they determine what can and cannot be selected, and have more relevance than the actual economic or technical viability of an innovation. Thus, one cannot neatly divide up and study the processes of invention and market implementation, given the amount of uncertainty that goes into both of these processes. And one cannot regard the actions of actors as purely logical, as all of the above takes place within a 'selection environment' that determines how the usefulness of technologies evolves over time (Nelson & Winter, 1977: 61).

## 2.7 Agency in the Niche: Key Questions and Debates

### 2.7.1 The Categorization of Actors in the Socio-technical Environment

The categorisation of actors by the MLP perspective is somewhat limited. The theory takes cognisance of the fact that groups within socio-technical systems have both their own internal dynamic and form part of the dynamic of the system through the enactment and formulation of rules and through interconnected networks. However, very little concrete attention has been given to the assignment of different categories to different actors. This is because the dynamic interactions observed by the MLP are predominantly between the three conceptual levels. The relationship between high-level categories of actors has been considered by MLP theorists, for example the relationship between 'incumbent actors' and 'policy-makers' and the relationship between 'niche actors' or 'innovators' and 'regime actors'. It has been argued that the MLP does not allow for the definition of actors at its landscape level (Fischer & Newig, 2016: 6). With its large sweeping categories, such as external actors, regime actors, niche actors, incumbent actors and firms, the MLP generally allows for the comparison between different elements resulting in systems change rather than focussing on the effects that one element - such as a specific actor group - has on another. The question thus is, *at niche level, which are the categories of actors that can be differentiated?*

When taking into account the focal area of this study, the niche environment, I argue that this type of specification is not only advantageous, but also extremely necessary for understanding niche dynamics and that conclusions can be drawn from further sub-categorisation that will improve our understanding of the processes of socio-technical transition. Crucially, however, one must guard against the possibility of this type of categorisation becoming a reductionist exercise. That is by no means the desired effect of categorising actors; rather, I wish simply to define elements to be included for the extraction of meaning out of a complex system.

#### 2.7.1.1 Regime Membership

Regime members do not all look the same and their positions can never be regarded as permanent. One method of measuring and understanding regime membership is to look at the degree to which actors participate in the activities that reproduce the path dependencies within the regime (Smith, Stirling & Berkhout, 2005: 1505). Crucial in the determination of the development and perpetuation of a regime is not only the agency that rests in the core members (those who intensively contribute to the perpetuation of the regime) but also the norms and procedures governing their relationships and interdependencies.

This is complicated by the way in which non-core members provide inertia. This type of inertia represents a whole new power relationship, as the agency of these actors are not found within the legitimate structures within the dominant regime or within the possession of resources, but rather these external forms of authority and external resources bring new issues to the table, conditioning the structures of demand and supply in new ways. In order for non-core regime members to successfully bring about change, coalitions have to form that actively seek to change strategies, initiatives and power relationships in the existing regime (Smith, Stirling & Berkhout, 2005: 1505).

#### 2.7.1.2 Types of Actors

Avelino and Wittmayer developed a multi-actors perspective that functions as a heuristic framework for understanding shifting power relations between different categories of actors in sustainable socio-technical transition (Avelino & Wittmayer,

2016: 628). This perspective distinguishes between sectors (market, state, community, and an additional third sector, of which more further below) and between different levels of aggregation for actors in terms of sectors, organisational actors and individuals. This aggregation differs from the MLP’s functional aggregation of the landscape, niche and regime levels. It is an elaboration of previous attempts at vertical typologies of power (the governance perspective) to which they add a horizontal arm which allows one to analyse who exactly exercises power and how the disposition of power, cemented in actor configurations is arranged across different actors. The actor categories differ in relation to their being formal or informal, public or private and for profit or not-for-profit as represented in the table below.

**Table 1: Actor Categories**

	<b>Formal</b>	<b>Informal</b>	<b>For Profit</b>	<b>Not for profit</b>	<b>Public</b>	<b>Private</b>
<b>State</b>	x			x	x	
<b>Market</b>	x		x			x
<b>Community</b>		x	x			x
<b>Third Sector</b>	x	x	x	x	x	x

Incorporating these four categories of actors with the proposed aggregation differentiations between actors, allows them to address two important shortcomings of the current transitions literature: they address the bipolar view that categorises anything that is not immediately state related as civil society, and in so doing they allow for differentiation and specification when we talk about actors and the power of actors in the form of aggregation, where previously studies simply referred to actors or groups of actors.

Another group that could have a significant influence on the transitional process is intermediary bodies. These are organisations that operate between other actors or groups (Moss, 2009: 1482). These bodies can take a variety of forms. The concept resonates strongly with the ‘boundary institutions’ (Guston, 2001). The relationships

affected by boundary institutions are not static and often require hybrid forms of governance to succeed in multiple domains. Intermediaries include a variety of different actors with one role in common- their ability to mediate (Fischer & Newig, 2016: 10). They mediate between production and consumption, between levels of priorities including funding and regulation and between different ideologies or visions created (Hodson & Marvin, 2010: 6). Steyaert et al. described these actors as matchmakers, aligning two or more actors or groups of actors with one another (Steyaert et al., 2016: 3). These actors cannot be viewed as neutral participants in the transitional process as they actively engage in the various tensions that exist in a market (ibid.).

Of particular importance here is Avelino and Wittmayer's conception of the third sector. The third sector lies in between the three others and can occupy any of the categories of differentiation as indicated in the table. It is not simply a residual category but rather lies in tension between the other three categories. This includes actors such as intermediaries that were discussed earlier in this chapter, however it also includes sub-sectors, such as science. Science could then be viewed as an intermediary between state, market and community, crossing boundaries between private and public and acting for profit and not for profit. Here they argue along the same lines as triple helix theorists. The triple-helix relationship described by Henry Etzkowitz denotes the university-industry-government relationship as being interdependent, overlapping institutional spheres where the model has shifted from the state encompassing industry and academia. He has found globally that bilateral relations between governments, academia and industry has expanded into what can be considered a triadic relationship emerging from different starting points with the common purpose of stimulating knowledge-based economic development (Etzkowitz, 2002: 2). Etzkowitz found that new relationships are being established across institutional boundaries, creating hybrid organisations such as virtual incubators and centres of technology (Etzkowitz, 2002:11).

Avelino and Wittmayer suggest that our understanding of power relations between actors needs to be refined. Specifically, in terms of the MLP, assumptions about power relationships that underlie frameworks of transition needs to be crystalised- meaning that we need to delineate which type of sectors or actors are situated in

niches and in regimes (Avelino & Wittmayer, 2016: 638). While sectors themselves can be regarded in the same way that transition studies regard actors, they can also be viewed as discursive contexts in their own right or as institutional contexts with their own dynamics. When considering these categories and their interactions one can move from questions of who has more or less power in a study of agency, toward also understanding different types of power and how this affects interdependencies between actors over time (Avelino & Wittmayer, 2016: 644).

### 2.7.2 The Categorization of Developmental Trajectories within the Niche

With its large categorical boxes, one of the things that the MLP does best is describing developmental trajectories in socio-technical systems. The tenacity of the regime, as described earlier in this chapter, forms a solid foundation for understanding the change resistant attributes of socio-technical regimes. The transitional pathways put forward by the multi-level perspective have been discussed in detail earlier in this chapter. Even though the niche conditions in each case are considered, this is mostly in dichotomy with the regime. Interestingly enough, later works by Geels and Schot further elaborated these pathways through the characterisation of niche actors (as those bringing about radical innovation) and of regime actors (as only bringing about incremental advancement). And yet they do not elaborate on the sub-categories of niche and regime actors, which complicates this mission. Another aspect that is also under-theorised by the MLP is how different types of niches have different internal developmental trajectories. The MLP theorists do take account of these internal dynamics to some extent, but not in detail. What is made clear is that all niches have three core processes: the articulation and adjustment of expectations; the formulation of social networks, and lastly, processes of learning and articulation. In light of this shortcoming, one of the main questions that is posed by this thesis is: how do actors contribute to the three above-mentioned processes? Or rather: *under what conditions do actors contribute to the formulation and strengthening of developmental trajectories within niche environments?*

#### 2.7.2.1 Types of Niches and their developmental trajectories

In work not directly related to the MLP, Schot and Geels explored the use of the niche

concept for understanding radical change based on the work done by evolutionary theorists on the topic. Radical change, by their definition, is an alteration to the underlying structure that regulates technical changes, meaning a shift in the socio-technical regime. Change in the socio-technical regime means new pathways along which incremental advancements can take place, a shift in the dynamic equilibrium. They proposed that radical change is generated by four different evolutionary patterns and mechanisms: natural selection; punctuated equilibrium; market niche development; and technological niche development (Schot & Geels, 2007). They also found that the differences between niches lead to different outcomes based on their positioning within or outside of the socio-technical regime and the level of stability reached within the niche regarding the rules for design.

Natural selection is involved in cases where a variant in the regime's internal market niche links up with a selection criteria or trend in the socio-technical regime. The success of this variant might lead to replication and imitation and lead to tensions between regime actors and regime rules, which leads to alteration of the rules of a regime, which ultimately leads to the establishment of a new regime (Schot & Geels, 2007: 617).

Punctuated equilibrium denotes change that results from large-scale inventions that break through because of dramatic changes in the selection environment. Processes of incremental changes in niches, coupled with competition between niches leads to new regimes (Schot & Geels, 2007: 618). Market niche development in contrast denotes the development of big or small innovations in isolation from the mainstream market. Once stable enough this might diffuse to other niches and result in regime shifts.

Technological niche development denotes patterns where macro-inventions are applied in proto-markets created by a coalition of actors that want to test new technologies with the aim of producing new markets. These coalitions could be made up of both incumbent actors and new actors. Often these niches result in a few pilot projects and culminate in nothing more than niche gestation. However when these niches lead to socio-technical change one of the above mentioned patterns of development is followed.

Based on the patterns of evolutionary development found for niches, Schot and Geels distinguished four types of niches (Schot & Geels, 2007: 618):

1. Internal market niches - a niche that is highly stable but not very isolated from the dominant regime.
2. External market niches - A niche containing stable rules that builds on its isolation from the dominant regime.
3. Technological niches - an isolated niche with no stability.
4. Breakthrough niches - a niche that, despite not yet being at a good level of stability, is not isolated from the dominant regime because the regime is deteriorating.

#### 2.7.2.2 Properties of Niches

Smith and Raven (2012) focussed on how agency and politics play out in niche-based or protective spaces. Protective spaces in their framework exhibit three distinct properties that relate to socio-technical transitions: shielding, nurturing and empowerment. Shielding involves the protection offered by a protective space from the selection pressures that are at play. Nurturing involves the identification and development of path-breaking innovation in both passive and active ways. Empowerment involves the processes that help innovations to become competitive within unchanged selection environments or through processes that change the selection environment to favour path-breaking innovations.

They also distinguish between active and passive niches. Passive niche spaces are often the initial environments where selection pressures are felt to a lesser degree for contingent reasons, such as remote geographical location, for which an alternative to the dominant regime proves more fruitful, or a market that is willing to sacrifice price or other trade-offs that they deem more important. These generic spaces that pre-date the deliberate mobilisation of certain innovations still provide the shielding properties of a purposefully created niche. An active niche space is constructed through niche management interventions and include regulations, tax and tariff interventions on the supply side and quotas, public purchasing, information campaigns and market segmentation on the demand side.

### 2.7.3 Power and Agency in the Niche

According to Avelino and Wittmayer, the socio-technical perspective associates power with the rules that underlie socio-technical regimes. Socio-technical perspectives on transitions are concerned with power to the extent that it relates to struggles between individuals and groups, conflicting goals, conflicting interests and the hegemonic power that lies in the regime's ability to resist change played out by incumbent actors as discussed earlier in this chapter. Avelino and Wittmayer question the tendency of transitional scholars to equate regime dynamics (or power) to particular actors at the cost of other actors. According to them, this leaves little room to observe the fluid nature of power or the shifts in power that take place, because what more is a transition other than shifts in power (Avelino & Wittmayer, 2016: 632)?

Because the categorization of elements in socio-technical systems by the MLP focuses on umbrella categories, the theory doesn't really get down to discussing the micro-level methods that actors use to exert power and the differences that exist between power beyond the oppositional kind. However it must be noted that recent additions to the MLP have touched on this in recognising the importance of alliances, and that alliances could exist between actors that occupy heterogeneous groups, for example instances where incumbent actors strategically align themselves with external and/or niche actors toward 'transformation' transitional pathways. Again, in the light of this gap in research, another of the main questions posed by this thesis is: *What methods do actors use in niche environments to exert power?*

#### 2.7.3.1 Agency in Policy

Innovation scholars model technological transitions as long periods of incremental advancements followed by episodes of rapid change. Superior technological breakthroughs in these cases are seen as exogenous to the system. Even though there is empirical support for the affectivity of exogenous factors in bringing about transition, the magnitude of performance improvements required have been shown to be quite large (Unruh, 2002: 321). These types of developments generally do not come from within the dominant regime, as the natural inclination from those actors locked in by the dominant regime is to resist changes to the status quo.

One strategy of bringing about this type of change for policy-makers is to allow for development to happen within a special niche. This, however, might work for certain technology, but it will be challenging to find a niche for an entire technological system, and niche developments are only effective if they are allowed enough time for market conditions to mature (i.e., the threat of environmental degradation or other casualties is not so immediate) (Unruh, 2002: 321). The idea of using niches to foster the development of specific transitional pathways is captured in the Strategic Niche Management (SNM) concept. It involves the management of protected niche spaces for the development of technologies and often requires policy support: “*SNM is a strategy to escape lock-in by fostering learning processes and processes of socio-technical alignment.*” (Nill & Kemp, 2009: 672).

Another evolutionary policy approach is Transition Management (Nill & Kemp, 2009: 672). In terms of this approach the aim is to shift the production and consumption patterns within an entire system due to persistent problems, such as greenhouse gas emissions for which incremental advancements and reorientations will not suffice. Various pathways are explored concurrently to avoid lock-in to certain paths.

Time Strategies is yet another type of evolutionary policy intervention that might take place in socio-technical transitions. This approach takes into account that lock-ins may vary from time to time during the stable and unstable phases of transition and that political opportunities for intervention are dependent on the underlying dynamics of the system (Nill & Kemp, 2009: 673). Techno-economic windows of opportunity result in unstable phases of transition.

Three different windows of opportunity can be found and acted on by policy-makers: Windows of Preparation, where a feasible technology provides a solution to a problem in the dominant regime in order to stimulate technological diversity and develop solutions to become competitive. This is similar to Unruh’s End-of-Pipe policy solutions: End-of-Pipe (EOP) policy solutions are typically the first solutions that are sought to climate change issues that result from lock-in and tend to be those that affect the system in the least dramatic way. It usually takes the form of add-on

technology on the output side of the system and generally does not add much value to the system (Unruh, 2002: 318).

Secondly, Windows of Creation: where there is stronger social pressure on the state to act, it needs to balance the need for a quick solution with the need for long-term, viable market shifts. This is similar to Unruh's conception of Continuity Policy Approaches. If EOP solutions prove to be ineffective, the next step is usually incremental advances that function within the limits created by the path dependencies of the dominant regime and often includes component or intra-system advancements (Continuity Advancements). This means that a new technology is introduced within the framework of the existing dominant technology, using the same language, and same technological pathways, meaning that it fits neatly into the structures that already exist (Unruh, 2002: 318).

Lastly, when the dominant regime has become unstable the state can apply Windows of Utilisation Policies, through which they enact pressure on the selection environment (Nill & Kemp, 2009: 674). The last, and most radical option, according to Unruh, is discontinuity. This is similar to Windows of Utilisation Policies. There are some examples of this type of radical change, however this is not very common in large complex systems like electricity and transport. Technological choices often influence the nature of the policy response. As Unruh explains, renewable energy technologies can be connected to the existing grid in a continuity response or they can be made to function in a way that abandons the grid. Technological constraints are less of an obstacle for changing policy than those constraints created by techno-institutional lock-in. Thus the social component is harder to shift than the technological component (Unruh, 2002: 319).

The more change happens the more resistance to shifting policy will happen, which is why policy makers tend to opt for continuity shifts in order to minimise resistance to their initiatives. This holds two major issues: continuity change in policy is a scale dependent phenomenon. Even though these changes might not necessitate change in the entire system, they might still find that the components of the system that do need to change pose resistance. Unruh uses the example of

replacing internal combustion engines with fuel cells in automobiles. This will constitute continuity change for road users, however it will be discontinuity change for the manufacturers of those vehicles. Secondly, while continuity based change might lower the possibility of inertia in transition, there are important performance trade-offs that go apart with it (Unruh, 2000: 319). This is to say that often trying to fit a new technology into the dominant regime box is much more complicated than simply designing a new box, and it often comes with trade-offs in efficiency, complexity and performance.

Regulatory structures evolve and are shaped by similar process to those that shape regimes. Governance is exercised through relatively stable sets of norms and practices, much like a regime and “*the concept of governance accommodates the fact that state actors rely upon non-state actors in the formulation and implementation of public policy. Effective policy levers for regime transformation... cannot be decreed by states in isolation*” (Smith, Stirling & Berkhout, 2005: 1498).

Governance within the regime is carried out through processes of negotiation between various actors. Major impulses for change will seldom succeed because of the fact that they often represent uncoordinated interactions between shifting selection pressures and struggling adaptive capabilities. Smith, Stirling and Berkhout argue that more attention needs to be given to the context in which regime transformation takes place, meaning that both the nature of the regime and the specific features of governance need to be taken into account.

#### 2.7.3.2 Agency in Action

According to Smith, Stirling and Berkhout (2005), agency in socio-technical transition can be defined as “*the ability to intervene and alter the balance of selection pressures or adaptive capacity*” (Smith, Stirling & Berkhout, 2005: 1503). These scholars have made two important contributions to our understanding of agency in socio-technical transition. Firstly, they showed why agency and power are important in regime transformations and secondly they went on to explore different ways that social actors govern regime transformation.

Power, exercised through agency, can modify behaviour. It can persuade actors in a regime to modify their behaviour in a specific manner as these actors adapt to changing selection pressures. Agency in this case can also act to keep certain issues on the agenda and others off. Power and agency can modify adaptive capacity in another way, by restricting critical reflection. In doing so, those with agency can prevent other actors from realising that they are at a disadvantage. Agency in this case can take certain options off the table so that this kind of reflection is not possible. Power and agency affect the representation of problems. In considering these points, we should look at how agency rests in different discourses during regime change as these visions of the future should indicate how selection pressures are recognised and how responses to selection pressures are coordinated. According to Smith, Stirling and Berkhout:

*The challenge here is to analyse how contrasting visions and expectations enrol actors into coalitions of support, come to define their interests, and shape the way that they seek to respond to selection pressures or shape their collective adaptive capacity (Smith, Stirling & Berkhout, 2005: 1503).*

Much of the tacit agency rests within the regime, as the regime provides a structure for conditioning the relationships and dependencies that form, representing certain interests and neglecting others. Lastly, agency and power are dependent on the physical structures that they inhabit. Resource distribution is an important factor in two ways. First, it makes the terrain for affecting behaviour uneven; an agent's power depends largely on his resources. Secondly, because no one agent has so many resources that she can be entirely independent, the distribution of resources dictates the interconnectivity of actors (Smith, Stirling & Berkhout, 2005: 1504).

### 2.7.3.3 Agency in Discourse

A key facet of the agency that actors wield is through the narratives that they develop in order to reshape perspectives and patterns and enable institutional reform. These narratives are important political tools to enable change and lock-in braking (Smith & Raven, 2012: 1032). The politics of a niche is captured in the narrative that is created within it. Actors create narratives in order to reshape societal action and mentalities in such a way that allows for institutional reform. Smith and Raven have found that

there are three over-arching themes within the competing actor narratives negotiating empowerment. Negotiating protective spaces involves the contestation of narratives regarding: positive expectations about the niche that justifies it for society; explicit claims for institutional reforms or claims on competition in order to change the environment; and lastly, a reframing of the past that justifies the challenges that the niche poses to the dominant regime (Smith & Raven, 2012: 1033). Narratives can also provide a basis for understanding how different levels of actors reshape each other, for example how global level niche actors reshape social action (Martin, 2016: 150). In this way, narratives of niche empowerment seek to mobilise resources, spread positive expectations and highlight tensions within the regime. The second approach to explaining the effect of discourses in the niche environment is framing. Framing is a deliberate form of discourse aimed at mobilising resources and actor consensus around a specific issue (Martin, 2016: 150).

#### 2.7.3.4 Agency in Networks and Resources

In reference to the work of Grin, Avelino and Wittmayer explain that the governance perspective on transitions, views an agents' capacity to 'act otherwise' as a trigger for institutional transformation by 'smartly playing' into the power dynamics that exist between various layers. This perspective is linked to the MLP through a multi-levelled framework of power and distinguishes between three levels of power: rational, dispositional and structural that corresponds with the niche, regime and landscape. The governance perspective considers rational power at niche level that rests upon the competition at niche level and the ability to draw on regime actors. Dispositional power is observed at regime level, where rules, resources and actor configurations lead to a powerful dominant image. Actors at regime level may draw on the dispositional power of the dominant regime. Structural power is found at the landscape level as symbolic, economic and social capital (Avelino & Wittmayer, 2016: 632). This framework opens up the regime concept by looking at how agency relates to the structures in a socio-technical system. In order to establish a proper understanding of the relationship between structure and agency in transitional dynamics, Grin suggests that it is important to view a modern sustainable transition as a process of redirecting the regime (the co-evolutionary structure); and agency or innovative processes toward a complex normative orientation (sustainability), while

taking into account a whole range of exogenous trends (Grin, 2012: 73). Regarding agency, Grin suggests that it is important to distinguish between first order reflexivity and second order reflexivity. First order reflexivity indicates the unintended reflex-like consequences; second order reflexivity indicates self-critical processes, which evokes a sense of agency and intended change. Critical outcomes in transitions processes are often the unintended consequences of actions. These unintended or otherwise intended actions result from first order reflexivity and can often be considered as part of the normal way of doing things. Second order reflexivity denotes a process of conscious decisions, a plan made and followed toward an end. With this differentiation in mind he suggests that politics in transitions, with the added normative orientation produced by goals of sustainable development, might be easier to address if we understand how transitions not only presuppose the transformation of agency, the creation of legitimacy and power relations, but may, in addition to this, aid in creating these conditions (ibid.).

Smith, Stirling and Berkhout's quasi-evolutionary conception of regime change views socio-technical transition as being a function of two elements: shifting selection pressures and the coordination of resources within and outside of the regime in processes of adaptation to these selection pressures (Smith, Stirling & Berkhout, 2005: 1494).

Governance within regime transformation is organised through the intervention of these two co-evolving realms by affecting the intensity, articulation or direction of selection pressures. It might also happen through addressing the adaptive capabilities of actors. According to them this latter form of governance operates mostly through regulative or financial channels (ibid).

Selection pressures however, is more dispersed in socio-technical transition as debates in wider society, including academia, civil groups and consumer awareness and preferences affectively frame the functional reproduction of known truths and consequently, change, in socio-technical systems. Changes in the broader structures of society that are related to, but do not directly focus on a specific socio-technical system, might affect the system because of interconnectivities. Examples here are to

be found in the wider political and economic landscape that surrounds the socio-technical system in question (Smith, Stirling & Berkhout, 2005: 1495).

In any given regime there is no shortage of selection pressures. This is a given and constitutive to the logic of a complex system itself and it is very difficult to control as these pressures shift at different time scales on different levels. The significant component of transition shaping is captured in the way in which selection pressures are articulated. Selection pressures can be orientated to different degrees to form coherent pressure in a specific direction. The second element that makes the articulation of selection pressures effective is the processes that make this accumulation of pressures explicit in such a way that prompts a reaction from the dominant regime (Smith, Stirling & Berkhout, 2005: 1495). An example offered here is that of climate change for which scientific, social and political consensus resulted after years of articulation (ibid).

The change resistant characteristic of regimes is the factor that affords them the capacity to adapt to selection pressures (Smith, Stirling & Berkhout, 2005: 1495). It is the functions of a regime that become specialised and consequently locked in, and the better the members of the regime are able to fulfil these functions according to the path dependency created, the higher the adaptive capacity of the regime. Sometimes when the adaptive capacity of a regime is weak, alternate developmental trajectories might come from outside of the regime.

Those actors that act to create selection pressure might not be separate from the ones that act to coordinate the resources necessary for adaptation (Smith, Stirling & Berkhout, 2005: 1497). This overlap is especially prominent in cases where the 'search function' of adaptive capacities has been influenced by the articulation of selection pressures and result in unanticipated possible avenues for finding solutions. This is to say, in situations where the positive feedback loop has deteriorated or stagnated, that the parties providing this stagnation or deterioration might be the same parties looking for alternate avenues for development.

Selection pressures differ in magnitude and reach. The more prominent selection pressures require interactions and alignments along networks, including those within

the dominant regime for adaptation to follow. The extent to which regime change can be achieved depends on the positions held by the ‘coalitions of prime movers’ defined in terms of their interests and ideas and the degree to which the actions that they perform is central to the collection of pressures at play within the dominant regime. Coalitions of prime movers, according to Smith, Stirling and Berkhout, are groups of actors that are financial, technically and politically powerful enough to influence the diffusion processes of selection pressures and adaptive capacities (Smith, Stirling & Berkhout, 2005: 1497).

Smith and Raven have added to this debate that selection pressure and protective spaces function at different levels of socio-technical systems (Smith & Raven, 2012: 1028).

**Table 2: Socio-technical Selection Pressures and Protective Spaces (adapted from Smith and Raven, 2012)**

<b>Regime Dimension</b>	<b>Selection Pressures</b>	<b>Logic of the selection space</b>	<b>Passive shielding</b>	<b>Active shielding</b>
<b>Industry structure</b>	Industrial Networks, user-producer networks, shared industry routines, labour force, skills	<i>Industrial protection-</i> Business models need to adapt or be re-designing. Path-breaking innovations do not fit neatly within the industry structures. Resource allocation shifts are required	The mobilisation of a technology to a market that falls outside of the existing market	The establishment of incubator units or test cases in the short term in order to guide decision-making in the long term
<b>Technologies and infrastructure</b>	Standards; infrastructural requirements	<i>Technological protection-</i> Path-breaking innovations are usually at a disadvantage because of incumbent technological and infrastructure standards.	The development of a market for new technologies outside of the reach of current standards such as rural markets or farms	Granting temporary exemption from existing standards, often pending the review of such standards
<b>Knowledge Base</b>	Formal research associations and groups, normal processes of review, established knowledge.	<i>Socio-cognitive protection-</i> Knowledge is organised and specialised in academia and research putting new trajectories for research at a disadvantage	Using generic research and development support schemes to research new technologies or their application	Implementing new focussed research and development programmes in support innovations
<b>User relations and markets</b>	Market practices, institutional networks and	<i>Market protection-</i> the dominant regime is at an	The identification of users that are willing to trade	Support schemes to lower the price and increase the

	preferences	advantage primarily because the market preferences have been shaped in its favour	performance or price in order for the gains provided by a new product (such as environmentally conscious consumers)	adoption of a specific type of technology, such as solar water heater rebates
<b>Political power and public policies</b>	Regulations, policy goals, political networks and power relations	<i>Political protection</i> -the dominant regime is enforced by the status quo of the day, which means that often, socio-technical systems are underwritten by the political structures that surround them.	Framing new developments so that they fit within existing regulatory frameworks or acting in unregulated spaces	Lobbying explicitly for shifts in political programmes and ideologies
<b>Cultural significance and associations of the regime</b>	Media; symbolic meanings of technologies, cultural values of innovations	<i>Cultural protection</i> -The current cultural climate that supports the dominant regime will usually place new innovations at a disadvantage	Reframing values of civil society or dedicated groups	Actively enacting new media discourses linking technological innovations with new value sets that are deemed important by society

Smith and Raven have focussed on how agency and politics play out in niche spaces. Protective spaces in their framework exhibit three distinct properties that relate to socio-technical transitions: shielding; nurturing and empowerment. Shielding involves the protection offered by a protective space from the selection pressures that are at play. Nurturing involves the identification and development of path-breaking innovation in both passive and active manners. Empowerment involves the processes that help innovations to become competitive within unchanged selection environments or processes that change the selection environment to favour path-breaking innovations. Empowerment has been studied in various ways, including empowerment as a systematic transitional pattern; disempowerment as a process through which actors gain or lose their intrinsic motivation, and empowerment as a functional property of niches (Avelino & Wittmayer, 2016: 633). This thesis is most interested in the latter. Two types of empowerment are found in protected spaces (Smith & Raven, 2012: 1030): fit-and-conform empowerment and stretch-and-transform empowerment.

When an innovation that is originally viewed as path breaking becomes incremental because of the broader socio-technical implications, but when cumulative economic

impact is larger than other path-breaking advances, fit-and-conform empowerment acts toward making niche innovation competitive with regards to the dominant regime within an unchanged selection environment.

There are two challenges when we are talking about sustainable transitions: first, one of the results of this type of empowerment is improved alignment with existing industrial norms of the dominant regime. However this could be to the detriment of sustainability goals because of the trade-offs made to 'fit in'. Secondly, the providers of the protective niche might find it hard to govern the performance improvements that would allow for the niche to fall away. The main actions in a fit-and-conform empowerment model in terms of sustainable transitions are: institutional reforms that change incumbent regimes and political capacity that can avoid a scenario where the niche becomes captured by sectional interests and to ensure that a protective space stimulates the dynamic accumulation of capacities for sustainable avenues of development.

Conversely, when empowering innovations undermine the dominant regime and transmit niche-driven institutional changes into re-structured regimes, stretch-and-transform empowerment applies. Here niches influence their selection environments and favourably affect the subsequent changes to the socio-technical system. The processes here rely on the broader environment and are not internal to the niche. Niche advocates here present solutions to instabilities and tensions within the broader regime that often include control policies.

#### 2.7.4 Directionalities of Agency

From the discussion of agency above, it is possible to synergise existing knowledge into distinct categories of directionalities for agency. I gather three interlinked directionalities of power from the literature and base my analysis in Chapters 5, 6 and 7 on this typology: relational-, hegemonic- and networked agency.

##### *Relational Agency*

Relational agency can be exerted through the alignment of actors and through discourse. The alignment of actors involves two inter-related loops: the articulation of selection pressure and the coordination of resources. Shifting selection pressure

means affecting the articulation, direction and intensity of selection pressure. This is done through alignments and interaction across networks that inhabit different levels of the socio-technical regime.

Smith, Stirling and Berkhout (2005) suggested that the extent to which regime change can take place depends on the positions held by 'prime movers'. This is to say the degree of technical, financial and political power held by coalitions, and it is measured by the response that is elicited from the dominant regime. They also showed that directing action towards different selection pressures results in different types of shielding within the niche.

Even though the coordination of resources falls under the shifting of selection pressure, this most often relates to networked agency. Actors' resources affect their ability to exert power to a large extent. Addressing this inequality, however, can only happen through cooperation with other actors. No one actor is entirely independent, so the distribution of resources is a determining factor in the interconnectivity of actors.

#### *Hegemonic Agency*

Hegemonic agency is the top-down agency exerted mostly through policy. However it must be realised that the exertion of relational agency most often leads to making the terrain for action uneven and in so doing results in some actors becoming more powerful than others, thereby giving them a form of hegemonic agency. Top-down power considered in transitional studies most often relate to the policy mechanisms that can be implemented to change, or to resist change in a socio-technical system. As it relates to the niche, various policy mechanisms have been identified through which policy-makers can enable niche development. These include SNM; transition management and time strategies.

Power in policy is a complex matter because the effect of policy may be intended or unintended. Foreseeing the effects of policy in unstable environments, such as transitioning socio-technical systems, is most often impossible. Thus it would be wrong to assume that the power that policy holds rests only within the policy-makers.

This is one of the cases where distinguishing between first order reflexivity and second order reflexivity becomes very important (Grin, 2012). First order reflexivity relates to unintended consequences, while second order reflexivity relates to critical processes that evoke agency and directed action.

### *Networked Agency*

Networked agency involves the power that actors get from their network. As previously mentioned, the coordination of resources is one of the processes within the niche that can clearly be attributed to networked agency. A second type of networked agency that is to be observed is the formation of alliances, not to be confused with the alignment of actors and resources. The formation of alliances relates to actors' ability to link up with other actors with a specific purpose in mind. This involves partial or complete sharing of goals, sharing mind-sets and ideologies or simply having a common enemy.

#### 2.7.5 The Relationship between Power Giving and Power Taking in the Niche Environment

Understanding the differences in power relationships at the niche level is key to understanding how actors govern in the niche space. Up to now I have elaborated on the different power relationships that have been found in socio-technical regimes. The MLP does take account of this to some extent, as they recognise that power does not only result from one's position in the socio-technical system but also one's position in networks and that alliances can be sources of power for actors. This leaves one important stone unturned with regards to understanding the relationships of power in the niche space that effect socio-technical transitions: the relationship between power giving and power taking.

Theories of transition accept that some actors are more powerful than other actors. It has also been suggested that power can be transferred through networks and by association or by various mechanisms of discursive or behavioural intervention. However, all of the transitions theories that I have come across proceed to study the methods-, differences between- and effectiveness of power giving, and none of them

give much attention to the processes involved in power taking. The final question posed in this thesis is thus: *what are the conditions for 'rowing' and 'steering' within the niche environment?* I study power taking (rowing) by firstly taking into account what we already know about power giving (steering), and secondly by borrowing from the governance literature to structure my exploration.

Rhodes defines governance as “*self-organizing, interorganizational networks characterised by interdependence, resource exchange, rules of the game and significant autonomy from the state*” (Rhodes, 2007: 15). There are various definitions for the term. There are however three basic correlations to be found across the board in different understandings of governance (Walker et al., 2010: 10). First, governance involves multiple actors that function in a networked system. According to Wood and Shearing, “*governance takes place through programmes that articulate with institutions to produce practices*” (Wood & Shearing, 2007: 7). They explain that governance is the outcome of a network that interacts toward a common goal. These networks include both living and non-living elements.

Secondly, governance implies new forms of authority and power. Colin Scott, for example, argues for shifting the focal point of inquiries into governance away from simply looking at state law, toward a wider analysis that encompasses a variety of norms and mechanisms through which control is achieved, albeit indirectly (Scott, 2004: 2). New forms of decentred regulation happens through different structures including the state, hybrid alliances of the state and the non-state, and private actors in the ‘post regulatory state’ (Black, 2002: 105). Dupont has found a diffusion of responsibility in networks of security governance where vertically structured hierarchal arrangements have been replaced with horizontal collaborative networks. (Dupont, 2004: 88).

Lastly, governance demands a multi-level application and often deals with issues of scale. The transformation of social and political order forces us to readjust our conception of the economic role of the nation state as shifts that take place at the macro scale are brought about and adjusted by technological shifts, economic efficiencies and international obligations for the nation state that are not comparable to those that took place in the past (Levi-Faur, 1999: 176). Simply put, governance

can be observed at different interactive levels from local to transnational, involving different actors at each level.

Smith and Raven's argument resonates in much of the modern governance literature, specifically when the governance relationships between the state and other actors are considered. The two types of empowerment, stretch-and-transform, and fit-and-conform will be used as a foundation for distinguishing between rowing actors. Often, the modern state adopts a steering role, while other governing actors adopt a rowing role. Emphasising the complex relationship between those that steer and rowers allows one to consider regulation and governance beyond the (imagined) dichotomy that exists between the state and other actors. It is by no means a bipolar relationship.

Where the law has acted as an organisational force rather than a stipulation of rules, other mechanisms of coercion are often used for the coercive power on the ground (Scott, 2004: 167). This conception of regulation resonates strongly with Foucault's analysis of political power and his concept of '*governmentality*'. The latter, he explains, is the techniques and procedures that govern behaviour, and leads us, in an investigation of regulation, to research both the governed and the governing actors and, perhaps more importantly, to ask how governors govern and to what end (Rose, O'Malley & Valverde, 2006: 85). The end often proves more important than the means of governance, because, I suspect, that is how the niche is formed.

Various authors have used Osborne and Gaebler's (1992) analogy of steering and rowing to understand how governance takes place in the world today.<sup>1</sup> In criminological literature, studying governance rather than regulation has often been a means of getting past the dichotomy between the state and 'the rest' to arrive at an understanding of how pluralised forms of power governs a system. In this thesis I want to extend this train of thought by suggesting that viewing various actors and their modalities of governance could lead us to understand the relationships between the large conceptual boxes of theories such as the MLP better, in the same way that plural security governance is understood in criminological studies. The traditional conception of regulation by the state has been extended to 'steering', setting a course

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<sup>1</sup> See for example: Braithwaite (2000); Shearing and Wood (2003) and Stoker (1988)

and monitoring the direction of the regulatory function (Crawford, 2006: 453).

Steering or power giving entails the following according to Crawford:

1. Explicit delineation of direction, meaning goals and values.
2. That this direction be conveyed clearly to the actors that row.
3. The establishment of monitoring mechanisms that measures performance against the goals and value sets provided.
4. Using the jargon, resources and capabilities of those that row.
5. Designing regulatory institutions with the rowing actors, their institutions and their capabilities in mind.

## 2.8 Conclusion

The MLP considered how the rules of a regime work, how they are established and how they affect the flow of events within a regime. To a large extent the MLP considers a regime to be nothing more than a set of rules. These rules are difficult to change in isolation because they affect the rest of the rule system. Rules are created through the decisions of actors and become embedded in the artefacts within the system. The adoption of a rule is shaped by: the physical environment, by the action of other actors and by existing rules. Even though the rule system that underlies the functioning of a socio-technical system is largely dependent on the physical environment and technical aspects of that system, the actors within the system play a key role in rule maintenance. Ultimately the power to realise the goals of sustainable development in electrical and other socio-technical systems lies in the role that actors play in rule maintenance and rule adjustments in these systems.

Actors reproduce and reinforce rules by acting them out or reshape rules through constant power struggles. The MLP considers rules as one of the analytic dimensions of the regime, together with actors and the broader socio-technical system. Once established, the rule set of a regime becomes a factor that actors need to contend within it. An established rule system effectively starts having a life of its own. The longer a rule is able to withstand change, the stronger it becomes. This strength is derived from two things: the accumulated functionality of the rule, meaning that it is beneficial to enough actors or powerful enough actors are protecting it. The second

reason why the longevity of a rule makes it stronger is because the longer a rule remains standing, the more offshoots of action and consequence will result from this rule. Reversing these pathways for action, or rules, becomes increasingly difficult once offshoots have formed.

The MLP excellently sketches this holistic picture of actions and interactions by taking into consideration that the system is more than the sum of its parts and that outcomes within the system are not generated in a linear fashion but through the interplay of multiple dimensions within the system. This layered view of socio-technical systems solves a critical issue for the study of complex systems: the delineation of boundaries. By viewing a socio-technical system through the MLP lens, one is allowed to temporarily categorise the interaction of long-standing rules of the system (the regime level) with the rules and meaning within artefacts and physical aspects of the world (the landscape level) with the newer rules within the system (the niche level).

This thesis aims to build on this by studying the role of human governance in the processes of rule formation within the socio-technical system. Guided by the MLP, this inquiry focuses specifically on the events and actions that take place at the niche level. The niche space is considered to be the primary location for the formation of new rules and the networks along which these rules govern. It is specifically regarded as the terrain where the rules that underlie radical system change are formed, and where these new rules result in temporary protection from the long-standing rules within the system. It is however not considered to be the only locations where new rules are formed as the formation of new rules take place in the context of the larger socio-technical system and the broader universe of actors, things and rules.

My point of departure from the MLP is toward a better understanding of the role of actors in the processes of rule formation, specifically focussing on the formation of rules that could lead to radical system change and more sustainably secure socio-technical systems. The MLP allows one to understand how actors contribute to the longevity of rules (path dependence) and how actors resist change through rule systems. However it does not adequately explain how actors govern to create new rules within socio-technical systems. This is a crucial issue and results in the MLP

failing to do justice to the sustainable orientation that underlies the perspective. If new rules are formed at niche level then one should expect that new sustainable electricity rules be formed there too, and thus the formation of rules at niche level should be at the centre of MLP studies.

Agency can be viewed as a commodity within a socio-technical system. It becomes amplified when shared among a group of actors and it is by no means equally available to all actors of the system. This commodity allows actors to contribute to the creation of rule systems within a socio-technical system, bound by the realities, things and rules that exist in the system. As much as the physical aspect of a socio-technical system creates outcomes within the system, so too does the agency held by actors.

Agency plays out within the socio-technical system in a non-linear fashion.

Considering the outcomes created through agency as simple rule-making and rule-taking between actors, and between actors and the system, disregards the nuances of the flows of power in a complex system. Actors are reactive to one another, thus the process of rule creation can be viewed as a constant struggle between actors and this struggle must be viewed within the context of the system.

In order to account for this constant struggle and the uneven distribution of authority between actors, I suggest viewing the governing behaviour of different actors as rowing and steering governance. Borrowing from the governance literature in criminology allows me to view the pluralised arrangement of agency between actors while considering the context provided by the system in which they govern. Agency has been considered in the transitions literature as taking various shapes, including framing and discourse, guided policy, the modification of adaptive capacity and the coordination of resources, through one or a group of actor's alignment of more actors with their goals or through actors strategically aligning themselves with other more powerful actors. The conceptualisation of steering in the governance literature, including the delineation and direction of meaning and goals, and the monitoring of these goals around a specific issue, resonates with forms of empowerment that is considered in transitions literature as one of the core attributes of niche environments, together with shielding and nurturing. Much of the groundwork has been laid for investigating the role of empowering or steering actors within the niche. Much less has been done toward understanding the role of rowing actors, or those actors that act

because of the ideology of another actor and follow the rules created by these actors, yet, in reaction to the actions of steering actors, contribute to the creation of new rules within the socio-technical system.

## **Chapter 3**

### **Methodology**

#### 3.1 Introduction

The previous chapter makes clear that there is a substantial need for empirical research to understand the role of actors in governing the processes of socio-technical transitions, especially at niche level. Transition theories focus primarily on two interlinked aspects of the socio-technical terrain: understanding the structure and functions of socio-technical systems and understanding how systems change comes about. This research is focussed on the latter. Various methodological practices for understanding how systems change comes about have been developed in the literature in recent years. One of the most prominent theories in this regard is the Multi-Level Perspective on Socio-technical Transitions (Geels, 2004c, 2005a, 2010; Verbong & Geels, 2007). The MLP is part of a class of theories focussed on analysing occurrences of low carbon transition. These are transitions that look at major changes in systems like construction, energy and transport in which substantial shifts in efficiency, demand or carbon emissions are taking place. Socio-technical change denotes that it is not only the technological aspects in the system that becomes altered but also the social components, which means that these types of changes are enacted by a wide array of actors. Because these actors have different interests, transitions often involve struggles, which are characteristically unpredictable in nature. As a product of the unpredictability of the outcomes of struggles between actors in socio-technical transition, system innovations are generally characterised as having non-linear dynamics (Geels, Berkhout & van Vuuren, 2016: 2).

MLP studies typically consider the feasibility of low-carbon transition pathways by analysing the regime, niche and landscape levels and by considering the historical setting of the socio-technical system. This allows MLP theorists to identify barriers, or lock-ins and drivers of change. Essentially it is a qualitative framework that offers researchers the ability to: focus on different dimensions of socio-technical change at different levels; take account of groups of actors and the different behaviours that they might exhibit; analyse institutional change by looking at how the rule systems change in a socio-technical setting; and identify the sources of inertia in a system (Geels, Berkhout & van Vuuren, 2016: 5).

## 3.2 Methodological Foundations

In this section I will discuss the theoretical perspectives and knowledge claims that form the basis for this research. I will firstly discuss the considerations that led me to a qualitative approach. I will then focus on my specific ontological and epistemological foundations for this study.

### 3.2.1 Qualitative Research

This thesis focuses on understanding the role of actors in governing socio-technical transitions by looking at how actors govern change in niche environments. The broad question that it aims to address is: **How is agency constituted in the niche environment of transitioning socio-technical system, which enables the establishment and strengthening of alternate developmental pathways, and what are the implications for socio-technical transitions?**

In order to address this broad question, I have elaborated in the previous chapter on four sub-questions namely:

- 1) At niche level, which are the categories of actors that can be differentiated?
- 2) What methods do actors use in niche environments to exert power?
- 3) Under what conditions do actors contribute to the formulation and strengthening of developmental trajectories within niche environments?
- 4) What are the conditions for 'rowing' and 'steering' within the niche environment?

These questions, guided by the debates in the literature, focus on establishing an understanding of agency in niche environments of socio-technical systems in transition. This requires the exploration of a variety of issues, including the ways in which actors understand the system, shifting institutional arrangements, attitudes, and practices of actors. In essence, these questions aim to study the meaning that can be attributed to the actions and inactions of actors in governing socio-technical transitions. This is why a qualitative approach is most suitable for this investigation. According to Creswell, qualitative research begins with assumptions and utilises a particular theoretical framework that guides the process of researching problems

addressing the meaning that people ascribe to a human problem. This entails a collection of data in a natural setting, and data analysis that allows for both inductive and deductive reasoning and the establishment of key themes and patterns. The final product of qualitative research includes the voice of participants, reflexivity of the researcher and a description and interpretation of the problem being studied (Creswell, 2013: 44).

Qualitative research today has many different modes, modalities, targets, functions, and uses. Creswell has summarised these as a few generalisable characteristics (Creswell, 2013: 45): First of these, he notes, is a natural setting. This means that qualitative researchers follow their participants to the area where the problem that is being studied occurs. They do not bring participants into a laboratory or ask them to complete instruments such as a survey, but rather observe them in their natural setting and gather up-close information through conversation and observation. Secondly, in qualitative research, the researcher is the key instrument. They collect data themselves through the examination of documents, discussions and observations. At most they might have a set of open-ended questions that guide their observations. Thirdly, qualitative researchers often use multiple forms of data. Lastly, qualitative researchers employ complex forms of reasoning. Categories for research are most often built from the bottom up through cycles of data organisation into growingly complex abstract units of information. Researchers constantly go back and forth between data, literature and theory in the formation and refinement of these categories for research. This requires an ‘inductive-deductive’ logic and demands complex reasoning skills from the researcher.

Perhaps some might argue that a quantitative approach could have been primarily employed in this study (using structured forms of observation such as surveys). I am of the opinion that it would not do justice to the research questions, because the questions posed in this thesis evoke narrative explanations that are better dealt with through natural observations.

This thesis uses a variety of data sets, some of which include secondary quantitative data. These types of data sets include, for example, the number of municipalities that participated in a specific programme in the Western Cape and funding amounts or the

number and aggregation of PV installations in a particular region. Quantitative data was thus used only to substantiate the story that was told by the qualitative data gathered.

### 3.2.2 Knowledge Claims and Theoretical Perspectives and General Reasoning

In any study, the researcher holds ideas about the nature of reality (ontology), ideas about how knowledge claims should be justified, and about what constitutes knowledge (epistemology), about the role of values in research (axiology) and about the processes of research that should be followed (methodology) (Creswell, 2013: 20). In this section I will discuss the ontological, epistemological and axiological underpinnings of this research. In order to contextualise the knowledge claims that underpins this research, I will also discuss the combination of deductive and inductive reasoning employed in this study.

The knowledge claims of this theory are in line with that highlighted by Derek Layder's *Adaptive Theory*, which represents a mixture of approaches to research and in so doing holds an epistemological position that is neither positivist nor interpretivist and encompasses both subjective and objective ontological expectations in research. It presupposes that the world is complex, multi-faceted and densely compacted and is excellent for research inquiries that focus on the interconnections between human agency, social activities and social structures and systems (Layder, 1998).

The research presented in this thesis adopts a reasoning process that employs both inductive and deductive reasoning in all of its processes, from defining the research problem at the very start, to sampling choices, data collection and analysis and results. This project assumed a general lack of understanding of the role of agency in socio-technical transitions based on the critique of the MLP in the literature. Initially, the research question revolved around the role of the private sector as active agents in bringing about transition. However, upon initial data collection and concentrated literature review, the question and focus of the research was reformulated to rather include a variety of actors and move away from the state-private sector dichotomy in an inductive manner. However, deductive reasoning was employed based on the

inductive reformulation moving forward in the research project. This project included various loops of inductive, deductive refinement. In short, I made use of both inductive and deductive reasoning in much the same way that is suggested by Layder, who views inductive and deductive reasoning as frameworks of ideas, discourses and practices. Adaptive theory advocates adaptation to the research process, both in terms of theoretical explanations and emerging data (Layder, 1998: 135)

Empiricism denotes that valid data or knowledge can only be gained from our sensory experiences. This notion can be described as a 'correspondence' conception of knowledge, as theory and concepts are thought to correspond in some direct fashion to facts and empirical data. Rationalism on the other hand puts its faith in the initial basis of knowledge. Rational theorists are of the opinion that knowledge is independent of our sensory experience and results from forms of debate and reasoning that is more valid than that provided by our sensory experiences. In this sense rationalism can be associated with a coherence conception of truth because the internal relationships between concepts in a theory is thought of as paramount for understanding the phenomenon to which the theory refers (Layder, 1998: 137). The epistemological premise for this research builds on an understanding of empiricism and rationalism as discourses that are open to the influences of one another, much in the same way that the link between deductive reasoning and inductive reason was approached. This is also in agreement with Adaptive Theory (Layder, 1998: 139).

There are phenomena in the social world that bare similarities with those found in the natural world. Social phenomena, such as structures or processes, must not be confused with human behaviour even though they are directly impacted in analyses of human behaviour. Rather, Layder suggests viewing these phenomena as having their own emergent properties that set them apart from human behaviour and social activity, while at the same time holding very real ties with the world of social interaction (Layder, 1998: 140). Adaptive Theory thus conceives the world as being comprised of both objective and subjective aspects, meaning that both the world of social interactions and the world of context and social setting are considered to be real and connected features of the realm of social research. The moderate view of objectivism adopted by Adaptive Theory means that the interwoven nature of subjective and objective aspects of the world are seen to affect one another and thus

that social activity is conditioned by systematic phenomena (Layder, 1998: 41). This holds true in its entirety for my research, and it illuminates my ontological approach to the study. Studying human agency in a complex system, such as an electricity sector demands that one realise that humans affect humans and are affected by things. The meanings and understandings gathered by this research are informed by the critical distinction that is to be made between social phenomena and human behaviour. What is more, some of the most important insights are gathered from- and premised upon the interconnectivity between human behaviour and social phenomena.

The axiological claims of value that underpin this research, is once again captured completely by Adaptive Theory. Adequacy and validity of knowledge is represented in two ways in Adaptive Theory: first, in an attempt to produce a better understanding of the nature of the social reality in question than we had before: and secondly, through the formulation of more powerful explanations for social phenomena through explanatory forms, theories and constructs that include more in their terms of reference than previous explanatory forms (Layder, 1998: 142).

### 3.3 Strategies of Inquiry

#### 3.3.1 Adaptive Theory

The goal of this thesis is to build on understandings of socio-technical transition by conceptualising the study in terms of the Multi-Level Perspective and elaborating on specific elements of the theory through empirical research. This requires that the research had to be undertaken within the analytical boundaries set by the MLP, however in such a way that further theorising could add to the theoretical basis. This is why the Adaptive Theory approach is suitable for this research. The main reason for adopting the Adaptive Theory approach is because Adaptive Theory is agency centred, and takes serious the notion that the world is made up of social connections and agency, together with systematic structures.

Adaptive Theory is ‘adaptive’ in the sense that the theory adapts to the data being collected, while, at the same time, the data is being filtered through and thus adapted

to prior theoretical structures relevant to their analysis (Layder, 1998: 5). On the continuum of approaches to theory generation one can view grounded theory at the one end, and middle-range theorising at the other. The middle-range approach to theory generation dictates that the research needs to formulate a theoretical hypothesis before the commencement of research so that this can guide the research endeavour and give structure to subsequent theorising, based on the data collected. Grounded theory on the other hand emphasises that the researcher commence research with as little pre-theorising as possible to allow for theory generation during the research process (Layder, 1998: 15). Adaptive theory places equal emphasis on the processes of the discovery of theory and on the employment of prior theory, and these two aspects of Adaptive Theory research are considered to have reciprocal influence on one another (Layder, 1998: 20).

This approach is especially applicable in research aimed at better understanding the linkages between agency and social structures, as is required by this thesis. As described by Layder, Adaptive Theory:

*...targets the multiplicity of forms of interconnection between social agency and social structure (or system elements). These elements are tightly bound together to form a complex and multi-faceted social reality. Adaptive theory attempts to abstract from this tightly compacted complexity to identify specific forms of connection (between agency and structure / system). (Layder, 1998: 143)*

It is this focus on human agents in socially complex systems, together with the methodological needs presented in this thesis that requires both the incorporation of existing theory and the grounding of theory building (or rather theoretical elaboration) in empirical observations that resonates strongly with my research. In this sense, Adaptive theorising allows me to consider some of the claims that have been made in the literature about the role of actors in governing socio-technical niches and at the same time elaborate on the scope of the MLP.

### 3.3.2 Collective Case study

Case study research, according to Creswell, involves the study of a phenomenon through one or more cases within a bounded system (Creswell, 2013: 73). He adds that case studies can be done in either one or many bounded systems and that it involves in-depth data-collection from multiple sources. Generally, case study researchers report a case description based on specific themes found within cases. Creswell distinguishes between three types of case studies (Creswell, 2013: 74) : Instrumental case studies (where the researcher focusses on a specific phenomenon with one bounded case for illustration); collective case studies (where the researcher selects one issue to observe through multiple bounded cases); and an intrinsic case study (where the researcher focusses specifically on the case itself as it presents as unusual or particularly interesting to the researcher).

This thesis adopts a collective case study approach (or multiple case study approach), in combination with Adaptive Theory. The multiple case study approach offers two distinct advantages for the research conducted in this thesis: first, it offers the ability to explore actor agency at niche level in two different types of niches, and secondly, it offers a podium for replication, even in two distinctly different types of niches, which is more robust than the explanatory power that rests in a single case study (Yin, 2003: 47).

Yin explains that there are three general approaches that can be followed in case study research (Yin, 2003: 111). He prefers relying on the theoretical propositions that led to a case study. These propositions are reflected in one's research questions, views on the available literature and within the researcher's hypothesis and subsequent propositions. The data collection process would also be affected by these propositions and ultimately, ones analytical process would be focussed by them. The second strategy lies in thinking about rival explanations (Yin, 2003: 112). Generally this approach is taken when researchers are aware of rival explanations for the phenomenon under investigation, and include the search for alternate explanations as part of the research design. Rivals can take a variety of forms from rival theories to

societal rivals that explain a phenomenon better than it was noted by previous attempts.<sup>2</sup>

The third analytical strategy discussed by Yin is the development of a case description (Yin, 2003: 114). This can be used in cases where the original purpose of the study was to be descriptive and can yield, for example, an embedded unit of analysis and patterns of complexity, which together can yield causal explanations for ‘why’ questions. This study is approached using theoretical propositions about 1) the actors involved in the niche environment, 2) the pathways of development within niche environments, 3) the modalities of actor governance within the niche environment, and 4) the relationship between power giving and power taking, which led to the case study as analytical strategy.

### 3.4 Sampling

#### 3.4.1 Theoretical Sampling

Purposive sampling, or non-probability sampling is a sampling methodology in which there is no way of estimating the representativeness of the sample (Layder, 1998: 46). The power of purposive sampling lies in the rich information that is gathered from cases. There are no prerequisites for size of samples and flexibility is of utmost importance. Theoretical sampling is a subtype of purposive sampling designed under the Grounded Theory approach, however nonetheless useful for Adaptive theory to build upon. Glaser and Strauss described theoretical sampling as the process of data collection towards generating theory by which the researcher simultaneously collects, codes and analyses her data and, based on the cycles of collection, coding and analysis, determines sites for further collection, coding and analysis in such a way that theory emerges and develops (Glaser & Strauss, 1980: 45).

Layder suggests that theoretical sampling can be performed with Adaptive Theory’s primary theoretical focus in mind - a focus on the interconnectivities between agency and system elements that are central to social life (Layder, 1998: 48). Layder found

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<sup>2</sup> Yin (2003: 113) names nine types of rivals that can be incorporated into one’s analytical strategy.

Glaser and Strauss's account of theoretical sampling to be negligent by not taking into account the role of prior theory, and it is this that Adaptive Theory aims to include (Layder, 1998: 47). Maxwell took a similar stance to the inclusion of prior theory, noting that through the inclusion of prior theory in research endeavours means considering a wide array of concepts and ideas, which in some way captures or models something about the world (Maxwell, 2012: 48). This means that concepts and ideas can be borrowed from theoretical works and explanations can be built thereon. It does not indicate any prerequisite in terms of complexity levels and can include anything from grand narrative accounts of the world to conceptual elaborations in theoretical endeavours.

The theorising that takes place in this thesis is highly dependent on this mode of selection. Even though the propositions for research are grounded in the MLP, much of the inspiration and direction for elaboration was attained from other theoretical models. I will demonstrate this by looking at an instance of theoretical sampling in this thesis, by considering one of the sub-questions (see chapter 2): "*which categories of actors can be differentiated at niche level?*" However it must be noted that theory sampling forms part of the on-going process of research adopted in this study and there are countless other examples to be found within the study. As for the categorisation of actors, this is an example of simple theory sampling. This sampling was based on the identification of a need for more detailed categories of actors that was not provided for by the MLP. I took note of the fact that the theoretical models that I borrowed from use these categorical boxes in ways that I might not use them. However, this was not regarded as a problem because I use them as concepts rather than conceptual clusters, while the MLP can be regarded as my base typological model, which provides a more holistic view of system change into which my concepts and conceptual clusters fit. Layder explains the relationship between concepts, conceptual clusters and typological models as the three groupings of theoretical elements that are considered important by Adaptive Theory. Concepts are small slices of the social world and are understood as making up the building blocks for more holistic pictures of social reality (Layder, 1998: 159). Conceptual clusters, networks and frameworks are clusters of related concepts and can be categorised in terms of their theoretical underpinning. They can also be classified as having open or closed

boundaries with other frameworks or concepts and as being tightly or loosely integrated.

There are four differences between single concepts and conceptual clusters: concepts can be temporary devices used to orientate a study. They can be employed in order to depict a phenomenon, which might later be abandoned or become less significant with time. This is indeed the case for this thesis in temporarily adopting, testing and building on the concepts of actor categorisations gained from other theories.

Secondly, a concept might have recently emerged from data or theorising or a combination of the two and because of its novelty might not yet belong to a larger grouping. Thirdly, groupings of conceptual clusters cover more ground than concepts, much in the same way that syntax covers more ground than single words. Conceptual clustering in this thesis was based on theoretical sampling to some extent. The MLP provides a structure for understanding certain aspects of development at niche level, however, the conceptual clustering used to differentiate between modes of agency within niches - fit-and-conform and stretch-and-transform empowerment - can be viewed as conceptual clustering of a variety of elements, including the types of actors within each of the niches investigated and the methods of power exerted by these actors. Lastly, the complexity and range of meaning covered by a concept is broadened by the conceptual cluster to which it belongs (Layder, 1998: 160).

With regard to theoretical and typological models it is important to realise that many of the general models that exist have a lot in common with conceptual clustering, as considered by Adaptive theory. Often they consider and group specific aspects of social reality, for example models of social behaviour or interaction, such as symbolic interactionism; or localised practices, such as ethno-methodological models; or models could group basic topographies of social life (Layder, 1998: 161). Layder defines typological models beyond their ability to group certain aspects of the social world; as an interlinked series of models regarding related phenomena that identifies similarities and differences between them. He further distinguishes between behavioural or action typologies and structural or systematic typologies.

### 3.4.2 Selecting Case Studies

As mentioned above, the sampling methodology of this thesis is a form of purposive sampling called theoretical sampling, by which the researcher decides who or what to sample next based on the data gathered, to make comparisons with former findings (Hesse-Biber & Leavy, 2011: 47). Other purposive sampling techniques such as convenience sampling are also drawn on in the selection of case studies and interviewees. This research focuses on two specific case studies. These are two instances of socio-technical niches that have become evident within the South African electricity sector, namely the case of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) and the case electric security in the Western Cape.

Theoretical sampling involves oscillating cycles between theory, data and analysis, which would be hard to represent as a fixed linear selection process. There are, however, three principles built into the sampling methodology for this thesis, and a discussion and elaboration of these three principles should serve to satisfy as an introduction to the processes of case selection for this thesis. Based on this discussion I will go on to consider some of the finer detailed sampling criteria for my case studies.

*1) Cases were selected based on their availability.* This is similar to convenience sampling (Neuman, 2014: 248). The goal of case selection in this research is to get in-depth observations about agency at niche level. It is not to get a representative sample, as this would be impossible to calculate based on the complexities of socio-technical systems and the issues related to establishing the exact number of niches in a specific socio-technical system. Such an exercise would be a waste of time and resources because a socio-technical system cannot be regarded as a stationary population - as soon as one has counted the niches, there are bound to be more or less within a short period of time. What is more, defining the boundaries of a socio-technical system would suffer the same issues as presented by the temporal and fluid nature of the existence of niches, and in addition require immense resources, as the influence and influences for any particular socio-technical system that would justify the elements to be included as part of the system are innumerable.

The research conducted towards this thesis benefited from and contributed toward a larger project entitled: “Transitions to Sustainable Energy Systems in Emerging Economies: A South African Focussed Comparative Project” (hereafter referred to as the SANCOOP project). The shared resources between the project and the thesis include interviews, literature and other data sources. The project was aimed at enhancing knowledge-based policies towards the facilitation of decentralised sustainable electricity systems in emerging countries, with a specific focus on the regulatory environment. The focus and aims of the thesis differs from that of the project in scope, variables and theory-building aspects. However, the fact that financial and other resources at my disposal for conducting the research was linked to the needs of the project was not a limiting factor, because my research can be viewed as a magnified section of the larger project. Nevertheless, it meant that I had access to and had participated in gathering data that I didn’t need. This privileged position allowed me to hand pick the sub-sections of data to be included into each case from a library of rich resources.

2) In connection with the issue of sampling availability, cases were selected because *they met the criteria held in this thesis to be defined as socio-technical niches*. This is a complex issue as the problem that this thesis deals with directly relates to the way in which the ‘niche’ is conceived of in terms of the MLP. Because of this, the working definition adopted in this thesis towards the delineation of the niche environment considers the MLP definition and builds on it, as far as it is necessary for the goals of this thesis. It must be clearly stated that it is not one of the goals of this thesis to redefine the ‘niche’ concept. The MLP defines niches as the ‘incubation rooms’ where novelties are shielded from the selection pressures at play within the dominant regime and can include small market niches and technological niches (Verbong & Geels, 2007: 1026). This idea of a niche as a protected space for novelties is sufficient for the purposes of this thesis.

3) The cases were also selected *based specifically on the insights that they could provide* in terms of the focus of the research. Most case studies are selected for the power of replication, however this does not mean that the case studies need to be similar in nature. Case studies can be selected deliberately based on the differences

that they offer. In cases like these, the researcher generally does not seek direct replication but rather seeks to prove the hypothesised contrast between cases (Yin, 2003: 54).

One of the basic assertions made about the nature of niches by the MLP is that they house three core processes: the articulation and adjustment of expectations, the formulation of social networks and, lastly, processes of learning and further articulation. This forms part of the base structural/ systematic typology for the thesis and thus the basis for case selection.<sup>3</sup> In order to build on this I further considered the properties of niches put forward by Smith and Raven (2012), namely shielding, nurturing, and empowerment, giving special attention to the latter and added to this by considering the two different types of empowerment discussed by Smith and Raven: fit-and-conform and stretch-and-transform. The two cases are examples of fit-and-conform empowerment and stretch-and-transform empowerment respectively (this will be discussed in more detail below).

Ultimately the niche environments selected as case studies had to be representative of specific conceptual clusters, with the possibility of elaboration on some select concepts. They were selected to include: 1) *special conditions* that foster the growth of renewable electricity, which could include a number of conditioning factors such as regulation, special benefits, new consumption preferences, new business models or practices driving the market, and many more. 2) *Evident growth* of one or more new forms of renewable technology that could be linked to the special conditions. 3) The possibility for elaboration on actor categories, and the relationship between actors.

This however means that my selection criteria does not include the following: 1) geographic delineation in all cases, 2) specified technologies, 3) specificity in actors 'present', 4) and specificity about the level of technological or performance improvements.

### *The REIPPPP niche as Case study*

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<sup>3</sup> See Layder (1998:161) for a detailed account of theoretical groupings in Adaptive Theory.

This niche is more centralised than the second one and therefore most of the data collected toward this case required two trips to the Gauteng province undertaken in 2015, because the headquarters of large firms and public institutions interviewed were mostly located in Johannesburg or Pretoria.

The boundaries of this niche are relatively irrelevant as explained above. Studying this niche meant studying the development that was shielded from the dominant regime via the REIPPPP process. Thus no geographical or formal boundaries apply as this includes consumers, the entire value chain of renewable electricity, various state departments and any actor or thing or process that impacts the niche. As mentioned it is not the goal of this thesis to redefine the niche concept but rather to study it, in the way that it is presented in the MLP. Considering this, concrete boundaries set for the niches, as case studies are rather useless.

The aimed insights to be gathered from the case studies hinged on power giving and power taking. Consequently the niches are differentiated by the modalities of empowerment, namely fit-and-conform empowerment and stretch-and-transform empowerment. The cases were selected because they displayed different types of empowerment with different types of actors. This could arguably have been phrased differently. One could consider centralised development and oppose that with decentralised development. The reason for my chosen focus is twofold: first, the implication of agency in the conceptions of empowerment serve my questions better, and secondly, this thesis builds on the work of other theorists and these were the terms that they came up with to describe specifically the issues with which this thesis deals. Thus I concluded that they were better suited as classifications for my case studies than, say centralised or decentralised development.

#### *The Western Cape Electricity Sector Niche as Case study*

Because of my geographical location in the Western Cape, gathering data in and around Cape Town was relatively simple for this case study. Even though this niche is geographically located within the Western Cape, some of the shielding, as I show in Chapter 6, comes from national level, outside of the geographical location. Thus here again setting concrete boundaries for the niche is a needless exercise

The second case study is represented across two chapters (Chapters 6 and 7). Chapter 6 (and Chapter 5) focus on power giving, steering or empowerment. Chapter 7 focuses specifically on power taking. Arguably, power taking or rowing could have been considered in finer detail for the first case study and this would be an excellent point for future research. Due to the data available to me and the resources at my disposal, focussing on rowing in the second niche was easier to accomplish. Some might say that this gives an incomplete picture of the steering and rowing that affected the niches studied. I would have to agree. However, any study has its limitations and this study takes note of this limitation. This is not to say that a discussion about rowing was completely left out of the first case study, just that it did not enjoy as much attention as in the second case study.

### 3.4.3 Selecting Participants

Various sampling strategies were employed in selecting participants for this research. As the project advanced, the methods of selection became more refined. This type of refinement is once again characteristic of Adaptive Theory. Neither the case study nor the participant selection processes included pilot studies. Taken together, the data gathered from interviewing participants was sourced from 24 in-depth, unstructured interviews of between two and three hours each. I will elaborate later on the process of interviews. The interviews took place in three sets, beginning-phase; mid-phase and final phase. The sampling logic for participants in each phase is represented in the table below.<sup>4</sup>

**Table 3: Sampling Logic**

<b>Sampling Methodology</b>	<b>Stage of Research</b>	<b>Number Of interviews</b>	<b>Benefit to The Study</b>
<b>Typical Case Sampling</b>	Beginning-phase	6	During the initial phase of research one of the main ideals of selection was to establish a base case. This was especially relevant for participants that were part of smaller businesses, because these actors do not generally publish

<sup>4</sup> Based on Creswell (2013: 127).

			information from which one can gather a basic norm with regards to the variables of this study. This meant for example establishing the normal interconnectivities that these actors have with other private or public institutions, and their perceptions of their own, and other actor's methods of exerting agency. This also included selecting participants that represent larger private institutions and public institutions to corroborate or dispute the picture sketched by the literature.
<b>Confirming and Disconfirming Sampling</b>	Mid-phase	5	Including a broad spectrum of actors, mostly specialists in the field selected to: 1). Elaborate on the theoretical problems already identified through initial analysis, 2). Highlight other issues and 3). Identify variations that might exist
<b>Criterion Sampling</b>	Mid-phase	9	Some cases were selected because they represented a specific criterion that was important for the study. One example of this is the selection of a specific company that specialises in mid-size solar rooftop projects in the Western Cape. Even though I had by that time had a variety of interviewees with renewable energy companies, this one was of particular interest because it contributed to the stretch-and-transform model of empowerment that I wanted to study within the Western Cape.
<b>Stratified purposeful sampling</b>	Final-phase	4	The final phase of interviewees were sampled with the direct aim of illustrating subgroups or sub-categories within the two case studies.
<b>Intensity Sampling</b>	Throughout	3	The sampling criteria applied to a few cases because they represented information-rich, 'must-have' participants. These include for example a representative from the REIPPP office and a representative from Eskom.

Interviewees served a dual purpose in this research: they were a source of data and they were compasses directing both the subsequent collection of interviewee data and data from other sources.

Interviewees can further be categorised by the actor roles that they assumed, which was important for the research.

**Table 4: Interviewee Categorisation**

<b>Actor Category</b>	<b>Number of interviews</b>
<b>National government</b>	5
<b>Local government</b>	4
<b>Intermediary</b>	3
<b>Private actor: small company</b>	4
<b>Private actor: larger company</b>	3
<b>Knowledge production actors: academia, researchers, finance companies</b>	4
<b>Activist</b>	1

### 3.5 Methods of Data Collection and Analysis

#### 3.5.1. In-Depth Interviewing

Qualitative methods, such as in-depth interviewing, produces knowledge that is linguistic, narrative, pragmatic and most of all contextual. Typically in-depth interviews are issue orientated and employed by researchers to look for patterns that emerge from thick descriptions from their interviewees (Hesse-Biber & Leavy, 2011: 95). The logic of choosing in-depth interviews relates to the role that was played by my interviewees in this study. The interviews served as primary sources of data but also as structuring elements in data collection, as I will explain below. In this sense in-depth interviewing was a good method for accessing subjugated knowledge, meaning the experiences and knowledge that remains hidden from mainstream data sets (Hesse-Biber & Leavy, 2011: 98).

Hesse-Biber and Leavy noted the danger in degrees of deviation and hierarchy between researcher and respondent because it affects the way in which the research comes to reflect the 'world view' of the respondent (Hesse-Biber & Leavy, 2011: 94). This was a major issue of concern in this study. Respondents in this study ranged from renowned experts in the field and high-level executives in government and the private sector to small business owners. The perceived degree of deviation on my part was thus often mammoth. Often I had studied materials produced by, or read news that discussed the respondents, which put them in a certain light in my mind. To mitigate this weaknesses of in-depth interviewing and to contribute to the validity of the research project I employed a technique called the triangulation of measure, meaning that I took multiple measures of the same phenomenon (Neuman, 2014: 166). This was achieved through gathering data in two primary methods (interviews and document analysis) and substantiating this with a third form of informal observation. This last form of observation was through the attendance of seminars, colloquiums and talks regarding renewable energy issues in South Africa.

### 3.5.1.1 The Process of Interviews Throughout

The interview process took place in three stages between November 2014 and June 2016. The interviews were usually arranged at the interviewee's place of business or at a restaurant, and recorded using a Dictaphone. After each round of interviewing the data would be transcribed and growingly focussed forms of analysis would be applied (discussed in detail below).

One of the big concerns in the mind of any researcher is a possible ethical quandary that they might encounter in their research endeavours. This research was conducted in line with the ethical requirements set forth by the University of Cape Town's Law Faculty's board of ethics. In line with this, interviewees were required to give informed and voluntary consent. As a researcher I was also required to respect the privacy and confidentiality of participants. The following measures were taken to insure the ethical treatment of interviewees and data:

1. Upon initial contact with possible interviewees, full disclosure was granted about the research project, my professional affiliation with the University and about the requirements set for interviews.
2. A formal interview time was scheduled with willing participants as it suited them, as far as possible in advance.
3. Upon meeting with interviewees, they were presented with an information sheet (which they could keep) that contained a delineation of the project and their rights and my expectations of them, the intended use of interview data, the safeguards set in place for them including privacy and anonymity as set forth by the ethics committee. It also included the contact details of the ethics committee and the researcher.
4. They were also presented with a consent form, which I required that they sign and give back to me.
5. Interviewees were asked if they objected to the interview being recorded and I respected their wishes in this regard. They were also verbally informed that they were not obliged to answer any question that I asked and could retreat from the process and withdraw their interview from the dataset at any time, before, during or after the interview.

Raw data, including recordings, notes and consent forms were kept in secure folders, either at the researcher's home or at the Global Risk Governance Programme's office at the University of Cape Town. They were not shared with any other parties save for the transcriber who was made aware of and agreed to respect the confidentiality and ethical guidelines of the university.

As the interview data gathered for this thesis also formed part of a larger research project, I was not always the only interviewer. In such cases South African members of the SANCOOP project team accompanied me. Most of the interviews were with one interviewee at a time, however in two cases interviewees either pre-requested that a colleague join them in the interview or invited a colleague during the process of the interview to explain specific elements of the interview better than they could. In these cases, informed consent and information sheets were provided for the secondary interviewees and all of the ethical considerations mentioned above were explicated.

#### 3.5.1.2 Structure of the Interview and Questions

The interview structure was different for each of the interviewees. I did not have a set question list that I wanted answers for from all of my respondents. The guiding factors in my interview process were threefold: 1) The emerging theoretical ideas, 2) my research questions, 3) the aim of eliciting their subjective worldview. This unstructured methodology by no means meant that I went in unprepared - as explained the selection of interviewees depended on the phase of research that I was busy with, consequently the content of the interview was largely dependent on the phase of interviewing. Nevertheless the process of preparation for each interview was similar. Before each interview I would create a profile for the interviewee, their company and what I could gauge to be their specific area of expertise as it relates to my research. Notably this could possibly have created a form of bias in that I was purposefully establishing preconceived ideas about the interviewee in question, however this was mitigated by the fluid and unstructured manner of the interviews. Should the interviewee not respond as initially expected to a topic raised, I would let the conversation flow, provided that it still attended to my research questions, theoretical concepts or that it was an explanation of the interviewee's view of his world. I was also wary of maintaining any set notions about constructs, people or

topics of concern and would often reiterate a question in a different manner to make sure that I understood exactly what the interviewee meant, or I would respond to a statement by rephrasing it and asking if this was indeed what the interviewee meant.

From the profile created for each interviewee, I created a set of information primers and theory primers to guide the discussion. This is similar to a probe as explained by Hesse-Biber and Leavy: a probe is a researcher's method for getting a respondent to expand on a topic, relate back to a previous chain of conversation or expand on a marker that was picked up on by the researcher (Hesse-Biber & Leavy, 2011: 107).

The information primers meant that the interviewee's acted as guides and informants to the rest of my data collection, both in interviewing and in documentary analysis.

They were also used to fill in the gaps that my literature review and previous sets of data collection failed to do, and to clear up confusing issues from my previous sets of data collection. The information primers generally consisted of the following types of points:

1. **Technical explanations.** Because of the nature of this study, it often demanded complex understandings of technical concepts from fields such as engineering and economics that I am not an expert in. My interviewees on the other hand often had first-hand experience and a working knowledge of these concepts and were generally all too willing to explain them to me.
2. **Practical content issues.** Because most of the literature at my disposal does not present in a narrative all-encompassing fashion, there were usually issues of interest to me that were left out in the literature as it veered from the point of articles, news and books in question.
3. **World-views.** These primers cover both theoretical and informative domains, depending on the response that I received from the interviewee. At the start of each interview I would typically introduce the research project and myself and prime the interviewee to give an introduction to their position, their experiences and their views. This was a crucial step to the rest of the interview as it allowed me to establish how comfortable the interviewee was with me and it also allowed me to identify preliminary markers that I would take note of and possible use as subsequent primers in the conversation. A marker is a passing statement or reference made to an important occurrence or the

respondents experience of something, someone or some occurrence (Hesse-Biber & Leavy, 2011: 106).

4. **Follow-up questions.** Often I would probe either the point of view or an elaboration of information from a respondent through statements like: “I read in *Engineering News* that X is becoming a big problem in the industry”

Theory primers were established and refined throughout the course of the research through processes of analysis and reflection. Thus at the start the theoretical primers were broad and ill focussed. This included the world-view of interviewees but also possible connections between the interviewee in question and the theoretical components of the study. It included for example:

1. Bringing up issues or asking questions related to the interviewees role within a specific niche;
2. Their experience of power dynamics within their setting;
3. Asking about their network and their network relationships;
4. Asking about their philosophy on renewable energy;
5. Identifying selection pressures that might impact the interviewee and probing a response in this regard;
6. Asking about their relationship with incumbents or the central actors in the production of ‘Eskom electricity’; or, if they were one of the incumbents, probing the question in the opposite manner;
7. Simply asking who holds the power in their area of operation and how this power is transferred;
8. Establishing their goals and then priming a response to their main methodologies of attaining these goals. This type of probe took various forms and was only posed to some of the interviewees. For example: probing an intermediary actor (see chapter 2) to describe their goals and methodologies is different to asking this of an actor from a small renewable energy company. Sometimes an actor’s goals (making profit in the case of the renewable energy company) are more obvious, so the question would not make sense. It was an important probe in cases where the ideology of the individual or company was seen as a dictation of action, or as a contradiction of action for which further investigation was needed.

### 3.5.2 Documentary Analysis

The documentary analysis was informed by and informed the interview processes, and a similar model for choosing useful documents was used as the priming model explained above. Interviews have the strength of being targeted and insightful as they are guided by the researcher, however documentary analysis provide other strengths that could counteract some of the weakness of interview research. Interviews are more subject to the bias of the researcher and the respondent. They can also become over reflexive as the interviewee might only give accounts of the issues and constructs that he or she thinks the interviewer wants to hear about (Yin, 2003:86). By contrast, documentary analysis can provide a stable, unobtrusive and exact account of an issue. Even though much of the information found in documents selected might not have been of initial interest to the researcher, documentary analysis has the added advantage of broadening the scope of interest of the researcher through wide coverage of issues related to and not-directly (or not thought of as directly) related to a construct, situation or event (ibid.).

The types of documentary sources used in this thesis are as follows:

1. **Speeches and media statements.** The main actors for whom speeches and media statements were accessed were those that could not be interviewed, or those that are not pivotal to an argument, but nevertheless provide a substantiating case. An example of the former is the 2016 *State of the Province* address made by the premier of the Western Cape (Zille et al., 2016). An example of the latter is a media statement by NUMSA that was used to substantiate an argument about the reaction of incumbent actors to the possibilities of privately procured electricity in South Africa (NUMSA, 2012).
2. **Company Reports.** These were accessed for companies of interest in order to obtain quantitative information such as consumption or production statistics and carbon emissions measurements.
3. **Project Reports.** This included a wide array of documents, such as the reports of successful or unsuccessful projects under the REIPPPP and reports for renewable energy-related projects by state and non-state bodies.
4. **Research Reports and Plans.** Various actor groups published research reports of pilot cases and studies conducted in the realm of renewable

electricity in South Africa. An example of a research project report is that of the Western Cape Provincial Government summarising their responses to climate change (Isaacs, 2016).

5. **Legislation and Rules.** This included formal legislation such as laws and bills and the project rules of the REIPPPP, but also institutional guidelines.

Some of my theoretical concepts benefited more than others from documentary analysis. An example in this regard would be that of the role of narratives in governing socio-technical niches. This was found to be a determining factor in the case of the Western Cape, and it was clearly demonstrated in their project plans, project reports and speeches and statements. The additional depth that documentary analysis provides to interviews can also be illustrated by this example. One of the first interviews that I had was with a representative of the Western Cape Provincial Government (Interviewee 10). In this interview various markers indicating the institutional mentality or narrative of the provincial government were identified, however only once the transcribed interview had been read. Had I picked up on these markers during the interview, I would have probed for more information from the respondent, however, at that stage I had not yet identified the narrative as an important construct for investigation. The supplementary documentary analysis allowed me to build on the markers even though I could not probe the respondent.

### 3.5.3 Observations

The observational analysis conducted in this research had two purposes: first, it was a source of further information and added to the triangulation of my data. Secondly, the type of observational settings allowed for a number of informal conversations which acted as more of a reflective mirror for my research than a reference-able form of data. Notably, none of the data gathered from these functions was directly referenced in this thesis, however the influence of meeting and listening to speakers, participants and delegates directed the lines of inquiry in my primary form of data gathering (interviewing) and my secondary form of data gathering (documentary analysis). No formal recordings were made during these types of observations; only field notes were made in some cases. These types of observations took place in two primary settings: at the 2015 Powering SA with Cleaner & Smarter Energy conference hosted

by SANEDI and the 2015 SAIREC (South African international renewable energy conference).

### 3.5.4 Data Analysis and Interpretation

This section serves to give an account of the ways in which I made sense of, organised, coded and analysed the data that was collected towards this thesis. As described throughout this chapter, the research was not completed in a segmented fashion. Rather, analysis began as soon as there was data and theorising took place throughout. As discussed earlier, the research is approached through a dual strategy of inquiry inspired by Adaptive Theory and Collective Case Study methodologies. The general approach to the study relies on the theoretical approach that led to the case studies as reflected in the research questions (Yin, 2003: 112) and by the simultaneous collection of data and processes of analysis advocated by Adaptive Theory (Layder, 1998: 20). The discussion that follows outlines this process

#### 3.5.4.1 Initial Data Sorting, Concept Formation and Nvivo

In quantitative analysis, researchers conceptualise variables and conceptualise them as a step in the processes towards measuring them. By contrast, in qualitative data analysis of new concepts are formed or refined, grounded in data, and concepts and evidence are mutually dependent especially when working with case studies (Neuman, 2014: 480). Cases are defined as such mutually through empirical units and theoretical categories. This initial process referred to by Neuman as ‘casing’ takes place throughout the research process, however can be regarded as the first step in data analysis. This includes sorting data into manageable categories and initially flagging links, categorisations, generalisations, similarities and differences. This was accomplished with the use of the NVivo software. Open coding (Neuman, 2014: 481) processes were used in this manner. It started with giving each transcribed interview an alias in the form of a random number from 1-25. Beyond this point I referred to interviewees according to this number in order to maintain anonymity. All of the interviews were transcribed completely and entered into a folder in NVivo. As described by Creswell, the advantages and pitfalls of a computer programme for qualitative data analysis are as follows (Creswell, 2013: 165): the single location

aspect of storing transcriptions and other forms of electronic data in a single location makes data retrieval more efficient. Computer programmes, through electronic coding, makes it easy for a researcher to store and locate similar data sets, ideas, concepts or references through built-in search functions. The biggest advantage is the concept mapping function provided by programmes like NVivo. This enables the researcher to visualise connections between concepts, issues, actors and cases. In addition to this I also found that the nested hierarchies that I could create in NVivo provided an excellent tool for making sense of large data sets in case study research. It also allowed for cross comparison and summarisation of ideas that could be exported and kept on file. This served as initial concept lists, which were revised as the research went on. The main pitfalls according to Creswell are related to the time and effort it takes to learn a computer programme and to the possible shortcomings of programmes.

Internal resources were organised into folders for documents, field notes and summaries, and transcriptions. The programme further allows one to create 'nodes'. Highlighting a section of text and selecting the node(s) to which it belongs can build up these nodes. This can be done through systematically going through text or searching through all of the resources imported, or a selection of the resources imported for a specific phrase or term. Thus the programme allowed for cross-coding from various sources while indicating in each node section where the coded section was sourced. Various initial nodes, or code categories were created, including a master node for actors, with 25 sub-categories indicating different actors. Another initial node was created for data that referenced policy as master node, with various policies as sub-nodes.

#### 3.5.4.2 Data Analysis and Coding

After the initial coding (pre-coding), the next step was to formulate orientating concepts in order to introduce my data to my theory. Layder suggests three sources of orienting concepts. These are: existing theories including general bodies of theory or a specific theoretical framework. The second instance is particular concepts; here he gives the example of Foucault's use of 'power', which was also one of the orienting concepts in my study. The third instance is concepts drawn from particular

substantive or social areas of analysis (Layder, 1998: 101). Drawing on the theoretical basis of this study, including the MLP, additional theories of socio-technical transitions and the governance literature, these orienting concepts were created and refined throughout the process of data analysis and gathering. Below I give an example of some of the types of ‘power’ as an orienting concept used as a code, its sub-categories together with an example.

**Table 5: Types of Power**

<b>Orienting concept</b>	<b>Sub-Categories</b>	<b>Nested sub-categories</b>	<b>Example</b>
<b>Power</b>	Actors	State	<i>“We haven’t stepped up to the plate” (interviewee 17)</i>
		Private Sector and consumers	<i>“I think you going to find that with time those small-scale renewables are going to move out of the utility space and out of the IPP space completely. And they are going to empower consumers to make choices and quite frankly that’s what’s going to disrupt the industry and that falls completely out of our regulatory domain. These are consumer choices” (Interviewee 2)</i>
		Intermediary/ third sector	<i>“everybody believes that they own us and in fact we do not belong to anybody” (interviewee 1)</i>
	Regime	War room	<i>“That is where the real war is taking place and it’s largely over who knows where the bodies are buried. Who’s actually done corrupt deals here and how do we cover up this and stop them from uncovering this complete mess” (interviewee 4)</i>
		Eskom	<i>“ Eskom is not adhering to the legislation at the moment in terms of emissions ... In fact, the department could, has the legal right to close down Eskom at the moment because its not adhering... but it wont of course” (Interviewee 6)</i>
		Deterioration of power	<i>“we always say there’s pockets of excellence and pockets of ...” (Interviewee 4)</i>

After the processes of pre-coding and the creation of initial orienting concepts, I began memo-ing throughout the rest of the research project. ‘Memo-ing’ is the process of taking stock of the progress of a research project by writing down ideas, concepts that emerge and questions and considering how these data points fit into the project as a whole. This is a great technique for a researcher to become more reflexive about their own position within the research (Hesse-Biber & Leavy, 2011: 123).

Layder suggests that along the lines of Adaptive Theory, one must opt for a form of

theoretical-memo writing. He expands on the work of Glaser and Strauss (1980) once again by including elements of both substantive and general theory. Thus memo-writing, as he sees it, must attend to the characteristics of the theoretical framework such as their roles in chains of reasoning and models of explanation and in so doing become more concerned with theoretical elaboration (Layder, 1998: 49).

Beyond this point, cycles of coding, memo-ing and analysis resulted first in a high volume of conceptual categories out of which systematic macro-level coding concepts became evident relating specifically to each case study. These overarching themes included: selection pressure; the modification of behaviour; power giving and power taking.

### 3.5.5 Conclusion

This chapter examined the iterative process of research adopted in this thesis. It described the various thought and action processes that laid the groundwork for the work done and the analysis shown in the substantive chapters of this thesis. This thesis did not follow a linear process - it was messy. Cycles of back and forth between data and theory informed further investigations of both data and theory that happened parallel to one another.

The chapter focussed on the rationale behind opting for a qualitative research methodology and looked at the guidelines used for selecting cases, participants and data sets. The strategy of inquiry was a combination of Adaptive Theory and collective case study methods. Adopting the Adaptive Theory perspective allowed the research to be flexible. Often, scholars present their research in a series of steps clearly following on one another. I have found that the actualities of research are never as simple. In fact, the research question that I started out with was not the one that I finished with. This is partly because during my research process the theoretical landscape was being developed. Various theorists had started attending to the same criticisms of the MLP that originally primed my research. Based on their work and on my growing familiarity with the theoretical terrain, I was able to sharpen my research questions.

The iterative process followed in this work contributed to the quality and refinement achieved in the study. The question of agency is a tough one to answer. It necessitates certain categorical differentiations between the variables that are thought to add up to agency. Initially this was going to be done by looking at the outcomes of agency in the niche as identified by the MLP and by other theorists of agency in socio-technical transition. Initially I focussed squarely on the action and inactions of actors toward shielding, nurturing and empowerment, and looked at how this contributed to the three processes of the niche as identified in the MLP. Later I realised that further categorisation of actors, be it temporally, might add to the explanations because saying that actors shield, nurture and empower and in so doing contribute to the developmental trajectories of the niche could be explored in more detail by saying which actors contributed in which ways. As explained above, the branches of action followed in this study were based on what had come before it.

The data was validated through a process of triangulation and the methodology of coding and memo-ing was incorporated after and during each step of data gathering. This thesis is both comparative and explorative. To a certain extent, the case studies were compared to one another; however, the main comparison was between actors within each case study. Thus the case studies served as terrains for action rather than bounded spaces. The informants served a dual purpose as both sources of data and sources for the identification of where to look next. Much of the data that was gathered through the interview process was followed up with documentary analysis.

The class of data gathered made this relatively easy: the work focussed on the real world experiences of actors and their perceptions of the system under study especially as it informed their mentalities and 'possible futures'. There was also a distinct focus on the role of discourse in the socio-technical niche and even though this is embodied in the way that people talk about the sector it is relatively easily available in the form of policy, plans and media statements. Because of the fact that studying discourse on the matter also includes interpretation of people's opinions, *reading between the lines* complicates the claims made in this regard. The process of triangulation through documentary analysis in this and other cases served to add to the validity of this study. Further, as much of the action research here pertained to either plans, legislation, rules or institutional standpoints, the substantiation of documentary

evidence proved invaluable. Possible shortcomings of this work might be found in the non-holistic account of governance mechanisms at niche level. They are non-holistic because I only regard the regime as it interacts with the niche, and because of the fact that the data was gathered during the formative phases of the niche environments because neither had broken through into the regime. However this can rather viewed as one of the accomplishments of the thesis as it investigates a time and space in niche formation that was previously not considered in the literature. Another shortcoming relates to the relative neglect of the landscape level of the socio-technical system. This is viewed as an acceptable oversight because of the nature of complex system studies: the boundaries drawn between what is considered and what is left unattended facilitates a sharper explanation, albeit a non-holistic one.

## Chapter 4

### Contextualising the Case Studies

#### 4.1 Introduction

South Africa's energy policy has been locked into a coal power pathway since the early 1950s when the National Party strategically launched the country's electricity production and so doing inserted the state into the wealth accumulation that came from minerals and energy developments. The National Party had its finger on the pulse of the energy sector, which they strategically operated in a way that created the perfect climate for industry growth due to low costs of electricity and relative independence from the international market in the early years of industrial development (Scholvin, 2014: 192). The end of apartheid's sanctions meant rapid internationalisation and growth of the already energy intensive industry (Scholvin, 2014: 194).<sup>5</sup> These increases in demand put pressure on the grid, which Eskom has attempted to counteract through the construction of new coal power stations and the reconnection of mothballed stations. Parallel to the on-going expansion of coal-fired electricity production to make up for shortfalls, the country is also perusing other avenues for securing electricity supply. These alternate avenues of electricity supply, together with a magnitude of technological development is changing the ways in which South Africans consume, produce and understand electricity. This chapter aims to form a backdrop for understanding the two case studies that are dealt with in the substantive chapters of this thesis, the REIPPPP and the development of renewable electricity in the Western Cape. The aim here is to sufficiently explore the political, social, historical, technological and regulatory contexts for these two case studies.

This chapter starts with an exploration of the historical development of electricity in South Africa, highlighting the development of the minerals-energy complex in the

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<sup>5</sup>Electricity consumption by the non-ferrous metals industry tripled between 1992 and 2004; consumption doubled for the production of non-metal minerals and it more than doubled in the metal and iron industries (Scholvin, 2014: 194).

country and the path dependencies created by this method of wealth accumulation. The second section explores the alternatives to coal-fired electricity that have been introduced into the South African electricity market, focussing specifically on the procurement of renewable energy from independent power producers and some more decentralised methodologies, including embedded generation and energy efficiency measures. The main aim of this chapter is to introduce the reader to the context of electricity debates in the South African electricity sector and to the two case studies.

#### 4.2 Historical Development of the South African Electricity Sector

During the late nineteenth century South Africa installed its first electrical lights at a railway station in the Cape Colony. In 1882 the mining town of Kimberly installed electrical streetlights, well ahead of the rest of the world, which was still using gaslight (Eberhard, 2004: 2). Following this, the electricity industry grew rapidly in the country, closely linked to the booming gold mining industry. The first commercial central power station in South Africa was erected in 1897 by the Rand Central Electric Works and supplied the mining industry around Johannesburg. Many mines had subsequently built their own power station and in some instances, were supplying electricity to neighbouring towns. The Victoria Falls Power Company was established in 1906 with the intention to provide electricity from hydro power stations, but this was soon replaced by coal-fired power plants, as it was cheaper. In 1910 the British colonies of the Cape and Natal, together with the colonised Boer republics of Transvaal and the Orange Free State formed the South African Union. The grid however remained relatively decentralised as it was made up of a mix of municipal and private power producers and was governed by municipal bylaws.

By the 1920s centralised electrification had been considered, as the availability of cheap and abundant electricity would be crucial to shape the iron and coal industries that had begun to flourish in South Africa. ESCOM (the Electricity Supply Commission) was created by The Electricity Act (42 of 1922) (Eberhard, 2004: 3). This Act also legislated the creation of the Electricity Control Board (ECB) to licence both private electricity generators and ESCOM, and approve proposed tariffs (ibid.).

The Act also gave ESCOM statutory powers to establish both generation and distribution capacity, and they had to do so at the lowest possible cost. They received loans from government in the early years but they had to issue bonds to raise the rest of the money. Exempting ESCOM from tax was one of many mechanisms implemented to oil the wheels of the 'no profit, no loss' machine. This legal mechanism made it possible for ESCOM to become involved in the power production of various cities in South Africa, which in turn led to ESCOM taking over operations of the power stations of the Victoria Falls Power Company.

By this stage ESCOM was bulldozing most of its competition by taking over smaller companies. It was able to do so with the help of increasing state involvement and support in growing the monopoly of the electric giant in the South African industry (Eberhard, 2004: 3). The government at that time was content with their anti-waste, anti-competition system of electricity production, as it boasted one of the cheapest power stations (in Witbank) by 1930. By 1973 South Africa had a fully functioning interconnected grid that was almost completely centralised. The 1970s were ESCOM's heydays, demand was at a steady increase and so was production. However, by the 1983 ESCOM realised that they had over planned, and that they had in fact ended up with double the capacity needed.

Funding for the massive expansions that the grid underwent came from commercial debt and bonds issued by ESCOM to the local and international markets. However, the cost of finance was increasing, which led to the amendment of The Electricity Act in 1971. The amended Act now allowed ESCOM to retain a percentage of their earnings in order to build up a capital development fund. ESCOM was now allowed to make a profit. This signalled price increases, public unrest and eventually a government inquiry in 1983. The end result of the inquiry was changes in the Electricity Act and to ESCOM becoming Eskom in 1987 (ibid).

#### 4.2.1 From Escom to Eskom

The new Eskom was aimed at improving financial and commercial performance as they moved away from their previous aim of 'no profit no loss to be made'. Eskom was to be governed on more 'business-like' principles. But these changes did not take

away any of the power that granted the old ESCOM a monopoly over the electricity industry. What is more, the new Act included a clause exempting Eskom from having their tariffs regulated by the ECB, which meant that the responsibility of governance now fell squarely on the shoulders of Eskom's Electricity Council.

Despite the efforts at downscaling, maximum generating capacity still exceeded the peak demand by 40% in 1992. Eskom then decided to promote electricity usage by offering electricity intensive, industrial consumers low-cost contracts. Eskom went into one such agreement with an Australian company, BHP Billiton, in 1992 regarding the sale of electricity to their smelter located in Richards Bay (Manuel, 2013). This agreement linked their tariff to the aluminium price on the London Metal Exchange, which meant that, should the price of aluminium drop globally, so too would their operating costs in South Africa. The arrangement was for 25 years, of which the first few were profitable for Eskom as the Rand had weakened.<sup>6</sup> The economy was growing rapidly at that stage and Eskom's capacity was fast approaching equilibrium with the national demand. Both parties were so happy with the agreement that BHP Billiton made another agreement of the sort for a smelter in Mozambique. By 2001 the Rand had weakened to R13.84 to the Dollar and soon there were plans for smelters close to Port Elizabeth and increases in the capacity of Hillside (BHP's Richards Bay smelter) as Eskom was now pocketing over 400% more than when the deal was signed in 1992 (ibid.).

The political shifts that South Africa underwent during the early 1990s also reshaped the industry. The African National Congress (ANC) had a broadly socialist economic philosophy, which signalled immediate efforts at social and economic advancement. Their Reconstruction and Development Program (RDP) promised, among other things, the provision of water and electricity to poor households, through the catchy slogan, 'electricity for all' (Fowles, 2004: 2). There were various stumbling blocks to the implementation of the new electrification objectives that including a fragmented industry; financial concerns; significant differences in tariffs charged across the country and discrepancies putting certain municipalities at a disadvantage in terms of purchase tariffs and electrification funding (ibid.). During the ANC's first election its

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<sup>6</sup> Part of the agreement was that BHP pay Eskom in US Dollars.

aims were for boosting employment through the creation of state-facilitated housing and infrastructure and various other poverty alleviation strategies through the RDP. By 1996, when the ANC had full control over government, managing the burden of debt and stabilising the economy became a key priority. The Minister of Finance at that time introduced the GEAR framework, which was intended to boost private investment. Already, this was seen as the ‘1996 Class Project’ by various labour unions - an attempt to cooperate with White Monopoly Capital towards the weakening of the democratic revolution (Nattrass, 2014: 16).

The National Electricity Regulator (NER) was established in 1995 and an Electricity Working Group (EWG) was established to formulate proposals on structural changes to the Electricity Distribution Industry (EDI). Another group, the Electricity Restructuring Interdepartmental Committee (ERIC) was formed to assess the recommendations made by the EWG (Fowles, 2004: 3). In 1997, based on a cabinet report, government, decided to introduce cost reflective tariffs, an electrification levy and a cap on tariffs for necessary municipal development.

Governance of the electricity sector has always been a somewhat murky matter, with Eskom historically responsible for most of the governing, although, legally, the responsibility for oversight had shifted between national departments. The Department of Mines and Industry was involved in the governance of the electricity sector until the creation of the Department of Commerce and Industry in the late 1930s. After the Department of Commerce and Industry, the Department of Industry was involved from the 1960s until the Department of Minerals and Energy took over in the 1980s. The Office of Public Enterprise was also involved at the end of the 1980s. In reality, there was very little actual departmental oversight up until this point (Marquard, 2006: 129). Early oversight of the industry by government, however limited, was accomplished through three main bodies (Marquard, 2006: 133). First, the electricity control board established in 1922 in terms of the Electricity Act that was responsible for the licencing of ESCOM and commercial producers. The board’s control effectively stopped with the issuing of licences. Instead they fulfilled a meditative role in terms of supply rights and infrastructure issues. Secondly, the De Villiers Commission was tasked to investigate the effectiveness of the Board, however they ended up focussing on ESCOM (Steele et al., 2012). Under the De

Villiers Commission the licensing system was done away with which meant that Eskom was effectively granted full control of the industry once again. The major changes that came from the De Villiers Commission was the corporatisation of Eskom and the end of the 'no loss no profit' formula for the utility. The last early regulator was the National Energy Regulator that was established separate to Eskom, however comprising of ex-Eskom employees, including a retired Eskom CEO. The Regulator was established as part of the country's economic regulation and the post-apartheid transformation of the industry as part of the process of national electrification between 1993 and 1995 (Eberhard, 2009: 237).

In 2003 a blueprint created by PriceWaterhouseCoopers regarding the reconstruction of the EDI was to be operationalised by government. In line with the blueprint, government decided on the creation of six Regional Electricity Distributors (REDs) under the management of EDI Holdings (Pty) that would serve to rationalise pricing structures and manage distribution across municipalities. In terms of distribution, ownership of the networks as set out would remain in the public sphere. The idea of 'contestable consumers' was also actualised (electricity intensive consumers that would be given the option to choose their electricity supplier) (Fowles, 2004).

Former president Mbeki announced the deadline for the establishment of the first RED, with the City of Cape Town as its industrial centre, in his 2004 State-of-the-nation address. The venture at restructuring electricity distribution in South Africa was not successful. Government realised that it would be more effective to retain the electricity generation assets that had historically been at the centre of the state's accumulation of wealth. The private sector realised the risks inherent in privatising parts of the electricity sector in South Africa. (McDonald, 2011: 79).

Costs for electricity services are currently spread out amongst the consumer base, with a portion of electricity subsidization for poor households built into pricing structures. Most of Eskom's assets are paid off and there is still an abundant reliance on coal to produce electricity. This still translates into relatively cheap electricity, especially for industrial consumers (Tsikata & Sebitosi, 2010: 1282). South Africa has an extremely electricity intensive economy and the country's dependence on this model of financial accumulation resonates in policy.

Eskom Currently operates 27 power stations with a collective capacity of 41 919 MW most of which is from coal-fired electricity generation plants (35 650 MW) (Creamer Media, 2014: 1). Almost two-thirds of Eskom's power stations are in need of maintenance that has been delayed. Eskom has two new large-scale coal fired plants on the way and one hydro pumped storage station. The Medupi (4 764 MW) and Kusile (4800 MW) coal fired plants will be brought online in the near future, however they are already behind construction schedule. The utility has also completed the return to service program, which brought online 3700 MW of power from three mothballed stations. Eskom has also invested 2.4 billion Rand in the 100MW Sere Wind farm and they have started a solar project to the value of 9 billion Rand that is expected to yield 500MW- 1000MW in capacity within the coming years (Creamer Media, 2014: 2).

Despite the efforts at staying ahead of the demand curve, Eskom is in trouble. In 2008 South Africa experienced its first electricity crisis due to antiquated power stations resulting in technical breakdowns. Again in 2014, the electricity sector found itself in a state of crisis due to similar conditions (Wentworth, 2014: 7). The price readjustments proposed during the first attempts at electricity restructuring described earlier also never realised. The price that consumers pay is determined by NERSA, and the level of output and capital investment in electricity is determined by the Department of Energy. This has resulted in a demand-supply equilibrium issue for Eskom (Wentworth, 2014: 8). Initial shortages in reserve margins started appearing as early as 1995, however this was only acted on in terms of price increases in 2007.

Eskom's CEO at the time, Tshediso Matona, reported in November 2014 that the utility was at its worst economic and operational position since its birth. This due to inflated costs of coal and diesel, municipal debt and various maintenance issues that dropped the energy availability factor to 76% at the end of September 2014 (Creamer, 2014a). The utility requested an average yearly increase in electricity prices of 16% but Nersa only granted them 8% average increase for the period April 2013 to March 2018. Eskom's financial dilemmas led to the creation of an interdepartmental task team to probe the issue, consisting of officials from Public Enterprise, the Department of Energy and National Treasury. The probe concluded that Eskom needs support to

safeguard its sustainability in the coming years with the immediate priority being the securitisation of short-term resources as the utility is facing short-falls of up to R25 billion over the next two years (Creamer Media, 2014: 2).

#### 4.2.2 The Minerals-energy Complex

Historically production and transmission of electricity in South Africa was separate to the distribution of electricity with the exception of distribution of electricity to mining companies and large industries. This led to a close relationship between electricity intensive industries and Eskom with its abundant cheap electricity, which underlies the development of the South African economy growing from a trickle-down effect of the networks of mining industries in the country. The mining and energy sectors, with their related industrial subsectors, constitute the main site of financial accumulation in South Africa through a complex web of interdependencies described by Fine and Rustomjee as the minerals-energy complex (Fine & Rustomjee, 2007: 71). They argue that the developmental trajectory of South Africa's economy rests upon the strong linkages that are to be found between a set of closely-knit industries and the consequent lack of linkages that these industries have formed with other sectors. Almost all of South Africa's electricity was generated by coal-fired power plants up until the early 1980s when the first nuclear plant was commissioned (Marquard, 2006: 122). This meant that electricity remained cheap, as it had mainly been sourced from the country's abundant coal reserve, which left the market relatively isolated from outside influences such as the oil price increases of the 1970s.

The developmental trajectory of the electricity market is tied into this relative independence in terms of two phases of development according to Marquard (2006). The state was able to strategically insert itself into the regional development of mining and industries through the electricity industry as there was a continuous supply of coal and cheap labour to sustain a growing monopoly in the production of electricity, with relatively high levels of autonomy from the rest of the world. Mining and minerals processing already accounted for around 40 per cent of the country's electricity consumption in the mid-1900s, with related industrial consumption accounting for a significant proportion after that (McDonald, 2011: 67). The second phase is the development of a national grid and the institutionalisation of relationships

between the electricity monopoly and energy intensive industries in South Africa (Marquard, 2006: 123). This resulted in the characteristics of the electricity sector in the country, which can be observed to this day. The South African economy has been built on this intrinsic link between private capital and public utilities. The complex has adjusted over time to include other related sectors and remains heavily dependent on electricity and mining at the centre, with the industries at the epicentre becoming reliant on the service sector due to the crisis of financial accumulation that the country was facing at the end of the Apartheid era. Mining-minerals and related firms were increasingly seeking protection in financial markets both locally and globally, which in turn contributed to the financialisation of the local market and a secondary connection added to the minerals-energy complex (McDonald, 2011: 67).

As illustrated by the failed attempt at restructuring the sector into REDs, discussed above, the economic developmental trajectory of South Africa that culminated in the minerals-energy complex means that the country is limited in terms of developmental paths that it could take in the future. The state will, for the foreseeable future hold on to assets that it deems crucial to providing for the financial accumulation demands set by the minerals-energy complex. For the time being, South Africa's options for 'base-load' electricity are locked into coal. The country also has limited capacity for hydropower because of low rainfall. It is only the Orange River that carries enough water to power a hydropower station (Scholvin, 2014: 191). The potential for hydropower in our Southern African neighbour states are relatively high, however their demand for electricity is much lower than that of South Africa. There have been attempts at regional cooperation with Mozambique to share the output of the Cabora Bassa station located in the Zambezi River. However, the conflict in Mozambique made the high voltage transmission lines easy targets for anti-government guerrilla movements in the 1980s and 1990s (ibid). There are however various other lucrative possibilities in the area of regional cooperation in hydropower, however the main reason for not acting on this is, once again, the country's abundance in coal (ibid). Privatisation in the electricity sector, based on a withdrawal from the sector by the state, will be highly contested as it holds serious ramifications for both the industries at the heart of the minerals-energy complex and for the state's ability to profit from the complex (McDonald, 2011: 79).

### 4.2.3 The Politics of Electricity in South Africa

The creation of energy policy has been described as a balance struck in terms of the energy ‘trilemma’ (Rhodes, Skea & Hannon, 2014: 5603). This trilemma consists of three broad policy objectives: energy security, energy affordability and the management of environmental impacts. The trilemma has both reinforcing and opposing elements. This trilemma is clearly evident in the South African case; however, policy decisions are currently made out of necessity to regain electricity supply security. Renewable sources of electricity have been considered as a beacon of hope if South Africa is to reach its carbon mitigation targets. To date, however, they have remained marginal in the grand scheme of things. The reasons for the slow and partial uptake of renewable energy technologies into the South African energy sector have been ascribed to institutional shortcomings, social factors and market-based barriers set by Eskom’s monopoly over the industry. The most powerful explanation is probably the minerals-energy complex, according to which the country’s economy is effectively locked in by the long-standing ties that have formed between industry, energy and finance (Scholvin, 2014: 187).

Political players in South Africa are not only linked to the electricity sector through the creation of policy. They are often active players in the sector and their reach and influence goes much deeper than the cosmetic policy level. This can be attributed to the political value that has been created by the minerals-energy complex in the country, but sadly, also to the high levels of corruption and nepotistic arrangement of politics in the country. The involvement of South African politicians in areas such as energy and electricity is highly sensationalised by the media; however, it remains an important avenue of exploration as it serves as one of the lock-ins that I will describe in more detail below.

Politicians in South Africa have often occupied the grey area of owning or holding personal stakes in the mechanisms underlying the dominant regime. The *Daily Maverick*’s Mandy De Waal quoted columnist and political analyst Aubrey Matshiqi as saying:

*Understanding who is in charge of this country means understanding the nexus between money and politics, and which interests are hegemonic in*

*South Africa... I think one has to look at it in those terms. And you have to look at which logic these companies support in the decisions they take – they can be powerful, but at the end of the day whose logic do these companies support? (De Waal, 2013)*

Indeed, the economic and political influence of these personal buy-ins to the energy and electricity sector and the political alliances formed have definitive ramifications for the creation of policy in the country (Scholvin, 2014: 188). Leading politicians in the ANC sit on the boards or hold a significant amount of shares in mining companies, most significantly, Cyril Ramaphosa (ibid). Another example is that of Bridgett Radebe, wife of Jeff Radebe (the Minister of Justice and Constitutional Development) and sister of Patrice Motsepe, one of South Africa's wealthiest citizens. Bridgett Radebe is the chair of Mmakau mining (a company with many coal interests) and the president of the South African Minerals and Mining Association (that advises the Minister of Energy). Her brother Patrice Motsepe, also has mining interests and has been linked to President Jacob Zuma and various other ANC elites. There are countless other examples of political networks that hide under the surface of the electricity market of South Africa. What I attempted to highlight with these two examples is the lobbying power that lies within these networks. I was by no means commenting on their legitimacy. It is important to understand that these networks often exert their influence on the formation of policy and on the developmental trajectories of the sector and that, through these networks, the development of electricity policy and infrastructure is linked to a variety of other interests. Why would one lobby to move away from coal power if one owns a coalmine?

International political pressure has also had a significant impact on energy policy and practices in South Africa. In 2012 South Africa stopped importing oil from Iran under pressure from the United States. The decision to implement Eskom's Medupi coal-fired power station is another example of South African electricity in the international political arena. It will be Eskom's largest single investment in its 84 years in operation and will provide up to 10 per cent of the country's electricity needs (Rafey & Sovacool, 2011: 1141). Medupi is, however, expected to push around 30 million tonnes of carbon dioxide into the South African air annually. The project is dependent on major funding obtained from the World Bank (albeit in a questionable manner)

(ibid.). The World Bank loan was surrounded by an outcry from civil organisations and environmental groups, which led to a firestorm of rhetoric. Support for the mammoth new build cited economic imperatives as South Africa's number one concern, which was reason enough to go ahead with the project. Medupi was even framed as environmentally friendly due to its cleaner coal technologies (Rafey & Sovacool, 2011: 1144).

#### 4.2.4 Electricity policy - toward the inclusion of alternative energy technologies

Almost half of the electricity capacity added globally in 2012 was from renewables (Msimanga & Sebitosi, 2014). By 2012, 138 countries worldwide had set in place renewable energy targets and 127 had already implemented some form of renewables policy, the most common of which was feed-in tariffs and renewables portfolio standards. There are various countries that have transitioned from a monopolised EDI model. There are a few identifiable models of transmission ownership in existence (Pollitt, 2008: 704).

1. The independent transmission system operator model, of which the UK national grid is an example, where the transmission system is completely unbundled from the rest of the system and privatised.
2. The legally unbundled transmission system, of which France is a good example, where two separate boards have control over transmission and distribution.
3. The independent system operator model requires an external body monitoring and controlling, but never owning, the transmission assets.
4. A hybrid model between independent system operator and the transmission ownership where these become unbundled from the rest of the system.

The South African transition is being shaped not only by a need to decarbonise, but also by the immediate challenges of electricity security. The transition will however be shaped by much more than this, as there are various path dependencies that block certain avenues of transition in the country. The political imperative to include the private sector and renewable sources of electricity in the South African electricity mix can be seen in the following policies:

1. The 1998 White Paper on Energy Policy was drafted during the initial phase of the National Electrification Programme and set out to define energy and electricity objectives in post-apartheid South Africa. This paper had the ambitious (failed) target of unbundling the electricity distribution from generation and transmission with the aim of introducing competition into the market through the outsourcing of 30 per cent of the current generating capacity held by Eskom (Morris & Martin, 2015: 11).
2. The 2003 Renewable Energy Policy White Paper set the first target of 10 000 GW of renewables to be procured by 2013, however this target was not met.
3. The Integrated Energy Plan of 2003 drawn up by the Department of Minerals and Energy, aligned energy policy with other national development strategies, international commitments and long-term climate change strategies. This report was to be updated annually over a 20-year period, however; this was not followed through. The second Integrated Energy Plan was released for public comment in 2013 (Morris & Martin, 2015: 12).
4. The Electricity Regulation Act of 2006 was initially established to create NERSA in replacement of NER and to clarify the regulatory body's relationship with Eskom. However, it also held major implications for the establishment of independent power procurement programs. NERSA was effectively separated from Eskom and charged with the mandate to licence new generating activities, while Eskom was charged with purchasing new generation in terms of the Act. This meant that the two bodies had to be in agreement before any new external capacity could be connected to the grid, effectively giving Eskom the power to delay the process as the Act enabled them to be the sole purchaser of electricity (Morris & Martin, 2015: 13).
5. The Long Term Mitigation Scenarios Paper (LTMS) of 2007, commissioned by the Department of Environmental Affairs, to assess the country's GHG emission mitigation strategies was conducted by a multi-stakeholder team that included representatives from the private sector, civil society and government. Its research findings have had a significant impact on commitments made by government towards lowering carbon emissions, which in turn creates a positive outlook for the private sector and renewable electricity markets. President Zuma committed to reductions at the 2009 Copenhagen Conference

of Parties, and the LTMS also informed future energy planning policy (Morris & Martin, 2015: 14).

6. The New Generation Regulations of 2009 outlined the process for the creation of power purchase agreements for all technologies, including renewables. This was accompanied by the Electricity Regulation Amendment Bill that stipulated that in terms of formulating power purchase agreements for independent power producers, the power should be stripped from NERSA and handed over to the Department of Energy. The Bill also made it possible for the Department of Energy to instruct Eskom to purchase power from independent power producers (Morris & Martin, 2015: 15). This was an important milestone in the acceleration of private sector entry into the South African electricity market.
7. The Integrated Resource Plan of 2010 was set to establish South Africa's electricity mix for the next 20 years. This document was to be revised every two years, however there has only been one such revision in 2013. This document included a significant allocation of renewables to be added to the electricity mix, however the mix was still dominated by coal electricity. The 2013 update happened together with the update of the Integrated Energy Plan and took a more practical stance to electricity developments as it had taken more current factors into account in its scenario planning (Morris & Martin, 2015:17).
8. The National Climate Change Response White Paper of 2011 gave a broad overview of South Africa's climate change response strategies and set priorities based on the LTMS.
9. The Independent System and Market Operator (ISMO) Bill was another attempt at liberalising the electricity market. In terms of this Bill, a separate entity would be created to control generation and resource planning. This entity would also then take over Eskom's role, as sole purchaser of electricity and it would also be tasked with overseeing general system operations. The Bill was presented to Parliament in 2013, but was abandoned.

### 4.3 Procurement of Electricity from Independent Power Producers

There are a few widely cited reasons for the inclusion of cleaner technologies in the South African electricity sector: first, governmental recognition that Eskom does not have the financial or technical capability to meet the country's demand and ensure electricity security (Montmasson-Clair, Ryan & Moilwa, 2014). eREACT is an activist group within parliament that came about in response to a lack of results, after tireless debates about issues such as the energy crisis, the country's carbon footprint, and the reality of the construction of new power stations (Meyer et al., 2011: 46). eREACT stands for the e-Parliament Renewable Energy Activists. In light of the energy crisis in 2008, this group was able to influence parliamentary opposition to include clean energy. This contributed strongly to the decision to introduce REFIT in 2009.

Secondly renewable energy technologies are becoming more and more effective and competitive because of various factors, including the possibility of carbon tax being introduced in the country. Thirdly the government's climate change mitigation and green economy strategies have set out the need for clean electricity as a main priority. The Integrated Resource Plan states that 42 per cent of the South African electricity is to come from renewables by 2030 (Scholvin, 2014: 199). Terence Creamer reported in October 2014 that the country had already attracted over \$10 billion in clean energy investments (Creamer, 2014b). Solar has accounted for the largest segment of this with \$6.7 billion. The inclusion of renewables in the South African energy mix has been a long time coming. Despite the various failed efforts and risks involved, most renewable projects have delivered on time with no budget overruns (Schwab, 2014). Daniel Schwab of *Business Day* suggested that scaling up renewables is the best solution for our current electricity dilemma as this will not only lessen our carbon emissions but also create jobs and transform the South African economy from a commodity-based economy to a knowledge-based economy (ibid.). Lastly the creation of a renewable electricity industry has, as one of its sub aims, the mission of contributing to the country's local economic development through job creation.

Globally, the path toward the inclusion of renewable sources of energy has taken different forms in different countries. Denmark - Europe's renewable energy pioneer,

for example, had a movement motivated by a need to evade the risk of an over-dependence on fossil fuels after the oil crisis of the 1970s, just like many other European countries (Roselund & Bernhardt, 2015). The Danish government considered the implementation of a nuclear build program as an alternative, however, this was strongly opposed by a citizens movement that began building small locally owned wind powered turbines. Government policy soon followed this with a program that subsidised 30 per cent of the cost of installations of renewables, which signalled the beginning of Denmark's renewables industry (ibid). The initial motivations underlying the inclusion of renewable energy technologies and the private sector actors in South Africa stemmed from a need to liberalise the market in an attempt to overcome some of the issues inherent in having a monopolised industry, such as discriminatory tariff structures and inefficiencies in supply. At a later stage, global pressures, directing the electricity sector toward greening strategies, also added to the list of arguments for the inclusion of renewable energy. Even though initial attempts at market liberalisation failed, the list of reasons for the inclusion of renewables and the private sector into the energy field grew when the electricity sector entered a time of crisis due to Eskom's production shortfalls and unmaintained equipment

#### *The National Cogeneration Programme*

In 2007 Eskom launched the Pilot National Cogeneration Programme (PNCP) to test the market for independent power producers (Montmasson-Clair et al., 2014: 40). The initial aim was to procure 900 MW of commercial cogenerated electricity by 2007. Eskom was specifically looking for projects that could utilise energy from processes that would otherwise be wasted; projects that produced by-products of other energy types (in addition to electricity); and projects using renewable fuel sources for the generation of electricity. The PNCP aimed at commissioning projects that could deliver more than 1 MW and had a ceiling price for bidders. The focus was on obtaining the cheapest bids in terms of technical and commercial specifications with power purchase agreements to be signed up for any period between seven and 25 years. Eskom received 15 bids with a projected output capacity of 5000 MW by June 2008, however they offered power purchase agreements totalling only 50 MW. The bidding process was said to be complex and too risky and finally no power purchase agreements were signed under the PNCP. However the Medium Term Power

Purchase Program, in the pipeline for the following year, 2008, seemed more promising.

#### *The Medium Term Power Purchase Agreement*

The Medium Term Power Purchase Agreement (MTPPA) was submitted late in 2008 with the focus on changing Eskom's short- and medium-term power supply and catering for projects that were not included in PNCP. The maximum planned capacity of the project was 30 000 MW (Montmasson-clair & Ryan, 2014: 41). It would include projects ranging from 5-10 000 MW and was open to all technology types including new build and capacity increases. Bidders could sign either a power purchase agreement or participate in Eskom's Power Conservation Programme. Eskom guaranteed a minimum price for buy backs that declined from 2009 annually. However the plans were short lived as issues with lower than anticipated tariff increases granted by NERSA, together with external costs of commitment, forced Eskom to step back and abandon the project. Despite being scrapped, the MTPPA received more positive feedback from bidders than its predecessor. The publication of predicted prices allowed bidders to better determine whether their project would be a success (Montmasson-clair & Ryan, 2014: 41).

#### *The Multi Base-load Power Procurement Program*

The Multi Base-load Power Producer Program (MBIPPP) was established in 2008 with the aim of specifically procuring 2100 to 4500 MW of base load power (Montmasson-clair & Ryan, 2014: 42). Eskom pre-qualified 27 national and international developers out of the 76 that had applied. Pre-qualification was essentially based on the companies' having 25 per cent black shareholders. Requests for proposal were issued and successful projects would have to sign a long-term power purchase agreement with Eskom. The project was suspended by Eskom in 2009.

The Renewable Energy Feed-in Tariff policy (REFIT) was the first policy outside of ESKOM. Even though the PNCP included the procurement of clean energy in its initial criteria for developers, REFIT was the first to focus solely on renewables. NERSA designed and administered the project and Eskom was the designated buyer of electricity. Set prices had been established for different technologies by NERSA. (Montmasson-Clair, Moilwa, & Ryan, 2014: 45). REFIT was approved in 2009 with its first phase kicking off in March that same year. It was designed to generation costs and real return equity of 17 per cent fully indexed inflation (Eberhard, 2014: 36). In phase one, NERSA published guidelines for the regulation of various technologies including wind, biogas and CSP parabolic through storage. For Phase Two, in July 2009, NERSA published further guidelines for large scale on-grid PV systems, solid biomass, biogas and a few other CSP technologies. The evaluation criteria for renewable projects under REFIT were published in early 2010. In its initial form, REFITs power purchase agreement had various issues: it allocated too much risk to IPPs and there was no stabilisation clause for legal changes (which created unrest among possible developers as previous procurement processes and agreements were abandoned leaving IPPs involved without compensation). NERSA then attempted to redraft the problematic power purchase agreement with the help of a private legal firm, Webber Wentzel. The risk that IPPs expressed as reservations to the first draft of REFIT were largely based on the pre-established price for which Eskom would purchase their electricity (Montmasson-Clair et al., 2014: 98).

The tariffs were revised in March 2009. The new tariffs were regarded as generous by the private sector, however this time they expressed concern about whether South Africa would be able to sustain these new tariffs over the 20-year lifetime of the power purchase agreement. They were concerned that the higher tariffs could result in costly electricity for the consumer and in so doing, halt development within the sector in favour of cost-cutting (Montmasson-Clair et al., 2014: 99). The last revision of tariffs was published in March 2011 by NERSA and this time, it they seemed to get it just right. Unfortunately this small success was short lived, as National Treasury announced in 2011 that REFIT was illegal, based on an audit done by Webber Wentzel, citing that the tariffs predetermined in the way specified by REFIT would

fall outside of South Africa's public finance and procurement laws. REFIT was abandoned without any power being procured under the program (Eberhard, 2014: 36).

#### 4.3.1 The Renewable Energy Independent Power Producers Procurement Programme

The implementation of the Renewable Energy Independent Power Project Procurement Program put its predecessors to shame. The historical and institutional shortcomings of the South African energy sector would have suggested that this would be yet another failed attempt, however, the program has exceeded expectations all round (Eberhard, Leigland & Kolker, 2014: 9). The Department of Energy (DOE) realised, however, that they too would encounter capacity issues when attempting to run the program. The DOE decided to learn from ESKOM's mistakes. They sought the assistance of the National Treasury's Public-Private Partnership Unit (PPP) to manage the program. The DOE PPP office was assembled with technical staff from both departments and with a few legal and technical experts from outside government. This unit effectively functions outside of the formal structures of these departments, with a focus on assisting the REIPPPP process (Eberhard, Leigland & Kolker, 2014: 9).

Familiarity with the structures and practices that are to be found within the private sector meant that they knew to include the private sector in dialogue regarding key structural issues of the program design and implementation. The REIPPPP's private sector consultant's list includes international reviewers such as Ernst & Young, project management reviewers, legal evaluation, technical evaluation and financial evaluation. High standards were set and maintained throughout the bidding processes and most of the deadlines were met (Eberhard, Leigland & Kolker, 2014: 9). A request for proposals was issued in August 2011. The REIPPPP initially envisioned 3625 MW of power to be procured from a maximum of five tender rounds and a further 100MW was reserved for smaller projects. Caps were set on the maximum capacity to be produced by a single technology with the largest allocation going to wind electricity (Eberhard et al., 2014: 11). Bids were due within three months of request for proposal and financial close would take place six months after the announcement of preferred bidders. The Request for Proposal comprised of three

main sections: general requirements; qualification criteria and evaluation criteria. The documentation also included a standard power purchase agreement; an implementation agreement and direct agreements (providing step-in rights for lenders in the event of default). Contracts were set to have a 20-year tenure. Project selection was based 70 per cent on price and 30 per cent on economic developmental considerations. The REIPPPP is not subject to the National Treasury Regulation 16 for evaluating and approving public private partnerships, however the IPP's are required to complete a list of 24 preparation steps, including being evaluated by specialised analysts. This is because Eskom, who has to sign off on all of the power purchase agreements, is considered a state-owned rather than government enterprise. More than 130 advisors were used to develop the Request for Proposal and also to evaluate bids. Private sector advisory costs were estimated at US \$ 10 million (Eberhard, Leigland, & Kolker, 2014: 12).

By June 2015 a total of 92 projects had been signed under the REIPPPP with a total investment value of R193 billion (Creamer, 2015). The process for the procurement of electricity from independent power producers is at an all-time high in the country, amidst the on-going state of crisis in 2015. Together with the announcement of 13 preferred bidders for round four of the REIPPPP came an unexpected announcement of a mopping up exercise aimed at securing another 1800MW from previously unsuccessful bids and other new bids as part of round 4 (ibid.). The tender documentation will be redesigned for round five to include a redefinition of 'local community' and further mechanisms to ensure early, equitable benefits to local communities and more serious considerations for local content requirements. The reviewed tender documentation will also draw in closer considerations of constrained distribution and transmission in the country. In addition to this the Minister, Joemat-Pettersson, confirmed the Department of Energy's commitment to procuring an additional 6300MW of renewable electricity in future bid rounds. Deputy Director-General of Policy Planning and Clean Energy, Ompi Aphane, stressed the scope extensions of IPP procurement in South Africa beyond renewables to include coal, cogeneration, gas and demand-side management initiatives (Creamer, 2015).

## 4.4 Non-utility Scale Renewable Energy and Energy Efficiency: the Case of the Western Cape

### 4.4.1 Renewable Energy at Provincial Level

For South African provinces, changing the way that electricity is produced and consumed within their jurisdiction is a difficult task, because most of the juridical power to affect electricity matters sits with national and local government. At city level, municipalities control their distribution grid, and the profit made from the distribution of electricity is a pivotal part of most South African municipal financial models. The goal of sustainable development has in recent years however translated into sustainable energy plans and roadmaps for many of the provinces in South Africa, and a part of this always includes making the electricity sector within their regions more sustainable. It must be understood that altering the electricity sector is hardly ever regarded as one of the main outcomes of these strategies. Even though these documents and plans are aimed at sustainable development across industries, this is made to fit into the socio-political ideology of the province and usually includes aspects of energy poverty, economic development and overall sustainability. Most of these policies and plans are not directly aimed at growing the renewable energy sector. Even though all provinces have the same mandate and relatively similar legislative power within their region, they cannot be considered to have equal opportunities to impact sustainable development in general and the renewable energy space in particular. The reasons for this include the unequal distribution of economic, social and environmental resources (Department of Energy, 2015: 39). The table below represents the renewable energy activities per province in South Africa. Notably, this information is adapted from a report by the Department of Energy on the State of Renewable Energy in South Africa, and consequently favours utility scale electricity and is biased from a national standpoint (Department of Energy, 2015).<sup>7</sup> Regardless, it offers an interesting presentation of the types of activities that are being undertaken at provincial level. The table is divided into action categories that include both broad focal areas in policy, identified technological developments and technological developments that have been acted on. Not included in this table are the

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<sup>7</sup> Minimal data is available regarding the activities of the Free State provincial government, thus it is not included in this table.

general areas of influence that are a part of the energy or sustainability strategies of all provinces. These are: job creation, the facilitation of a green economy, energy security, energy access, energy cost issues and addressing consumption patterns within the province.

**Table 6: Renewable Energy Activities Per Province in South Africa.**

Action	Western Cape	Gauteng	Kwazulu-Natal	Eastern Cape	Northern Cape	Mpumalanga	Limpopo	North West
<b>CSP identified</b>	x				x		x <sup>8</sup>	
<b>SSEG identified<sup>9</sup></b>	x	x		x <sup>10</sup>			x	x
<b>PV identified</b>	x	x	x <sup>11</sup>		x		x	x
<b>Wind identified</b>	x		x	x				
<b>Energy Efficiency Identified</b>	x	x	x					x
<b>Cogeneration Identified</b>								x
<b>Bio-energy Identified</b>			x	x		x		x
<b>Hydro Identified</b>					x			
<b>CSP pursued</b>					x			
<b>PV Pursued</b>	x				x			
<b>SSEG Pursued</b>	x	x		x				
<b>Wind Pursued</b>	x			x				
<b>Cogeneration Pursued</b>								
<b>Energy Efficiency Pursued</b>	x	x	x					
<b>Mineral and Industrial</b>	x			x	x <sup>12</sup>		x <sup>13</sup>	
<b>Dedicated</b>	x	x <sup>14</sup>	x <sup>15</sup>	x <sup>16</sup>	x			

<sup>8</sup> A target of 100 MW has been set for CSP.

<sup>9</sup> Additional information regarding small-scale embedded generation also obtained from a report published by SALGA, GIZ, AMUE and GreenCape (SALGA et al., 2016)

<sup>10</sup> With the support of GIZ, a REIPPPP permitting and authorization process was published for projects in the Eastern Cape. A support study was also conducted.

<sup>11</sup> Additional information was also adapted from the Climate Group summary of the Western Cape and the Province of Kwazulu-Natal (The Climate Group, 2017b).

<sup>12</sup> Special Economic Zone for solar themed projects in the Khara Hais Municipality.

<sup>13</sup> Limpopo has substantial silicon reserves and the second largest silicon smelter in the world. Limpopo's Green Economy Plan identifies the development of silicon for component solar panels, solar chargers and small-scale electrical devices as a key industrial opportunity.

<b>institutional support in Government</b>								
<b>General renewable energy Targets set</b>	x	x			x			
<b>Self sufficiency</b>	x			x				

The ‘top green planner’ provinces, identified in a study by the South African Local Government Association (SALGA) and GIZ, were Gauteng, the Western Cape and Kwazulu Natal (Ferry & Von Kalm, 2015:11). This study analysed the Integrated Development Plans of municipalities to determine how many municipalities had incorporated renewable energy, energy efficiency and climate change into their planning modalities and categorised municipalities as top green planners if they have *prioritised* renewable energy and climate change issues by identifying green projects and allocating budgets towards these projects. In 2015 only 60 of the 278 local municipalities fell into this category (Ferry & Von Kalm, 2015: 3).<sup>17</sup>

#### *The Western Cape*

The province houses approximately 6.1 million citizens, covers an area of 129,370 square kilometres and is the fourth largest province in South Africa (Musango et al., 2015: 3). The policy response for the province stem from the National Climate Change Response White Paper, published by the Department of Environmental Affairs in 2011, which mandates provinces with developing a climate change response strategy that should evaluate the risks and impacts of climate change (ibid). The Western Cape Government established its Green Economy Strategic Framework in 2013 and with that, aimed to become the lowest carbon province in the country and the green economic hub of South Africa.

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<sup>14</sup> Through the creation of a center or an energy office within the Gauteng Provincial Government towards the coordination of investors, municipal and sector departments and to deal with energy issues, including renewable energy and energy efficiency.

<sup>15</sup> KZN sustainable energy Forum and the renewable energy hub

<sup>16</sup> The Eastern Cape Provincial government established an energy forum to facilitate the implementation of and investment in sustainable energy.

<sup>17</sup> Of the total 278 municipalities in South Africa, 44 are district municipalities and 226 are local municipalities. Of these, eight are considered to be Metropolitan (Buffalo City, City of Cape Town, City of Johannesburg, City of Tshwane, Ekurhuleni, e Thekwini, Manguang and Nelson Mandela Bay) All eight metros were identified as Top Green Planners.

The Western Cape has three key target areas for affecting climate change-related issues: GHG emissions reductions, energy efficiency and energy productivity and renewable energy. Targets have been set for all three of these areas by the Western Cape Provincial government (The Climate Group, 2017a). Crucial for the success of the Western Cape Government has been the identification of ‘levers for change’, which include the facilitation of installations of embedded generation, solar water heaters and other energy-efficiency measure on both public and private buildings. The table below offers a summary of the initiatives taken on by the Western Cape Government in the sustainable energy and electricity space.<sup>18</sup> The crucial formula to success, which is discussed in great detail in Chapter 6, includes the identification of the issues of sustainability, the identification of levers for change, the implementation of these levers and the quantification and measurement of the implemented levers over time.

**Table 7 Sustainable Energy Activities of the Western Cape Government<sup>19</sup>**

<b>Activity</b>	<b>Period</b>	<b>Main Outcomes</b>
<b>Climate Change Mitigation Scenarios for the Energy Sector</b>	2015	Mitigation scenarios considered best outcome identified: replacing coal-fired electricity with renewable energy and natural gas
<b>Western Cape Provincial Strategic Plan</b>	On-going	Reduce reliance on Eskom by 10% by 2018 Levers for change include small-scale embedded generation, solar water heaters and reduction in energy usage for buildings
<b>Small-scale embedded generation (SSEG) focussed work</b>	On-going	Collaboration with municipalities and other key stakeholders to facilitate SSEG with a specific focus on the necessary guidelines, by-laws and tariff structures
<b>Solar PV on public buildings</b>	On-going	Installing solar PV on government buildings, and feasibility studies in this regard
<b>Western Cape Modernisation Programme</b>	On-going	Relating to office space- the promotion of metering technology in order to measure consumption and calculate potential savings
<b>Climate Change Municipal Support Programme</b>	From 2012	Support municipalities in realising and setting sustainable goals, climate change frameworks and action plans
<b>Annual Integrated Development Plan assessment of local and districts</b>	On-going	Monitoring and evaluation of the progress of municipalities in responding to issues of climate change

<sup>18</sup> This section provides a preliminary overview of the renewable electricity developments in the Western Cape. The topic is discussed in more detail in Chapters 6 and 7.

<sup>19</sup> Adapted from the Climate Group (The Climate Group, 2017a).

#### 4.4.2 Renewable Energy and Energy Efficiency at City and Municipal Level

Above I described how provincial governments guide and facilitate the uptake of renewable energy in municipalities. National government also has a substantial hand in guiding the production and consumption of electricity at municipal level. They affect this through programmes such as the Energy Efficiency and Demand-Side Management Programme (EEDSM). This programme was established by the Department of Energy and currently delivers grants to 68 municipalities in South Africa (Joemat-Pettersson, 2016: 17). Most of these funds are directed toward retrofitting streetlights. The Local Government Energy Efficiency and Renewable Energy Strategy set up in 2013 provides a framework for local governments to develop an energy efficiency framework tailored to their own needs. National government has set two basic targets for municipalities in relation to energy efficiency: firstly a 20 per cent reduction in energy intensity, indicating the consumption of energy per person residing in the municipality and secondly, a 30 per cent reduction in fossil fuel intensity of the municipality's own vehicle fleet (ibid.).

By 2016, 18 municipalities in South Africa already had approved SSEG application processes in place, a further three had application processes under development (SALGA et al., 2016). Seventeen municipalities had already allowed customers to feed into the grid, three of which had not yet established approved SSEG application processes. Fourteen municipalities had either approved tariff structures for SSEG, were in the process of approving these structures and a total of 25 municipalities were keeping track of the SSEG installations in their jurisdictions (ibid). The municipalities in the Western Cape make up: 13 out of the total 25 that lists their installations; 12 out of the total 18 that have approved SSEG application processes; 13 out of the total 17 municipalities that allow customers to feed into the grid; and 11 out of the total 14 municipalities with approved tariff structures in place, or having tariff structures under development (ibid.).

There are a few identifiable pioneering renewable energy projects at municipal level: eThekweni municipality owns a landfill gas-to-electricity project that was commissioned between 2006 and 2008. Capital and operating expenditures for this project come from the sale of carbon credits and the sale of electricity (Department of

Energy, 2015: 61). Bethlehem Hydro established in 2009 and 2012 at two sites is commercially managed in the same way as the eThekweni's landfill gas project, through the sale of carbon credits and electricity fed back into the municipal grid. It was the first commercial hydro power station established in South Africa in 22 years (Department of Energy, 2015: 65). Both of these projects had to overcome various regulatory hurdles, including obtaining long-term power purchase agreements between municipal actors, other departments (the Department of Water Affairs in the latter context and the Cleansing and Solid Waste Department in the aforementioned). Notably these types of innovations were pioneers in municipalities becoming competitors with Eskom on commercial terms. The Darling wind farm in the Western Cape has a long-term power purchase agreement with the City of Cape Town and is another pioneer in this light. It was the first large renewable energy project in the country that acted as a testing ground for various new policies, including the wheeling of electricity (Department of Energy, 2015: 64). In addition, all of these cases had to contend with relatively low electricity prices affecting the viability of projects.

#### 4.5 Conclusion

Gwede Mantashe was quoted in late November 2014 as saying: "*Electricity remains a public good and therefore, if you privatise it, it will have problems*"(SAPA, 2014). The electricity market is undoubtedly becoming a shared space. Private investment and the technical abilities of the private sector are at the basis of the success of the current IPP procurement project. This 'shared space' has trickled down into local electricity markets and has translated into a growing level of decentralisation in the electricity market of South Africa. Transitioning away from the centralised dominant regime that is firmly rooted in the minerals-energy complex is a complex process. This chapter has introduced the successes and challenges of the South African transitioning electricity sector. In the following chapters (5-7) I provide a substantive analysis of the interactions and governance modalities of actors at niche level.

## **Chapter 5**

### **The Case of the REIPPPP**

#### **5.1 Introduction**

The aim of this thesis is to explore how actors govern change toward the breaking of lock-ins in socio-technical transitions. More specifically, I consider the dynamics of governance that takes place within protective spaces, or niches, as the primary location for the formulation of new rules in socio-technical systems. In order to contribute to this debate, three specific interrelated areas are discussed in Chapter 1 and built on in Chapter 2. Collectively these topics are dealt with in each of the substantive chapters (5, 6 and 7). Toward this goal, two niche environments have been identified in the South African electricity sector in chapter 4 of this thesis: the IPP project (discussed in Chapter 5) and the Western Cape electricity sector (discussed in Chapters 6 and 7). In this chapter I focus on modalities of fit-and-conform empowerment (Smith & Raven, 2012: 1030), specifically considering the categorisation of actors, the methods of steering and empowerment and the contribution of actors to the developmental trajectories of the niche.

The REIPPPP unit (hereafter referred to as the IPP unit) was set up in 2010 collectively by the DOE and the Public Private Partnership Unit of National Treasury. The unit effectively functions outside of the formal structures of these departments, with a focus on assisting the REIPPPP (hereafter shortened to the IPP Process) process (Eberhard, Leigland & Kolker, 2014: 9). Even though the establishment and success of the unit was a mammoth accomplishment, it cannot really be considered to function in strict opposition to the dominant regime. Eskom is the sole purchaser of electricity generated from this programme and the levels of procurement are controlled by the DOE. Arguably, the programme would not have existed if not for the various incidents of electricity shortfall experienced by the country, the international pressure toward lowering the country's carbon footprint and the availability of alternative technologies. The existence of the programme is legally mandated, however, as I will show in this chapter, there are various actors that influence the niche created by the programme beyond the regulatory actors.

### 5.1.2 The Interpretation of Policy

The programme is mandated by the IRP 2010, which states that around 42 per cent of the electricity generated in the country needs to come from renewable sources. According to the DOE, the IPP programmes' existence confirms the state's commitment to the implementation of the IRP, in fact, the Department stated that the implementation of the programme was essential if the country wanted to maintain its credibility:

*In terms of the IRP2010, about 42 percent of the electricity generated in the country is required to come from renewable resources. The forthcoming launch of the Renewable Independent Power Producers (IPP) Programme, confirms the commitment by the South African government to implement the approved IRP2010... It was essential for the department to proceed with the implementation of renewable energy initiatives to maintain credibility of the country (Department of Energy, 2011).*

Prior to the IRP, the 1998 White Paper was the first policy document that signalled changes to the electricity mix in South Africa, and the possible unbundling of Eskom. Even though the White Paper was a bold step towards a renewable energy economy, the execution of its suggestions remained relatively unsuccessful for a very long time. The interpretation of the White Paper was one of the first points of misalignment that occurred within the electricity sector of South Africa. From Eskom's point of view the White Paper did not necessarily instruct the breaking up of the utility, but rather that the distribution industry needed to be sorted out. It said that transmission and distribution needed to be separate and that generation should include private sector participation in one form or the other.

Since the White Paper there have been various interpretations of what the electricity sector *should* look like, primarily because the White Paper was published before the political debates accepting the implications thereof had taken place. In 2004, government employed a team of consultants who effectively designed a Nordic model for the country's electricity system. An interviewee who was part of this process

explained that the White Paper was never really implemented because the debates had never really taken place within the ANC and within the broader sector (Interviewee 6). According to this interviewee, there was definite discomfort in what the consultants were proposing, around unbundling and particularly around the participation of the private sector.

Post 1997, financial crisis's in the developing world together with the collapse of companies such as Enron influenced European and American investor confidence in developing markets. Development Finance Institutions also reconsidered their position with regards to restrictions place on infrastructure investments (Gratwick & Eberhard, 2008: 310). The open market liberalised industry model, suggested by policies such as the White Paper, came into question after international financial crises prompted a reconsideration of the national goals for the electricity sector. This would be the second point of de-alignment for the electricity sector of South Africa. The perception now, 17 years on, is that the country doesn't have a clear vision guiding the electricity sector, and that it is becoming increasingly difficult to update the vision because of the amount of contesting streams of development. The regulatory structures of the electricity market have essentially become de-aligned.

### 5.1.2 The Unforeseen Circumstances of Changing the System

Eskom understood that it would not necessarily be the vehicle for future capacity within the power industry. This is why they created a business diversification vehicle called *Eskom Enterprises* (Interviewee 2). This was easier said than done as some of the normal operating methodologies that the electricity sector functioned on for so many years, now started to become issues. One such issue came in the form of cost reflective tariffs. This and other issues started surfacing when the utility tried to ready itself for the structural changes proposed by the White Paper. Eskom also predicted issues with the supply of electricity in the future. The utility had re-adjusted after a period of over-supply in the early 1990s and realised that they had to invest in their infrastructure if they were to survive in the future. Eskom asked NERSA for a tariff increase, which was opposed, based on the White Paper. NERSA's argument in response to Eskom was that the utility was in top financial shape, and seeing as they

would not be the vehicle for future growth in the electricity sector, raising the price of Eskom electricity did not make sense.

It seems that the crisis needed to reach a critical point (which it subsequently has) for political dialogue to follow. After 1998 there were various attempts at industry liberalisation that took place in South Africa. The case of the Independent Systems Market Operator bill (ISMO) was mentioned by a few of my interviewees. In terms of this Bill, a separate entity would be created to control generation and resource planning. This entity would also then take over Eskom's role, as sole purchaser of electricity and it would also be tasked with overseeing general system operations. The Bill was presented to Parliament in 2013 but was rejected. The perceptions around the (unsuccessful) Bill, was that the state, through Eskom, was not 'exposed to the market' in any real way; they have a captive market, which they are not willing to give up without a fight. The IPP office is viewed as a possible precursor to an open market. This widely-shared sentiment is clearly indicated in the following quote:

*So, we were going to liberalize completely in the 90s, we didn't go that way, and it just got stuck and Eskom was the hierarchy on its own and wanted to maintain its own ways and then they started to talk about the ISMO Bill. The IPP office could be a precursor of a sort of independent system and market operator. They are outside of all those other bounds but it's all long-term agreements and electricity isn't traded in real time and the government isn't exposed to the market on any specific day. They like that! They have now retired the ISMO Bill. (Interviewee 3)*

Around the same time that the ISMO Bill was proposed, Eskom was in crisis. A 'War Room' was set up late in 2014 by the President with the aim of addressing the electricity crisis and facilitating coordination between the various departments that hold a stake in matters of electricity security. The perceptions of various of my interviewees around the happenings within and around the War Room shed light on the issues that were surfacing regarding the de-alignment of the electricity sector. In addition to NERSA, Eskom and the DOE, the Department of Cooperative Governance and Traditional Affairs, the Department of Mineral Resources and the Department of Trade and Industry were all included in the discussions that took place in the War

Room. It was Chaired by Deputy President Cyril Ramaphosa and co-chaired by the Minister of Energy and the Minister of Public Enterprise. Various high-level academics and private sector actors in finance and business acted in an advisory capacity to the War Room. Even though the War Room was set up to address a national crisis, the discussions happened behind closed doors.

The interviewees that spoke about the War Room did so with disdain, saying that it was not serving its purpose. It was perceived as a last attempt at saving Eskom rather than resolving the electricity crisis, and that it was used to drive alternate political agendas in the electricity space, that had very little to do with solving the immediate problem at hand.

*Not many people really know what is going on in the war room that's part of the problem. They are very insular, they do not share a hell'uve lot. What they firstly seem to be concerned with is the financial sustainability of Eskom. Rather than how do we actually resolve this energy crisis... (Interviewee 4)*

*And this is actually to allow big vanity projects such as nuclear and shale gas which dominates at the level of the Executive, the Cabinet sub-committee on energy security, they seem to think that energy security is something for 2030, but they better do something about it now. Nuclear and gas are not pertinent to the short-term prices and then we have this whoa! And I do not know if you guys have managed to pick up whether the war room is an Eskom war room or a DoE war room?... (Interviewee 5)*

The messy politics that is illustrated by the War Room is the result of poor execution of the plans and policies that are in place, and ignorance of these plans through which the political elite drives alternative agendas, such as the procurement of large-scale non-renewable electricity. Ignorance and alternative agendas alone cannot, however, take all of the blame for the lack of push behind policies and political action that could have been aiding the development of the renewable electricity industry. By now pull factors had resulted due to: 1) the dominant regime mind set lobbying for big energy projects and centralised control over electricity resources; 2) the kick back of previous attempts at market liberalisation, including a shift in the global financial

climate; 3) a need to resolve the issues highlighted by the structural shifts that had already taken place in the industry, such as problems with cost reflective tariffs; 4) indecision in the political space about the best way to move forward after policies had been drawn up, partially through the influence of non-politicians.

The resulting mistrust in government's capacity to solve the electricity supply crisis worsened and the fact that various high-level government officials had been involved in the incumbent industries that form the nucleus of the minerals energy complex, such as major mining houses, contributed to the private-sector suspicions regarding the factors that drive electricity decisions.

Another example of the divisions that exist in government was discussed by various interviewees, that of nuclear power, which is yet another instance where the DOE has functioned as a mere backseat driver, if that. The presidency has strongly advocated for nuclear new builds and has been involved in questionable deliberations on the matter with Russia. President Zuma also restructured his cabinet in such a way that allowed him a close relationship with the new minister in energy, who herself is an avid supporter of the nuclear programme (Morris & Martin, 2015: 32). A renewable energy activist interviewed in 2015 said that this type of policy over-ride is not a matter of bad planning, as the fragmentation issue has been resolved through assigning the authority of energy governance to the DOE and through the creation of the Integrated Resource Plan. According to him, there is now a problem of an "authoritarian" approach to planning because energy policy and energy decisions are governed from the centre (the presidency) in complete disregard of planning systems that have been put in place. This perception is shared by those privy to the discussions and deliberations that happened in high levels of government. One interviewee, who was part of the National Planning Commission (NPC) explained that there were rational discussions taking place, which looked at the timing, cost and need for nuclear electricity. This interviewee also explained that there was another voice, that of the President, pushing for nuclear regardless of the cost, finance and timing. This issue was of grave concern to many of the key actors in renewable electricity that I interviewed. It was seen as a clear sign of corruption and that certain actors within the state were prepared to act in a completely irrational manner in the pursuit of alternate agendas, be it personal enrichment or the refusal to let go of a captive market. One

important fact became clear throughout this whole debacle: that the South African government has a variety of different voices, driven by contradicting ideals for the electricity sector, and the actors supporting big new builds such as nuclear, powerful as they might be, remain in the minority.

Perhaps if the political will existed during the deliberations around ISMO Bill or during the initial unbundling of Eskom, the country would have never entered a state of crisis. The electricity sector was in a catch-22 situation. There was some political will to introduce IPPs, however this was overridden by agendas aimed at maintaining the Eskom monopoly. These incumbent agendas had nevertheless started deteriorating, which meant that the tariff increases requested by Eskom were also not allowed. The early introduction of IPP's or an allowance enabling Eskom to expand and repair its fleet could arguably have prevented the electricity crisis starting in 2008. The political will toward the inclusion of IPP's grew and resulted in procurement programmes such as REFIT and its predecessors, however the state was still not willing to level the playing field as was evident by the retirement of the ISMO Bill. The state has since made commitments toward carbon reductions, both nationally and internationally, which have to be honoured.

The incident of the War Room sheds light on the fact that there are still strong alliances that act toward keeping the Eskom as monopoly intact, even when there is a successful procurement programme underway. The nuclear deliberations showed that there are also powerful government officials that have no issue with overriding policy to serve stock electricity plans. However, it also clearly started showing the fractions in government. The REIPPPP was born out of these issues of electricity governance. It happened because of shifting tensions that had been looming within the dominant regime for quite some time. The new ideals portrayed by this misalignment do not necessarily have to be in favour of a decentred, or renewable electricity market. They merely have to provide enough stagnation or resistance in the incumbent developmental trajectories for other possibilities to be considered.

## 5.2 The Placement of the Programme

The programme was strategically placed outside of the direct mandates of its parent departments, the Department of Energy (DOE) and the National Treasury. Their instructions were simple: find the barriers to private participation in the production of electricity in South Africa and remove these barriers, as explained by an interviewee representing the IPP office:

*At the Inter- Ministerial Committee it was very clear, in fact the instruction, was to go and look at the barriers, why is the private sector not participating in the SA energy space and the further instruction was to remove those barriers and make sure we get the programme going. (Interviewee 1)*

Even though the DOE credits itself with the promotion of renewable electricity, this too has been done through the outsourcing of regulatory responsibilities to the Renewable Energy Independent Power Producers Procurement Programme office. From the examples discussed above one should come to realise that, even though the programme had been mandated by law, this was by no means the reason for its creation or for its success, as there were various prior attempts (two mentioned above) at liberalising the market that had failed. Secondly, the reason for its creation or its success could not possibly have been the country's reaction to electricity supply issues alone. The War Room example illustrates clearly that, even in a conversation aimed at resolving the electricity crisis, the paramount issue for certain political actors remained saving Eskom. One could argue then that the War Room was aimed at solving the short-term issues with the 'devil we know', however, the political will to do so was interrupted, and trumped by the presidential will to procure nuclear electricity, which would not have yielded a single MW for many years to come.

Why then does the programme exist? Perhaps it's a combination of heightened risk of electricity supply shortfalls coupled with the political will that does exist to lower the country's carbon footprint. Neither of these reasons explains why it has been so successful. The success of the programme and of renewable efforts outside of the programme, and the breaking of lock-ins in the electricity sector can be explained when paying careful attention to how actors have been aligned around the programme

and how the actors within the programme, and those aligned with the programme have exerted governing influences within these alignments and the broader electricity sector. The way in which the programme is structured and the reputable employees of the IPP office has meant that, while the programme functions, it has had a significant effect on renewable electricity developments.

Because of the space that the electricity sector occupies in South African, the work that they do affect a wide set of state and non-state actors. Even though the affected parties have divergent interests in the growth of the industry, the programme office has become a point of alignment between these divergent interests. These divergent interests are not always in favour of renewable electricity and in some cases could even be considered as a lock-in for development within the sector. The main methodology of the programme has been to find and build on those interests that are conducive to the growth of the renewables industry. The programme has aligned actors along two main objectives: Social development objectives and financial objectives.

#### 5.2.1. Alignment along Social Objectives

The IPP Programme has a strong social development agenda that is enacted through minimum compliance thresholds that bidders need to adhere to in order to obtain preferred bidders status. The criteria include: South African Entity Participation requirements of 40 per cent; job creation targets that have been escalated in each consecutive bid round; local content requirements; black ownership requirements; local community ownership requirements and socio-economic development targets. The bidder is to identify the needs of the society surrounding the project site and contribute to the alleviation thereof. Beyond this there are socio-economic drivers set in place that are not a prerequisite to obtaining preferred bidders status, however, complying with this set of requirements enhances the competitiveness of the bids. These include a commitment to black South African management within the company; enterprise development targeted at black-owned businesses and preferential procurement targets through which goods and services are procured from businesses owned by black South Africans (Clean Energy Pipeline, 2015: 7).

These requirements are in line with the Industrial Policy Action Plan of the Department of Trade and Industry (Department of Trade and Industry, 2014). This alignment has meant that the project and the industry have enjoyed overwhelming support from the Department of Trade and Industry. An interviewee from the Department of Trade and Industry (DTI) explained how the programme is in line with their directive. They have taken a keen interest in all areas of development that pushes the mandate of re-industrialisation. Energy is one such area. The DTI looks specifically at what can be produced locally and at local job creation. They have been involved with renewable electricity along those lines since the DOE started the REFIT programme, and their involvement has been heightened because of the REIPPPP programme. The requirements for local content and job creation set by the programme played an important role in their levels of involvement.

The level of involvement from the DTI in the programme means that they now hold a stake in the success of the programme. They have put a lot of work into attracting investors to the programme and it would be detrimental to their mandate if the programme should fail. A quote from my interviewee with the DTI clearly illustrates this sentiment:

*It's very important, because if you just deliver the electricity and you do not meet the other requirements as an industry then you are running the risk of the plug being pulled and the programme being stopped. And we do not want to see that because we are right in the middle now, we have done a lot of work trying to attract investors and some have invested and they are looking at how far is this going to go, for our investment to be successful it needs to go as far as possible. (Interviewee 9)*

The DTI and other supporting organs of the state are not the only actors that bought into the social ideals of the programme. Independent power producers recognise that, even though they might be taking on the socio-political responsibility for which the onus traditionally falls on the state, the addition of social and economic development aspects of the bids provides a basis for legitimacy within communities and in the eyes of government. A representative of SAWEA, the wind industry association,

interviewed in 2015, explained how they view this additional social developmental role in the role of electricity developers in South Africa:

*It is almost an acknowledgement by government that they cannot do service delivery as they want to and so they are outsourcing service delivery in rural areas to renewable energy developers. It's a fantastic opportunity for us. So what I am saying that the government generally has a huge job of trying to create jobs for how many millions and create education for people without proper schooling so they are looking for all the help they can get. And it's a great opportunity for us because if we get it right we will always be their favourite solution. (Interviewee 3)*

What is more, this approach has made the programme more attractive to large multinational corporations. Energy & Sustainability director Rick Needham explains what prompted Google to invest more than \$1 billion in clean energy in South Africa (Clean Technica, 2013). According to him, the company looks for projects that have 'transformative potential'. By this he means that a project becomes more attractive to them if it holds the potential to change society for the better, and according to him, the Jasper wind farm that Google invested in, and other projects under the IPP programme offer exactly this - an opportunity to invest in sustainable growth while creating jobs and enriching communities.

### 5.2.2 The Alignment of Actors along Economic Objectives

Investments such as those made by Google, speak volumes about the trust that the programme office has built between private sector financiers, banks and businesses that have chosen to invest in the programme. At the end of 2016, the programme had attracted over R194 billion in investment.

The relationship between investors, developers and the programme office hinges on the legitimacy that the staff of the IPP office has been able to maintain through the effective and transparent bidding processes and the legal structures which underlie these processes and effectively removes the programme office from the direct control of its parent departments. High-level engagements with government representatives

and the constant welcomed input of the private sector also resulted in a financial structure that promotes affectivity.

Negotiating this position was not an easy task on the part of the IPP office. Initially, the Development Bank was to fund their appointments and pay for their consultants, and they would have a 25 per cent stake in each project. The Development Bank withdrew and they had to make another plan. The IPP office decided to go to NERSA and proposed that they (the IPP office) should charge a 1 per cent development fee for every project brought to financial close. NERSA accepted these terms of operation for the programme. The interviewee representing the IPP office also explained that mistakes are extremely costly to the project office themselves and so their motivation for meticulous attention to detail and reaching financial close in every single project that received a bid is of paramount importance:

*So we cannot choose the wrong one because then we lose our money. And we spend money before we get money. So if we spend money on something that doesn't close that will be to our detriment. During that time, and I think it is still the same, we realized that South Africa cannot have a programme that is not successful and the reason for that is we didn't have a programme before, so it was our opportunity to convince political decision makers that we need to do this, but then we were also very scarce as far as our reserve margin was concerned so we had to - every project that we announced as a preferred bidder must close, there was no doubt in our minds that that project needs to close and we couldn't let project megawatts be sterilized because of our reserve margins. (Interviewee 1)*

Beyond the IPP office's targeted action toward successful bids, they also gained legitimacy through their engagements with state and non-state agencies. One example is that of the DTI, as discussed above. Another engagement that was crucial for building legitimacy after previous failed programmes was with National Treasury. Treasury serves as transactional advisor for the REIPPPP programme, which means that they assess the financial standing of project companies and evaluate the company's financial modelling, underpinning the price offering of each bid (Montmasson-Clair, Ryan & Moilwa, 2014: 98). Treasury also backs the power

purchase agreements made between Eskom and the IPP's, which significantly lowers the risk of investment for independent power producers. Their engagement with Treasury has helped them in selling the programme to the private sector.

The programme has been able to provide a very secure podium for private sector investment, which has aligned the interests of various multinational companies toward growing the sector. By this I mean that the profit-driven actions of companies were realised as renewable projects through the programme. Granted, these companies act with individual interests in mind, but the programme has been able to align these individual interests toward projects that build the industry. The success of the project has lowered the risk for investors and financiers further through its significant impact on the price and profitability of renewables in South Africa (Eberhard et al., 2014). The project is widely credited for bringing about a dramatic drop in the price of renewable electricity in South Africa and in stimulating the growth of the industries that underlie it. The relationships between the programme office and the private sector, including IPP's banks and developers resulted in a level of trust from the private sector that had previously been absent.

The private sector and those state actors looking to ensure social and economic development are not the only actors that have changed their behaviour based on possible financial gain. Another interesting example of an actor aligned through the REIPPPP toward building the sector is the Western Cape Provincial government. Because the procurement and control of most facets of the programme is located at national level, one would expect that local and provincial government actors would not necessarily go to great lengths to support the programme. In fact, provinces are probably the least mandated authority in South Africa to deal with or profit from any form of electricity development (Technical Assistance Unit and Western Cape Government, 2014). However the Western Cape Government realised very early on in the process that there is a valuable opportunity for developing the industrial sector of the province, and actively sought to cluster renewable energy development within the Western Cape. Premier Helen Zille said in a media statement in 2014 that the Western Cape provincial government aims to grow the renewable electricity industry in the province in such a way that it offsets the costs and consequences of climate change with economic growth and job creation.

*Just over two years ago, I announced our government's intention of becoming the green economic hub of South Africa. Our aim was to build a dynamic green economy, which offsets the costs and consequences of climate change with economic growth and job creation.*

*Since then there has been further foreign direct investment. Most notable is the R220m investment in the manufacture of wind turbine towers – as part of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) – by Spanish company, Gestamp, located in the Atlantis Green Manufacturing Hub. This will create 200 permanent jobs in the area. Chinese based Jinko Solar has also just made the decision to set up a solar panels plant in Cape Town. (GreenCape, 2014)*

The Western Cape Government saw that their economic development portfolio could benefit from the industrially intensive renewable energy economy, so they created a special purpose vehicle, GreenCape, which is funded by and reports to provincial government but that sits outside of the direct mandate of government. The initial role of GreenCape was to promote the growth of the renewable energy market in the Western Cape, specifically around the IPP programme, in such a way that it attracts investment to the province.<sup>20</sup> GreenCape facilitates the interaction between government and the private sector. They have been described as a middleman between the state and the private sector because they provide government with an opportunity to engage with the sector on neutral ground. Since GreenCape doesn't have to adhere to the red tape that the organs of state have to, and because they do not carry the stigma attached to the state, it is a lot easier for them to solve problems for both sides.

### 5.2.3 Spill-overs of Agency

The legitimacy gained from alignments along social and developmental objectives has recently provided IPP's with a strong argument for reigning in Eskom's negativity

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<sup>20</sup> The role of GreenCape has since broadened substantially. The growth of the renewable electricity industry in the Western Cape is now not only tied to the REIPPPP. Various other renewable electricity developments outside of the project, and the role of GreenCape in these developments are discussed in Chapters 6 and 7. For the purposes of this chapter, only their role in developments around the REIPPPP is discussed.

regarding the signing of power purchase agreements with them. Brenda Martin, chair of SAREC explained in 2016 that there are 26 preferred bidders with whom Eskom was refusing to sign power purchase agreements. These projects represent a total of R50bn investment into the country. According to Martin, these projects also represent over 13,000 jobs during construction and over 1,900 jobs for the 20 years of operation (Biz Community, 2016). SAWEA, the wind energy association also lodged a complaint with NERSA over Eskom's failure to comply with ministerial determinations. According to them, approximately R19.3 billion in social development and around R6 billion in enterprise development will be ploughed back into the South African economy once these agreements have been signed. SAWEA pointed out that 12 new industrial facilities have been established as a direct result of the IPP programme and that Eskom's refusal to sign power purchase agreements is inexplicable in light of the current financial climate (Moyo, 2016). Webber Wentzel is of the opinion that the delays in signing the PPA's is unlawful. SAREC is willing to take Eskom to court over the matter but would prefer to settle the disagreement out of court (Creamer, 2017).

At the end of 2016, around the same time that Eskom indicated problems with signing power purchase agreements, the utility and the DOE entered into rush determinations for nuclear procurement once again. This time the nuclear new builds were to be controlled by Eskom. The determinations came as a great surprise as the (yet to be completed) IRP 2016 signalled that nuclear was not a foreseen addition to the country's energy mix for at least the next 13 years (Duvenage, 2017). The South African public would not entertain this, according to Duvenage.

Since the crisis in 2008 there have been several incidents that have seriously damaged the trust that the country has put in the utility. Above the supply shortfall, the utility was also implicated in the *State Capture Report* issued by the previous Public Protector, Thuli Madonsela, in which Eskom was mentioned a staggering 916 times (All Africa.com, 2017). The report linked Eskom to the infamous Gupta family in several ways, most notably through the major coal contracts with the Gupta family and the President's son; the personal relationship between the Guptas and former Eskom CEO Brian Molefe and lastly the case of Shiva Uranium, which used to be a subsidiary of Rosatom, a Russian company, but had subsequently been bought by

Oakbay Resources. Oakbay belongs to the Gupta family and the President's son is a major shareholder. The buy-out was a steal at R270 million, and even though it had been deemed relatively unattractive by other mining companies, it could potentially become very attractive should the country need a new uranium supplier (ibid.). The contestation between the centralised nuclear agenda of the presidency and the push for the longevity of renewable procurement was never more evident. In the midst of Eskom's refusal to sign further power purchase agreements, the Minister of Energy, Tina Joematt-Petterson defended Eskom's actions. This, however, at the same time as the utility announced that it would be able to fund their nuclear procurement ideals off their balance sheet. The refusal to sign power purchase agreements was argued by Eskom to be related to the unsustainable cost of renewables that would start affecting the consumer. Various institutions including the CSIR have since challenged this sentiment. The CSIR showed in a study in late 2016 that, if one considers the cost reductions in the first three bidding windows, PV and wind electricity is now 40 per cent cheaper than new coal (SAREC, 2017).

The CSIR further showed in their study entitled *Least-cost electricity mix for South Africa by 2040* that the country could drastically reduce its electricity costs if it aimed for 70 per cent renewables by 2040 (Cloete, 2017). Further, the Minister of Energy recently presented the draft of the IRP 2016 to the Ministerial Advisory Council on Energy. The Council decided to pose it to a subcommittee, comprising of Prof. Anton Eberhard, Dr. Tobias Bischof-Niemz, Prof. Johan van Dyk and Mr. Mike Levington for further analysis. Interestingly, this committee, much like the one that birthed the White Paper, consists primarily of academics and external consultants. Both the 2016 IRP draft and the CSIR study answered the questions of future capacity. Much of the current coal-fired power stations will be non-operational by 2050 and decisions need to be made about which type of electricity would be responsible for which component of future supply. Both documents argue that coal usage will lessen while renewables will increase.

#### 5.2.4 The relevance of alignment in the case of the REIPPPP

The REIPPPP office had the difficult task of aligning the interests of civil society with the interests of the state in such a way that creates a secure podium for private sector

investment. They did this through stringent planning and the proper execution of those plans, and through the involvement of respected individuals. The fact that they were removed from the direct mandates of the state simplified this process of alignment. Being mandated by government regulation means that they have enough political support to remain active. Being removed from their direct mandates of their parent Departments means that they can actively pursue a single goal, which means that, unlike state departments, they can seize all of the opportunities provided by the cracks in the dominant regime, with little political rebuttal. It allows the IPP programme office to be able to grow the renewable electricity sector by acting on the weaknesses of the incumbent regime. This sentiment is clearly illustrated by a statement made by an interviewee from the IPP office:

*...it's a funny way of saying things, but what I keep on saying to the team is that the challenges that Eskom are dealing with now is in fact now our opportunity so we just need to use it as much as we can, so we need to bring in as many IPPs as we can, as soon as possible, and we just need to entrench this position so that there is no turning back. I do not think there is turning back, it's too late. (Interviewee 1)*

This meant that the channels for cooperation were open to the private sector, and the dialogue that happened with the private sector shaped the programme. Dialogue with the private sector was however not aimed at serving only their interests. The IPP office managed to create a podium for the type of knowledge exchange that would lead to a balanced outcome, where no point of view outweighs another. They explained to us that maintaining this middle ground, between comfortable and uncomfortable, is where they operate best:

*The refit, rebid thing was big in the newspapers, but we kept on talking to the market. And then we had special sessions with the banks, so I had many Friday afternoon discussions with the banks to say: "what is it that you would do? If we do this, what will be your reaction? If we do that, what will be your reaction?" And that is how we came up with the documents and we said we are not going to negotiate on anything... Because between comfortable and*

*uncomfortable that's where we should all be. So nobody should be too comfortable* (Interviewee 1)

The creation of the cracks in the dominant regime that might lead to breaking lock-in thus cannot be considered as strategically caused. The cracks were however strategically filled. Alignment here has two important components: it must be around the risks posed by the failures of the dominant regime, and it must fit in with the broader socio-political climate of the day. The risks posed by the dominant regime were initially related to electricity security issues and public mistrust of Eskom. Later, the risk of supply shortfall had been addressed and the major risk of the day became the projected tariff increases of Eskom electricity. The programme succeeded in driving down the price of renewable electricity to the point that the business case to be made for renewable energy no longer hinged on fulfilling environmental responsibilities and adhering to international standards but rather that the renewable electricity will be cheaper for businesses than Eskom electricity in years to come.

In a developing country, one crucial alignment made was with the interests of state development. The success of the programme to date required both the strengthening of developmental trajectories that led to its creation and the creation of new developmental trajectories that could become integrated into the social structures surrounding the electricity sector, to such an extent that breaking free from these new developments would be hard. The buy-in of stronger, more vested interests can result in a spill over of agency for newer less powerful actors. This is evident from the social developmental objectives adopted by the programme, which aligned it with the interests of other departments, such as the Department of Trade and Industries. IPP's and industry associations who acted along this developmental trajectory effectively adopted the power that rests in this type of alignment, thereby being able to fall back on this powerful alignment and make the case against Eskom for refusing to sign further power purchase agreements.

Further, in a developing nation, the alignment of non-state entities with state entities is simplified when the centre of action is removed from direct state mandates. Even though the REIPPP programme was mandated by the DOE, the execution of this mandate happens in isolation from the Department. This means less red tape, higher

investor confidence and a higher level of input and debate from the private sector, which resulted in a programme that was effectively formed by various key actors in the sector, not just by the state. This recipe for success is scalable, as proven by the successes of GreenCape in the Western Cape.

Lastly, when considering the alignment of actors, the importance of technological specification falls away to a large extent. This is not to say that it is not important for the entirety of socio-technical transition, but perhaps the social shifts that happen need to be afforded more weight in a discussion on transition as they might not always follow from technological changes. Technological changes or choices might follow from social shifts.

### 5.3 Discussion

#### 5.3.1 Power and Agency within the Niche

##### 5.3.1.1 The Misalignment of Core Regime Members

The deterioration of the dominant regime created a few clear windows of opportunity for the success of the programme. It is clear that the deterioration of the dominant regime had to reach breaking point before these types of windows could be created and that it hinged on the misalignment of incumbent actors. External selection pressures, such as the international push toward market liberalisation and more sustainable energy systems, and the availability of new technologies, contributed to the creation of regulation that mandated the development of the programme. However for the initial misalignment the internal inconsistencies appear to be more important, yet not disconnected from the external forces, as the more inconsistencies appeared, the more opportunity opened up for alternative action, and, perhaps more importantly in this context, the more opportunity was created for actors to question the developmental paths of the dominant regime.

The actions of actors that deviated from the pathways set forth by the dominant regime did not do so because they realised that the “*rules of the prevailing regime would be productive*” (Schot & Geels, 2007: 612). Much of the misalignment was not aimed at supporting the prevailing regime. Some key factors to the misalignment of

the dominant regime can be concluded from the data presented in this chapter: an unequal perception of selection pressures by the core members of the dominant regime; the formulation of regulative rules underpinned by new normative goals; and the availability of alternatives to the dominant regime.

The unequal perception of selection pressures by the core members of the dominant regime is evident through different levels of response that actors exhibited toward renewable electricity. Geels found that socio-technical systems are stabilised by the fact that core regime members become blind to the negative externalities produced by the system (Geels, 2011). This attribute of relatively stable regimes has however also proven to be the root cause of much of the misalignment of regimes in socio-technical transition. Because of this inherent blindness, the perception of newly realised selection pressures will almost certainly not be a global perception within a regime. This leads to new tensions between the core regime actors, which results in misalignment of the dominant regime. Schot and Geels (2007) have considered the importance of ‘de-alignment’ as a transitional pathway. According to them, larger landscape pressures that occur suddenly and in a divergent manner coupled with increasing regime problems cause regime actors to lose faith in the dominant regime. Crucially they neglect to take account of the effect of unequal perceptions of selection pressures, and the role that this plays in misaligning a regime. The loss of faith in the dominant regime only occurs once the accumulation of perceived negative externalities and selection pressures are so high that the consequent misalignment has led to more blatant problems within the regime. In this case these blatant problems came in the form of the electricity crisis. Thus the ‘big’ problems of the dominant regime of not producing the outcomes that its occupants have come to rely on do not cause the misalignment; rather the misalignment is caused by the diverging responses of actors to different selection pressures and negative externalities in different ways because of the loss of shared perceptions of selection pressures and negative externalities.

When regulative rules adopt new normative goals (such as sustainable development) that deviate from the dominant regime it will often have misalignment as consequence. The creation of regulative rules that contradict the rule sets of the dominant regime is one of the expressions of the diverging perceptions discussed

above, and particularly dangerous for the dominant regime. These regulative rules are manifestations of specific actor perceptions in the state about the negative externalities of the dominant regime and of the selection pressures at play within the dominant regime. As discussed in this chapter, the normative goal of sustainability entered state institutions from the outside (from academia and the international market). They were not formulated and completely accepted within state structures. Geels's internal games never took place (Geels, 2004b). Thus the institutional acceptance of these new normative goals had not yet occurred. This is probably one of the most potent misaligning actions that core regime members can take.

The way in which regulative rule play out becomes an increasingly messy affair when the framing underpinning these rules are not shared by enough actors. The hegemonic agency that allows for the creation of regulative rules withers in the play out of contestations over the prognostic framing of these rules. An integral aspect of the deterioration of the positive feedback loops, where the diagnostic framing that predates and underpins the creation of policy is not accepted by the majority and consequently, the prognostic framing of policy becomes contested terrain after its creation, is the interaction between policy and human activity. The resulting issues expose the problem with scholarship that maintains that policy responses can be used to guide the flow of sustainable development. The issue here is further complicated by the fact that the responses to policy are not always second order reflexive (Grin, 2012: 73). Policy-makers have to contend with first order reflexive responses to policy; these are unintended outcomes and thus harder to anticipate. The role of actor agency in the misalignment of the dominant regime leading to the breaking of lock-ins lies to a certain extent with the diminished ability of prominent incumbent actors to articulate selection pressure and align the majority of actors in favour of the dominant regime.

The availability of alternatives to the dominant regime only came into play in the story of regime misalignment once the shared perception of problems reached a critical juncture. Only then did the availability of alternatives contribute to the internal misalignment of the dominant regime. One must differentiate here between external misaligning factors and internal misalignment: those factors that primed responses from some core regime members, while not yet having an immediate effect on the

ability of the regime to create positive feedback loops, can be viewed as external misaligning factors. The availability of alternatives to coal-fired electricity might have been one of the factors here, but the effect of realisations around the negative externalities of carbon-based electricity generation and the effect of international pressure to change does carry more weight. International pressure and negative externalities might have resulted in the creation of novel technological solutions to these problems. So at least initially, the availability of these solutions did not have as big an impact as the ideologies and problem framings that led to their existence. Factors of internal misalignment take effect once substantial damage has been done to the positive feedback loops in the dominant regime. These are the factors that become contested within the dominant regime, such as the use of new technologies, the direction of policy and ultimately the prognostic framing for mending the system. This prognostic framing might then include the creation of incubation room policy measures, such as the procurement programme.

What is the function of this instability in the transitional process? In this case the answer lies in understanding the selection pressures at play at a specific time, and the ability of actors to align those selection pressures in such a way that the programme could function effectively. Notably, the effective functioning of the programme required that it solve more problems for the dominant regime than it created at its point of inception; it needed to be able to function with minimal contestation in order for it form pathways and dependencies within the sector. Acting on the risks of the dominant regime allowed the IPP office this initial foothold. Both landscape pressures and the failures of the dominant regime created these risks. In turn, the failures of the dominant regime, the misalignments and disconnects within the network, allowed for the windows of opportunity for the programme. Thus an external risk such as climate change and internal misalignment of the regime are intimately connected to one another and to the possibility of acceptance of new developmental trajectories within the sector, or at the very least to the possibility that the contestation of these new developments by the incumbents won't be strong enough to stop development along this trajectory. This is because the role of risk in affecting the dominant regime in this way is directly related to the inability of core regime members to control possible futures in the minds of the broader socio-technical system. In this case then, policy is both the manifestation of misalignment in the dominant regime and a support

structure for alignment outside of the dominant regime. Policy then contributes to the deterioration of the agency within dominant regime networks and fosters the development of agency through the alignment of selection pressures both inside and outside of the regime, but in both cases harmful to the dominant regime. It provides windows for alternative developmental trajectories. The diminishment ability of incumbent actors to align other actors and articulate selection pressure is not so much the result of the decay of their own agency, but rather of the decay of the network that surrounds them.

#### 5.3.1.2 The Alignment of Actors in Fit-and-Conform niches

Alignment takes place both through the articulation of selection pressure and through the enrolment of actors in networks. In order for non-core regime members to successfully bring about change, coalitions have to form that actively seek to change strategies, initiatives and power relationships in the existing regime (Smith, Stirling & Berkhout, 2005: 1505). In this way the programme was able to align regime interests with non-regime interests. These alignments firstly acted to create pathways for development of the external and non-core regime, whilst only acting on the shortcomings of the regime and thus not yet entering into competition with the regime. In doing so the programme managed to create a broad enough network of developmental paths that, if reversed, would be detrimental to the system as a whole. Both the articulation of selection pressure and the coordination of resources took place within the boundaries of the dominant regime. From this case study, a few important conclusions about the processes of fit-and-conform empowerment can be made around the following: the shielding role of policy; the characteristics of the networks created and the importance of relational agency.

The same policy that resulted in the misalignment of the dominant regime, acted to shield the niche environment from the selection pressures within the dominant regime. The initial market- and political protection quickly translated into cultural protection. The interpretation of policy laid the foundations for this niche. The mandate for the inclusion of renewable energy sources in the electricity mix of South Africa no doubt exists in policy, however the policy that exists is not very prescriptive

regarding how this goal was to be achieved. The effect of this was that the goals of the niche, the prognostic framing, was very broad.

The networks that were created through these broad, open-ended goals required some ingenious considerations of how to make use of the windows of opportunity created by policy, whilst not disturbing the regime too much. Smith, Stirling and Berkhout suggested that the degree to which regime change can take place depends on the positions held by “coalitions of prime movers” (Smith, Stirling & Berkhout, 2005: 1497). Within fit-and-conform niches, these coalitions of prime movers prove to be just as important. The formation of these coalitions requires that niche advocates align themselves with the ideals of key regime actors. This is not toward changing the dominant regime, but rather a way for the niche to take root within the dominant regime. In Chapter 2, I discussed how long-standing rules in socio-technical systems become something to contend with; they start having a life of their own. Often times the offshoots from these rules come from either the actual or envisioned social, political or financial benefit that could be produced or aided by the socio-technical system. In this case, one of these offshoots that already existed within the dominant regime was socio-political benefit such as job creation and black empowerment. The role of coalitions with prime movers at niche level is to tap into these offshoots and feed off of the relational power that exists within them. The result of this type of action is the solidification of the niche environment within the broader socio-technical system. This makes it more difficult to reverse the progress made by the niche because now the niche contributes to an existing system of outcomes that is important to more than just the regime. The success of this type of action also depends on the degree to which these outcomes have shaped the dominant regime.

### 5.3.2 Developmental Trajectories within the Niche

The example of the IPP programme as basis for a niche in the context of the South African electricity sector is a complex amalgamation of circumstances, events and actions. In terms of the suggested niche developmental trajectories by Schot and Geels (2007), it is most closely related to their conception of a ‘breakthrough niche’. Even though one cannot regard the deterioration of the dominant regime as being so progressed that it has completely seized in its functioning, one has to realise that the

deterioration that has in fact occurred is directly caused, at least in part by the stabilisation that has taken place within the niche. It can be regarded as an active niche in which some of the developmental trajectories have built on the path dependencies forged by the dominant regime. A good example of this is the use of existing practices of reindustrialisation to motivate the processes adopted by IPP's. The regulatory boundaries set for the programme intended it to exist alongside the dominant regime; to fit in the dominant regime box. However, this meant that if the addition of electricity provided by the programme no longer served to mediate the problems within the dominant regime, or if the goods produced by the programme started changing the regime too much, it could easily be stopped.

The alignment of new actors, such as the independent power producers and multinational investors is important in a different way: practically, investment and private sector buy-in is needed for the programme to succeed. However, 'buying in' to the network that exists around the procurement programme takes various shapes, two of which were discussed in the data section of this chapter. The more actors 'buy in' or rather become aligned with a certain goal, the more powerful the goal becomes in rooting the non-dominant regime in the existing socio-technical system. The alignment of actors along the same lines as the incumbent regime actors lengthens the chain of agency. These lengthened chains of agency are characterised by agency spillovers from stronger actors to weaker actors. This chain of alignment also becomes very important when the non-regime develops to the point where it either challenges the regime, or is no longer an immediate necessity for the regime and therefore poses some threat of competition to the dominant regime, as demonstrated by SAREC challenging Eskom's refusal to sign power purchase agreements.

Third sector buy-in to the interests of the niche, represented by the role of academia, is to some extent an example of the triadic relationship represented in triple helix theories (see Etzkovitz, 2002). However, here, and possibly in other instances an important disjuncture in this relationship becomes clear: the fact that knowledge exists and even the fact that it is being disseminated in the policy space, does not mean that the state, market and private sector function harmoniously. What is more, in this case, it is exactly this disjuncture that might have caused some of the initial deterioration of the dominant regime through the establishment of policy: political

actors had not all bought into and consequently were not all prepared to act upon knowledge translated into policy. Regardless, the unintended consequence of such policy remained positive for the development of the niche.

The state in this case is the most bi-polar actor of them all. It is difficult to find clear examples of 'steering' here. Even though there was a clear delineation of action for the IPP unit, this did not extend to the rest of the state. The IPP unit is a rowing actor and IPP's are the only actors with clear rowing guidelines. Other rowing actors often acted in spite of the state or with little consideration for the guidance given by the state as steering actor. The Gupta debacle is a key example of this. The only rowing actors that were truly steered by the directionalities toward the development of the niche given by the state were those actors that bought into the two main alignments: along social developmental trajectories and along financial developmental trajectories. A good example here is Google.

Long chains of aligned actors produce and reproduce the same results in the same way that path dependent development takes place within an established regime. Thus processes of positive reinforcement begin to form. However, for the empowering actor to be successful in its mandate, it must create as many of these positive reinforcing cycles as possible. Because of the success of existing cycles, some paths might even self-formulate around the actor.

Initially alignment often takes place overtly, through the formation of alliances with strong actors in the dominant regime. Later self-alignment might take place as the positive reinforcement cycle becomes more productive. One example of an actor that self-aligned was the Western Cape Government. This alignment resulted in the clustering of renewables industries that act as a physical and technological support network for the programme. The existence of these industries further creates pathways for development, such as new jobs, which further entrenches the network around the REIPPPP into the electricity sector of South Africa.

Consider for instance some of the shifts accomplished by this niche, defined as a protected space for development that goes against the dominant regime, by looking at the programme's position relative to the dominant regime. It allowed core, non-core

and external actors to actively align themselves and the programme with the state interests that serve the programme, and distance themselves from those ideals in government that did not serve the best interests of the programme.

Secondly, it allowed them transparent contact with the private sector and enabled them to level the playing field for input from key actors across the spectrum without having to give any external ideals primacy over their narrow mandate. Lastly, they could situate the programme within the sector in such a way that it posed no immediate threat to the dominant regime, whilst creating enough stability and new developmental trajectories that abolishing the programme and the related industry developments would make difficult. The institutional setting of the programme, the programme office, is the result of the alignment of selection pressures on the non-regime and the regime toward the inclusion of independent power producers in such a way that balanced the interests of all of the parties involved.

A few conclusions can be drawn from the above: one of the key factors in fit-and-conform empowerment, as Smith and Raven (2012) have asserted, is improved alignment with existing industrial norms. In addition to this, this case study has shown that in developing nations, an alignment with the developmental goals of the nation proves to be just as important. Secondly, one of the crucial factors in the longevity and success of the niche from this type of empowerment is the balancing of trade-offs. As explained by my interviewee from the IPP office, everyone should be kept between comfortable and uncomfortable. This however ultimately means that there are no real winners and no real losers, which brings into question the longevity of the outcomes, should the protected space disappear.

### 5.3.3 Steering Actors and the three Core Processes of the Niche

As I mentioned above there is no clear steering actor within this niche. This is a strange realisation as law technically mandates this niche. The processes through which the regulatory rules were set in place can explain the absence of a champion niche steerer. This niche resulted from different levels of acknowledgement of the negative externalities and problems of the dominant regime. The rules that allow for it within the dominant regime are not normal regime rules. They are not the result of

majority consensus over the issues in the regime but rather the outcome of complex first and second order reflexive responses and actions. Within the niche, the IPP unit achieved the articulation and adjustment of expectations. The type of agency that these actors hold cannot be considered to be hegemonic, but rather relational. They fulfilled the role of steering actor, including monitoring and evaluation and the delineation of direction through relational agency rather than through hegemonic agency. The only recourse for actors that do not adhere to their prescriptions is exclusion from the programme. The second and third niche processes, the formation of networks and further learning and articulation was aimed at solidifying the place that the niche occupied next to the regime. It was not aimed at growing the market or increasing the outputs. The main work of the steering actors in fit-and-conform niches is thus to fit-and-conform to the dominant regime.

#### 5.3.4 Conclusion

Even though fit-and-conform niches rely on process of alignment with the dominant regime, this can only happen once the dominant regime has deteriorated and windows of opportunity have been created for the niche. These niches require a level of core regime actor participation, however this does not have to include majority support. These niches also thrive on ‘distracted’ regime actors that do not necessarily support the rules that are forming at niche level but nevertheless have stopped or slowed down their participation in the positive feedback loops within the regime by acting in ways that do not contribute to the path dependencies of the dominant regime or by merely stopping or questioning their previous contributions.

This chapter found three core contributing factors to the misalignment of the dominant regime. The unequal perception of selection pressures by core regime members causes new tensions between regime members and between regime members and regime benefactors. The crux of this lies not in the perception of big problems, but rather the emergence of diverse responses to selection pressures and negative externalities that were previously responded to in relative unity by members of the dominant regime.

One of the tangible ways in which these divergent responses become overt is the creation of regulation that contradicts the rules of the dominant regime. The normative goals of sustainability cannot possibly be shared by the entire dominant regime, if it were, the regime would collapse in an instant. The misalignment that results from this is a complex matter, because even if a wide array of actors support these normative goals, they won't support them to the same degree or with the same implication. Even though they might share the diagnostic framing of the problem, their prognostic and motivational framings might differ drastically. This results in further tensions within the dominant regime. These tensions lead to windows of opportunity. The windows of opportunity created by policy might seem like an active shielding action, however it is more complicated than that. The creation of policy does not mean that the entire policy-creating institution is in agreement about the prognostic and motivational framing of the problem. All that is needed for the creation of policy is a level of diagnostic framing agreement. This exposes a very real issue with hegemonic power in socio-technical transition, especially as it relates to state power. If the state is a core regime member, then it is rather the deterioration of hegemonic power that leads to transition or to the creation of niches than the effect of hegemonic activity. To some extent it is required that the actors that hold hegemonic agency within the dominant regime relinquish some of this agency. This is not necessarily an active relinquishment of power but rather the outcome of messy divergent reactions and selection pressures. One of the core factors of success for the IPP unit was their removal from their parent departments. This allowed niche actors to act in the vacuum of responses from the dominant regime that resulted from their growing inability to respond to selection pressures.

The availability of alternative sources for electricity production contributed to the misalignment of the dominant regime in two ways: internally and externally. Externally those factors that primed responses from some core regime members of the regime, while not yet having an immediate diminishing or retarding effect on the ability of the regime to create positive feedback loops, can be viewed as external misaligning factors. Only once these factors accumulate and cause problems for the dominant regime can the availability of alternatives contribute to internal misalignment in the form of a broadened search function of regime actors, new actions and new mentalities.

The biggest challenge for niche advocates in fit-and-conform niches is to grow roots within the existing outcomes of the dominant regime. This is done not by linking niche outcomes with regime rules directly but rather linking niche outcomes with the offshoots that have resulted from regime rules. These offshoots relate to the broader social, economic and political environment within which the socio-technical system functions and makes it difficult to reverse progress made within the niche.

Within this niche the triadic relationship between state, market and academia was not a success where the creation of policy is concerned. Perhaps this relationship is better suited to technological outcomes than policy outcomes.

## **Chapter 6**

### **The Steering of Decentralised Electricity Development**

#### **6.1 Introduction**

This chapter builds on the work of scholars that have studied agency in niche environments, especially as it relates to what Smith and Raven call stretch-and-transform empowerment (Smith & Raven, 2012: 1030). This chapter focuses on uncovering the role of steering, or empowering actors in the governance and creating of rules in this type of niche. Once again special attention is given to the categorisation of actors so as to provide depth to the analysis. Secondly this chapter considers the methods that these steering actors use to exert an influence over the sector and lastly, this chapter considers the implications that these forms of governance and the rules created hold for the formulation and strengthening of developmental trajectories and networks within the niche.

The case of the electricity sector in the Western Cape is used to study how actors govern through stretch-and-transform empowerment in niche spaces. The renewable electricity sector has clustered in the Western Cape, initially as a result of the industrial development within the province surrounding the IPP programme. Renewable energy industries, including assembly plants and renewable energy developers, have established their business within the province because of the favourable environment created for them within the province. Subsequently the province has also become a pioneer in the South African electricity landscape especially in relation to non-utility scale, decentralised forms of electricity production such as small-scale embedded generation. Within the province there is also a high prevalence of energy efficiency measures being implemented by both state and non-state actors.

At first glance, the renewable energy sector in the Western Cape appears to be a spill over from the national shifts in policy and the inclusion of utility scale renewable energy technologies into the national energy mix. However, upon closer examination it becomes clear that the Western Cape Government and its municipalities aren't only being steered by National government but have in fact actively implemented steering methodologies of their own toward the growth of a suite of renewable energy and

sustainable energy practices and technologies. By creating a conducive environment for the development of decentralised energy generation practices that are beyond the control of the dominant regime they have actively articulated the selection pressures at play in the broader electricity landscape and coordinated the resources of the actors within the province to produce solutions that pose a greater threat to the dominant regime, albeit only within the boundaries of the province and smaller cumulative financial value to that of the utility scale developments discussed in the previous chapter.

## 6.2. The Green Ideology

The position of the Provincial government of the Western Cape in relation to electricity governance is a complex one. As provincial authority they guide the policy decisions of municipalities and also the overall ideology adopted by the province. Municipalities have more power than provincial government in controlling the actual commodity that is electricity, because of the power that they wield in their distribution jurisdiction. Provincial government needs to see to it that the production and consumption of all goods, including electricity, happens in such a way that is beneficial to the province's economy as a whole and does not counteract the boundaries set by the National government. The actions and ideologies of provincial government affect both state (national and municipal government) and non-state entities (business and citizens). It also affects the non-human facets of society (biodiversity, natural resources and infrastructure).

Unlike municipalities the biggest affect that provincial governments have on the contents of their provinces is not through directly impacting 'things' or 'people' but rather in their effect on ways of doing things and ways of thinking about things, which then leads to direct impacts on and for people and things. The electricity crisis, the pressure to lower the economy's carbon footprint, and the availability of alternative electricity technologies has been push factors for ideological shifts in the Western Cape. The resulting ideological shift adopted by the provincial government is captured in the 'green economy' concept.

The Western Cape's Green Economy Strategic Framework is aimed at lowering the province's carbon footprint and becoming the green economic hub of Africa. The framework is an holistic plan that rests on five principles or focal areas, driving action (Western Cape Government, 2013(a): 08). The first principle is a market-focussed approach to green economic action, dictating that all action taken needs to be based on the dynamics that exist in the local and global markets. The second principle is that investment toward the support of green growth needs to be predominantly private sector driven. The third principle is that the public sector must be the enabler of the green economy. The fourth principle is a move toward new forms of collaboration, and the final principle is inclusion, as climate change challenges often threaten economic exclusion. The framework is made up of five drivers supported by the identification of five enablers. The enablers either fall within the public sector or are part of the results of collaboration efforts. The drivers are: the living and working environment; mobility; eco-systems; agriculture and enterprise. And the enablers identified are: finance; regulation and rules; knowledge management; capabilities and lastly infrastructure.

Transformation of the electricity sector is thus not always a goal in itself for the Western Cape Government but often a means to an end. The actions of the provincial government with regards to the electricity sector must be understood in this way. Within this context there are key areas of involvement for the Western Cape provincial government in the electricity sector, namely: sustainable electricity consumption and resource efficiency including a zero-waste economy; green economy finance and investment; research and development; electricity security; and most importantly, enabling municipalities.

The areas of action resulting from the ideological shift of the Western Cape provincial government has been twofold: firstly, they acted to mitigate the risk posed to the Western Cape's economy by the external and internal pressures relating to renewable electricity and climate change. This includes the risk of electricity shortfall and the rising cost of electricity but also the risk that shifts in the consumption and production of electricity holds for municipalities in the province and the looming adverse effects on the environment of continued reliance on fossil fuels for the production of electricity. Secondly, they acted to identify and pursue opportunities for economic,

social and environmental growth in a transitioning electricity sector. They realised that ‘making it work’ is crucial for the survival of the economy in the province.

### 6.3 Western Cape Government Facilitating Institutional Change

Provincial officers know that they have limited capacity to regulate the use and incorporation of renewable electricity in South Africa, especially at utility scale. Their main area of influence lies in affecting the sustainable development of the Western Cape’s economy and in affecting the reformulation of municipal electricity practices. The targets that they can set are those accomplishable by municipalities and businesses in their jurisdiction. This relates mainly to energy efficiency and small-scale renewable electricity developments, such as embedded generation.

The inclusion of alternative sources of electricity into the municipal mix and the rising cost of electricity meant that municipalities and provincial government had to re-evaluate what the future of the electricity sector in the province would look like. Not only did it dictate change to the financial model of municipalities, it also meant a re-evaluation of skills. Fundamentally it meant new regulatory structures in the electricity sector and within the sectors that surround and support new electricity technologies such as transport and environmental management.

Striking the balance between clear, transparent, safe and legal mechanisms and the effort to streamline the processes involved in growing a new market has been extremely challenging, according to an interviewee representing the Western Cape Provincial Government. Provincial and municipal governments have to manage these issues very carefully as they constantly have to evaluate their position in relation to that of national government. One of the biggest challenges faced at regional level has been the risk of their decisions not being in line with the decisions made at national level. The policy discrepancies found between the different levels of the state and the contested ideologies found at national level, make it incredibly hard for provincial governments to commit to changing their municipal structures in a specific way because of the indecisions and contestations at play within national government. Their concerns around policy discrepancies are captured by this quote from a Western Cape Provincial Government representative:

*But National Government, well.... It's a big concern for us. Is our policy being taken seriously or is it just a document? Because other than the wind, the IRP update is a really great document that has been very well received by the industry. And by players that have been fighting for renewables and energy efficiency... We do not know what we need to do around that because it's just such an awkward space. (Interviewee 10)*

Part of the challenge is also accounting for the repercussions that any changes to the regulatory structures within the province might have. It is difficult for municipalities to commit to changes in their business model because they are dependent on the income generated by the resale of electricity. As explained by an interviewee from the City of Cape Town, the initial up takers of alternative technologies will be high-income consumers, the same pool of consumers that use the most electricity. This is damming for the City's traditional method of financial accumulation. The two main challenges in regulating the use of small-scale embedded generation and similar technologies are thus the risk of falling out of line with national requirements, regulations and future decisions and secondly the risk posed by these shift to the municipal revenue model.

Before implementing new policies, the Western Cape provincial government started working with municipalities to first understand the actual impact that allowing embedded generation, energy efficiency and other changes, might have on their business models on a case-to-case basis. Initially they implemented various pilot projects such as a feasibility study for alternative and sustainable infrastructure and services in settlements. These studies tested alternative technologies for municipal infrastructure services at two sites which included an evaluation of alternative financial models taking into account the constraint that the Municipal Finance Management Act places on private sector involvement. Another example is a study focussing on the demand for PV in agriculture in the province that identified the key factors informing PV installations in the fruit and wine sectors, also looking at the financial models that work best (Hermanus & Ely, 2015: 14).

Despite the risk posed by change, and the lack of clear mechanisms for change from national level, the Western Cape Government decided to look for ways in which municipalities could respond to climate change in line with the national strategy that exists in policy. Between 2005 and 2008 the province implemented mainly adaptation-focussed and vulnerability-focussed assessments upon which an action plan could be constructed (Isaacs, 2016). One example of this is their Climate Change Municipal (CCMSP) Support Programme.

The Western Cape Government realised that the effectiveness of the National Climate Change Response Policy (NCCRP) depends to an extent on the actions of local and provincial governments. Their development of sustainable energy plans for municipalities is contextualised by the NCCRP. The CCMSP is aimed at building partnerships, putting new processes in place and designing new tools for its implementation with municipalities. This project initially consisted of two groups, one working on the development of climate adaptation plans and another that worked on four pilot programmes with specific municipalities.

The process included taking stock of the existing knowledge and tools within a municipality needed to accomplish a plan of action and sustainable change. What they found through the initial phases of the CCMSP was that the level of awareness of the issues at hand in municipalities was high, but that they had shortcomings in terms of skills and finances in implementing the changes required. Their approach to these and other issues related to climate change adjustments in municipalities and the province as a whole became continuous cycles of evaluation and implementation of changes. In this way they focused on two processes: adjusting the electricity master plans of municipalities and balancing normal services such as infrastructure development with demand and supply forecasts. These conceptual changes were tested in two small municipalities that had been due for new electricity master plans. The approaches under the CCMSP are summarised in table 8 below.

### 6.3.1 Testing Phase

In 2013 the team in the Climate Change Unit of the Western Cape provincial government consisted of five staff tackling questions around the best processes for

supporting municipalities in mainstreaming climate change into their planning. At this point the Provincial Government was not only asking how they could assist municipalities, but also distilling what their role as provincial authority should be in this process (Price, 2013). From inception, the CCMSP was on an ‘only for the willing’ basis. The team sent out letters to municipalities, inviting them to express interest in the project. At this stage, the programme was running two consecutive outcomes: the development of sustainable energy plans and the development of adaptation plans. Eleven local municipalities showed interest in both of these programmes and one district municipality asked to be included as well (ibid). The unit’s capacity at this stage was very low, with two staff members focusing on the programme and a budget that only covered their basic travel costs. They could only commit to supporting four municipalities in each sub programme. Even though they had hoped that they would be able to develop both of the sub programmes for at least one municipality, they decided to split it up because of the large response size. The unit selected the four municipalities in each sub programme based on the information provided by municipalities around interventions that were already in place and a need for the best geographical spread, ensuring that the program implementation reaches as far as possible.

In the first year the team assisted municipalities in developing draft plans, followed by mainstreaming and implementation in the second year, while assisting additional municipalities with the draft process during year two. The municipal support programme (MSP) included mapping key stakeholders and partners of the programme; devising different approaches to support and engagement and interfacing at local and district level to learn what the most effective approach would be to providing support. Inception meetings were set up with key actors in municipalities in the form of presentations and discussions with mayoral committees, or meetings with key actors (Price, 2014). Out of this, multi-stakeholder groups were established for each case, in which timelines and deliverables were discussed. At this stage the differences in approaches, capacities and needs were emerging across municipalities. According to Penny Price, it became quite clear early on that a ‘one size fits all’ solution would never work (ibid.). This flexible approach yielded various success stories, one of which was the Bergrivier Municipality. One of the main success factors here was the participation of experts in the field in producing the municipality’s

Climate Change Adaptation Plan. Among others the following actors participated in the multi-stakeholder workshops: the joint CSIR/UCT project focusing on climate change adaptation and planning in the West Coast region; UCT’s Climate Systems Analysis Group (CSAG) working on methods of sharing technical climate change information and UCT’s African Climate & Development Initiative (ACDI) focusing on interdisciplinary climate change research in the Bergrivier Municipality.

**Table 8: Western Cape Government Climate Change Municipal Support Programme<sup>21</sup>**

<b>Phase</b>	<b>Time span</b>	<b>Outcomes</b>
<b>Testing Phase</b>	2012-2013	The development of sustainable energy plans for George, Mossel Bay, Cape Agulhas and Saldanha Bay
		The development of adaptation plans for Drakenstein, Bergrivier and Eden District
		Testing methodologies with partners
<b>Consolidation Phase</b>	2014-2016	The development of integrated response frameworks for districts (West Coast; Central Karoo; Overberg)
		Conducting the barriers to municipal finance study with Treasury
		The development of a database and the implementation thereof
		Integrated Development Plans review tools developed
		Case studies conducted
<b>Implementation, fast tracking and readiness phase</b>	2015-ongoing	Mainstreaming results and methodologies into the fiscus
<b>Annual Adjustments</b>	Annually	Greenest Municipality Award
		30 IDP assessments
		Spatial Development Framework reviews
		SALGA and COGTA municipal support program
		MIGs- new focus
		On-going ad hoc support in the form of meetings, comments and so forth.

### 6.3.2 Consolidation Phase

The brunt of the work done under the first phase was in adjusting the missions and visions of municipalities in terms of sustainability. Even though electricity consumption formed part of this, the work was spread over various sectors affected by climate change issues. Part of phase two included a study conducted by the Western

<sup>21</sup> Adapted from *Western Cape Climate Change Response: Approach and Key Projects* (Isaacs, 2016).

Cape Government and National Treasury toward increasing investment in climate change related projects at the sub national level. This study consisted of three phases: 1. *Diagnostic Report: Barriers and Challenges to Implementing Climate Change Projects* (National Treasury & Western Cape Government, 2013). 2. *Towards a Financing Framework for Implementing Climate Change Projects* (Technical Assistance Unit and Western Cape Government, 2014); 3. *Energy Efficiency Guidelines* (Technical Assistance Unit & Western Cape Government, 2013).

This study specifically looked at the regulatory challenges faced by municipalities, in particular the challenges posed by the Municipal Finance Management Act and the Public Finance Management Act, which directly apply to the integration of renewable electricity technologies into municipal grids. The tables below summarise the key Barriers in the Diagnostic Report.

**Table 9: Legislative Barriers<sup>22</sup>**

<b>Issues</b>	<b>Summary</b>	<b>Conclusions</b>
<b>Municipal and Provincial Mandates to Engage in Climate change related projects</b>	Provincial and Municipal mandates to engage in climate change related projects are prescribed by the Constitution. Interviewees expressed concern that there are no funds allocated for these responsibilities <sup>23</sup>	The Constitution suggests that environmental powers should be embedded within municipalities, and that municipalities have an important role in mitigating the effects of climate change. Further, the National Climate Change Response Strategy is implicit in the responsabilisation of municipalities and local governments in these functions.
<b>Establishing Partnerships to Deliver Services</b>	The novelty of processes implementing climate change issues in municipalities means that they do not yet have the necessary funds or skills. This has resulted in the establishment of	In its current state, the system of financial checks in place for the establishment of a public private partnership (PPP) provides inherent

<sup>22</sup> Adapted from National Treasury and The Western Cape Government (2013: 11)

<sup>23</sup> Section 24 (1) of the Constitution states that everyone has the right to an environment that is not harmful to their health or wellbeing. Section 7 (2) of the Constitution states that the state (including provincial and local authorities) must respect, protect and fulfill the Bill of Rights. Section 152 further stipulates that municipalities have the objective of providing a safe and healthy environment, and section 152 (1)(b) compels municipalities to provide services, including electricity, in a sustainable manner.

	partnerships for ‘outside agency help’. The rules guiding these processes are complex and hinder development along this path. <sup>24</sup>	tension with a municipality’s ability to provide sustainable services in the most effective manner.
<b>Contractual commitments that extend longer than three years</b>	Usually, climate change related projects have payback loops of longer than three years. Legislation as it stands complicates municipality’s ability to generate debt of over three years. The affordability and sustainability of long-term commitments need to be established in order for municipalities to properly leverage private capital and establish partnerships toward innovative solutions (such as grid wheeling and municipal procurement of electricity form IPPs) <sup>25</sup>	The contracting process needs to be simplified in order to encourage the implementation of fiscally sound projects, especially as it relates to larger projects that extend beyond three years.
<b>Investing in Private Property</b>	Uncertainty regarding procedure for municipalities to invest in sustainable technologies such as lighting and water heating, in infrastructure that lies on property not belonging to the municipality hampers development along these lines. For effective demand-side management, it has become clear that municipalities will need to invest in upgrading privately owned property. This is retarded by three factors: first a lack of clarity regarding the regulatory allowance for investing in private property, the payback of longer than three years demanding funding for that duration and responsibility of maintenance.	Most municipalities opt for rather supporting companies and NGO’s in the implementation of such projects <sup>26</sup>
<b>Trading and Transfer of Municipal Assets</b>	This relates to the issues of carbon trading by cities. As carbon credits generated from these projects are considered to be municipal assets, trading must comply with legislative requirements. The objective of the legislation as it stands is to protect municipal assets that provide a basic service.	There is uncertainty regarding municipality’s rights to trade in carbon credits. The argument that can be made for carbon credits not being sold so that it does not have an impact on the municipality’s ability to perform its functions is a simple one. This issue simply requires clear methods of accounting for the process of carbon trading and ensuring that it does not place undue fiscal constraints on municipalities.
<b>Absence of over-arching policy at provincial and municipal level</b>	Currently, the policy framework at national level, governing provincial and municipal procurement of renewable electricity and energy efficiency technologies is not in place. Some of the facets are governed by existing policies but only by proxy.	A clear overarching policy is required in order to streamline and standardise municipal and provincial programmes.

<sup>24</sup> The Municipal Systems Act; the Municipal Finance Management Act and the Municipal Public-Private Partnership Regulations govern these transactions. Broadly speaking, the following is required: a review of the way in which the service is currently being provided by the municipality, a process for considering an external service delivery mechanism culminating in full council approval, a feasibility study, and a process of competitive bidding. In order to set up a public private partnership, the municipality has to adhere to specific requirements for the feasibility study and in addition to this the PPP must be approved by the council only after comments from National Treasury.

<sup>25</sup> Raising long-term loans at municipal level must comply with the Borrowing Powers of Provincial Government Act, which requires consultation with the National Loan Coordinating Committee. Further the Municipal Management Finance Act requires further consultation and evaluation including a public participation process.

<sup>26</sup> The City of Cape Town has since the publication of this report made great steps toward solving this problem. This is discussed later on in this dissertation.

Table 10: Process Barriers<sup>27</sup>

Issue	Summary	Conclusion
<b>Procurement Challenges</b>	As discussed above the processes for procurement are lengthy and costly for municipalities. In addition to this the legislation guiding procurement places great emphasis on the best price, which hampers the procurement of newer technologies as no concession is made for the value of externalities in relation to this cost.	A generic procurement policy for climate change related projects is inappropriate, as it does not factor in the environmental and sustainability cost over the long term.
<b>Performance Management</b>	Performance management outcomes are required from all municipalities. This leads to the executive level making decisions in terms of these outcomes, which neglects sustainable outcomes.	Provincial and municipal outcomes should be aligned with sustainability goals.
<b>Budgetary Processes</b>	Responding to climate change at provincial and municipal level is not an imbedded imperative in their planning methodologies. What is more, logically municipalities will shy away from projects such as embedded generation that will lower their income. The main focus on municipal expenditure is providing basic services. The budgetary deadlines set for municipalities place staff under immense pressure resulting in them not taking the time to consider the long-term implications of decisions made regarding their Integrated Development Plans.	Climate change issues need to be stipulated in provincial and municipal policy, or they will not translate into the budget.
<b>Community Participation</b>	The trade-offs between socio-political and environmental needs of a municipality means that climate change related project are a difficult case to make in the eyes of the public. There is an inability in the three spheres of government's capacity to link these projects with social goals and this has resulted in further marginalisation of these projects.	Budgetary decisions are affected by a lack of community support. A meaningful space needs to be created for community participation and acceptance of these projects before they can succeed.

Table 11: Systems, Information and Organisational Barriers<sup>28</sup>

Issue	Summary	Conclusion
<b>Institutional Hierarchy</b>	The staff involved in climate change related projects in provincial and municipal governments usually sit in environmental departments. These departments are usually low on both funding and staff, and when considering the daunting task of implanting a successful project as described above, it becomes clear that these departments often do not have the capacity or the reach in the hierarchy of the state to fulfil these requirements.	Environmental departments are often marginalised in big decision-making processes because of the hierarchy that exists. Classic infrastructure programmes end up being favoured. There is thus also a need for sensitisation of leadership in accomplishing these projects.
<b>Institutional Disincentives</b>	The nature of these projects and the legislative requirements for their fulfilment are complicated by the silo mentality of different departments of the state at different levels	Climate change projects are multi-disciplinary. The state is simply not set up for this which reduces the appetite for these

<sup>27</sup> Adapted from National Treasury and The Western Cape Government (2013: 19)

<sup>28</sup> Adapted from National Treasury and The Western Cape Government (2013: 22)

		projects
<b>Absence of accurate Data</b>	The consumption data needed to build a strong case for these projects does not yet exist. This is not a problem of willingness, but again rather an issue of capacity and monitoring ability.	The absence of data severely restricts the ability to build a strong case for climate change related projects, the expertise and resources to create these systems for municipalities and provinces should be a priority.

In addition to the identification of barriers, the diagnostic report also outlined the characteristics found within municipalities that have managed to successfully implement sustainable goals (National Treasury & Western Cape Government, 2013):

1. The ability to design innovative projects for which different stakeholders in a municipality gets on board;
2. Senior political and institutional buy-in;
3. The ability to utilise networks to source donor funding;
4. A high public and media profile of the projects that de-risk the projects implementation;
5. Bottom-up advocacy for project approval and social acceptance;
6. Highly skilled project management.

#### 6.4 Monitoring and Evaluation Toward the Alteration of Regulations

Rolling blackouts, rising electricity prices and shifting incentives in the electricity market of South Africa over the past 10 years have created the ideal environment for growing embedded generation and energy efficiency markets. General market forces affecting the behaviour of consumers including the fear of penalties such as carbon tax and blackouts and projected increases in electricity price have spurred consumers to invest in energy efficiency, self-generation and storage technologies. Another reason for consumers defecting from the centralised model of electricity production and consumption is a heightened awareness of the knowledge skills and technologies that exist within alternative markets. Even though this type of activity could potentially disrupt the way in which electricity has been provided in the country historically, certain factors closely related to electricity security and increasing amounts of negative externalities within the electricity sector resulted in national policies that not only condone but reward certain types of energy-saving behaviour through tax incentives, energy saving initiatives and cost reductions (Didiza et al.,

2016: 15). The South African market is regulated by The Integrated Resource Plan primarily, which accounts mostly for the generating practices of utility scale electricity. Changes have however been made to energy service policies, which has had a positive effect on the energy efficiency and embedded generation market. The Department of Energy and SANEDI have introduced the 12 L Income Tax Allowance on Energy Savings. Businesses can, in accordance with this allowance, offset their energy savings against their annual corporate tax. The offset allowance is calculate as 28 per cent of their tax rate. Various standards exist for construction requiring energy efficiency initiatives in new buildings; apparatus, measurement and labelling; testing, safety and minimum standing heat loss for water heaters; certification of buildings; solar water heater instillation requirements; measurement and verification of energy savings; measurement and verification of local content and smart meter standards (Didiza et al., 2016: 17). All of these measures are certainly conducive to decentralised electricity markets but they have not been enough to fast track the development of these markets. Consider again the findings of the Diagnostic Report presented in Tables 9, 10 and 11 above. The practicalities of small-scale embedded generation and energy efficiency technologies will first and foremost impact the owner of the grid to which they are linked. In most cases, especially where residential consumers are concerned, these grids fall in municipal jurisdiction. Provinces and municipalities have been mandated by the Constitution to engage in climate change related projects, further the NCCRS holds municipalities and local governments responsible for these functions. As far as the electricity system is concerned in municipal and provincial jurisdictions there are three apparent options toward becoming more sustainable electricity users: defect at least to a certain extent from the Eskom model through own (municipal) production; procure renewable electricity from a third party IPP or allow the customers within the network to implement own production and energy efficiency measures.

Despite being mandated in this regard, provinces and municipalities do not have the necessary funds allocated to perform these functions. However, even if they had the funds the legislative barriers that have to be overcome to accomplish sustainable development in the electricity sector would make the first two options incredibly difficult to attain. Legislative issues including the lengthy process of establishing public-private partnerships, the further issues relating to the extension of these

partnership contracts beyond three years, and the absence of an over-arching national policy to guide and standardise provincial electricity programmes means that investing time and effort into any directed action might end up being voided by later adjustments at national level, or might simply be too expensive to pursue.

The responses of the Western Cape Provincial Government and that of their municipalities, as discussed above, have been captured in their green ideology. They have essentially opted for a holistic response to the regulatory mandates provided by National government, the negative externalities of the electricity sector as a whole and the market pressures at play. According to the Western Cape Government's Green Economy Report, "*the green economy offers a lens through which the interdependencies between human and natural systems can be managed differently*" (Hermanus & Ely, 2015: 3). This report considers two aspects of cardinal importance to growing the green economy: the improvement of resource efficiency in such a way that mitigates the environmental risk to the economy and the identification of new value chains that manage natural resources in a better way.

Driving renewable energy policy is thus not one of the major aims of the Western Cape Provincial Government, rather it is using policy to shape the supply chain of the electricity sector so that it remains beneficial to the province. This cautious approach has resulted in three interlinked processes with the end goal of policy adjustments that pose the least amount of risk to the province. First, they crystallised their overarching goals in the form of quantifiable, measurable constructs. Secondly, they set in motion processes through which municipalities, other key actors and the province as a whole could report on the development of the goals for the green economy, using the constructs created; and lastly, based on the loops of monitoring and evaluation, they started setting targets for specific technologies within the province and they started lobbying at national level toward the alteration of crucial national policies governing the procurement of renewable electricity at municipal and provincial level.

#### 6.4.1 Quantification and Measurement

Because of the relative novelty of renewable energy and energy efficiency projects in municipalities and provincial governments, one of the most important first steps to

altering the legislative environment was the quantification and measurement of the goals that had been put in place through the green ideology. This included the identification of barriers that was accomplished through the thorough research conducted by the Western Cape Provincial Government and National Treasury discussed above. Secondly, indicators for progress and avenues for development needed to be quantified and measured. Within the Western Cape Infrastructure Framework the province clearly set out three targeted shifts in the energy sector: the introduction of natural gas processing infrastructure; the promotion of renewable energy including the promotion of the associated manufacturing capability for renewable energy systems within the province; and a shift in transport patterns aimed at reducing the provinces reliance on liquid fuel sources (Western Cape Government, 2013b: 31).

Sustainable consumption and resource efficiency is echoed in most of the provinces planning focuses on greening infrastructure, including more energy efficient buildings and the transformation of design standards; the promotion of green energy in businesses through the enhanced uptake up rooftop PV and efficient water heating mechanisms; enhancing the management of the electricity grid and lastly the minimization of waste which factors into all of the above. In this regard, the Western Cape Government developed Green Economy Indicators. These indicators fall into five categories: natural resource base; resource productivity; socio-economic; environmental quality of life; and policy and finance (Western Cape Government, 2015: 39). The indicators that apply to the electricity sector are summarised in the table below. The mitigation of risk took place at various levels and included the mitigation of climate change risk in the long term and the risk that non-adaptation held for the economy. It also included mitigating the risk posed by the inefficiencies of the dominant electricity system, and of the Eskom monopoly. As shown above, this was done through careful evaluation of the system as it stands and an umbrella philosophy that opted for large-scale ideological shifts rather than smaller tweaks to the system. This also included quantifying and measuring indicators to keep track of progress.

Table 12 Western Cape Government Green Economy Indicators 2015<sup>29</sup>

Indicator category	Indicator Focus	Indicator	2012 Value	2013 Value
Natural Resource	Carbon	% Change in energy sector emissions against 2009 baseline	-12%	No data
Resource Productivity	Carbon	Carbon emissions for energy sector	3634575300 tCo2e	No data
Resource Productivity	Carbon	Carbon Emissions per unit GDP	128.59 t CO2e/ million units GDP	No data
Resource Productivity	Energy	Total Energy Consumption	276,333,250.00 GJ	No data
Resource Productivity	Energy	Energy Consumption per Sector	Industry: 85,383,982.29 GJ Transport: 146,296,369.73GJ Agriculture: 6,968,221.23 GJ Commerce and Public Services: 10,921,301.41 GJ Local Government: 2,111,886.GJ Residential: 24,652,304.9 GJ	No data
Resource Productivity	Energy	Energy Consumption per unit GDP	977.65 GJ/ Million units GDP	No data
Resource Productivity	Energy	Energy Consumption per Capita	52.14 GJ/ Capita	No Data
Resource Productivity	Energy	Total Energy Produced from renewable energy sources by independent power producers	133. 40 MW	421.82 MW
Environmental Quality of Life	Energy	% Of households with access to Energy	90.5%	89.3%
Policy and Finance	Energy	Annual Value of renewable energy projects funded by national and international green/	R3 220 00 Million	R8 024 00 Million

<sup>29</sup> Adapted from the Western Cape Government Green Economy Report (2015)

		climate funds		
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#### 6.4.2 Reporting

A limited amount of data was published on the sustainable energy plans created for municipalities during the testing phase of the project. The effects in municipal policy in terms of climate change and energy usage in Western Cape municipalities are however quite evident. SALGA reported in 2015 that 10 out of the 30 municipalities in the province had the following: processes and policies in place that set climate change/ energy sustainability as a priority in their Integrated Development Plans; Specific climate change/ sustainable energy projects in their Integrated Development Plans and Climate change/ sustainable energy included in their budgets (Ferry & Von Kalm, 2015). The latest available Provincial IDP Assessment Criteria was set up in 2013. Section 2.2.3 of the IDP Evaluation Criteria Regarding Energy and Electricity Development strategies requires that municipalities report on energy planning and demand-side management, including the diversification of the energy mix and renewables. It also requires that municipalities report on their consumption (Western Cape Provincial Government, 2013).

Further, the Western Cape Climate Change Biennial Monitoring & Evaluation Report programme was initiated as a reporting platform in the province. It was aimed at aligning the provinces reporting with the National Monitoring & Evaluation strategy and reflects on the Paris Agreement. Its main goal is to monitor the Western Cape's Climate Change Response Strategy through:

1. Providing a clear picture of response mechanisms;
2. Providing an assessment for the effectiveness of these mechanisms;
3. Moving toward greater consistency in approaches and increasing the coordination of response methods and monitoring and evaluation;
4. Demonstrating the impact of responses over time;
5. Increase transparency and awareness (Western Cape Governmen, 2016).

This report also categorises municipalities into non-performance, compliant performance and optimum performance categories, and tracks among other things

energy efficiency in both the public and private sector and renewable energy and carbon emissions focussing on areas improved and areas to be improved.

#### 6.4.3 Target Setting and Lobbying for National Regulatory Changes

The province set a target of enabling independent generation through PV of 135MW by 2020. Between May and December 2016 the Metro saw a 120 per cent increase in improved installations. Fifteen municipalities had been assisted in meeting the legal requirements for embedded generation by 2017. The province aims to assist another 20 municipalities in obtaining the rights to allow embedded generation in 2017/2018.

The pioneering attitude of the province did not rest with rooftop PV and energy efficiency mechanisms. The Provincial government has lobbied for the rights to sign power purchase agreements with independent power producers, an issue that has been identified by many as the key to solving the problems of the municipal financial models within South Africa. However, as evident from Helen Zille's State of the Province Address's in 2016 and 2017 respectively, this has been an uphill battle:

*We need to diversify our energy mix so that we can create enough power for growth that is both sustainable and low carbon. To be successful, we will need to sign Power Purchase Agreements with Independent Power Producers (IPPs), focusing on solar and wind energy, and import Liquefied Natural Gas (LNG) into the Province on a large scale. The City of Cape Town has applied for permission from the Department of Energy to procure power from IPPs. This approval is the key that unlocks the full potential of this game changer, and we trust that the Department of Energy will act in the public interest by making it easier to purchase independently-produced power. (Zille, 2016)*

*We've also engaged National Treasury and the Energy Department numerous times on the business case for direct power procurement. We believe that allowing municipalities to enter into contracts with independent power producers is a four-fold win: cheaper electricity prices, lower carbon emissions, more investment and more industrialisation. This ultimately means more local jobs. The City of Cape Town is pushing hard for the right to do*

*this. Unfortunately, we have had no meaningful response to date from the DoE, and we are concerned that they may well be trying to defend Eskom's monopoly. Mayor De Lille has been clear about her plans to pursue the City's legal options in this regard, and we will support her. (Zille, 2017)*

## 6.5. Discussion

### 6.5.1 Power and Agency within the Niche

As a point of departure it might be useful to begin with a discussion about the steering attributes of the main steering actor within this niche. Generally steering or empowering actors are thought of as those that create regulations and legislation that hold some sort of hegemonic agency over other actors. For the actors in this niche, that is not always the case. The primary steering actor within this niche is the Western Cape Provincial Government. The delineation of direction, meaning and values takes place through their green narrative, and is conveyed relatively clearly to the rowing niche participants including producers, municipalities, third sector participants and other market actors. The reason for saying that the delineation of direction is relative clear is because, at the time when this thesis is being written, a high level of clarity had not yet been reached about the specific calls to action that are to result from the green narrative; there is no step-by-step guide or rule system for the impending change. The data presented in this chapter provides an account of the formation and refinement of a clear direction for action. Throughout this process of refinement the Western Cape Provincial Government was able to establish monitoring mechanisms in-line with the broad goals of their ideology and later, in line with the results of cycles of action, research and observation. Claims about institutional reform were strongly put forward in two ways in their ideology: first, private sector investment was to fund development with public sector guidance. Secondly, new forms of collaboration between consumers and producers, the public and the private, and new coalitions were to be formed. The latter later translated into reform strategies for the financial models of municipalities. The push for regulatory reform on national provincial and municipal level is an on-going effort.

### 6.5.1.1 Agency in Discourse

The politics of a niche is captured in the narrative that is created within it. Actors create narratives in order to reshape societal action and mentalities in such a way that allows for institutional reform. Smith and Raven (2012) have found that there are three over-arching themes within the competing actor narratives negotiating empowerment. Negotiating protective spaces involves the contention of narratives over: positive expectations about the niche that justifies it for society; explicit claims for institutional reforms or claims on competition in order to change the environment; and lastly, a reframing of the past that justifies the challenges that the niche poses to the dominant regime (Smith & Raven, 2012: 1033). The green narrative of the Western Cape Provincial Government effectively captures the niche. Beyond setting the justification of the niche, the claims for institutional reform, and the historical justification for the niche, the narrative has an important role in framing the ‘problems’ dealt with in the niche. In this way the Provincial Government is actively re-framing the mentalities of actors that they are steering in such a way that informs future decisions away from the dominant regime but toward the story that their narrative tells. Provinces are ‘thinking’ participants in the electricity sector. Their ability to shape the electricity sector rests with their ability to modify the behaviour of both the national government and of the occupants of their own jurisdiction. The ideology of the Western Cape Government is the value component of their governing power. This type of ideology is captured in policy plans with ‘principles’ rather than ‘rules’. These principles are as much to guide their own action, as it is to guide the action of other actors.

### 6.5.1.2 Stretch-and-Transform Empowerment

One might gain more insight about the entirety of the process of stretch-and-transform empowerment once stable sets of rules exist within the niche. However viewing the system at such an unstable point does provide interesting insights about the processes that steering actors go through toward the creation of stable sets of rules. One must realise that this niche, as any niche, had existing rules to contend with, albeit not many regulative rules advancing the development of the niche. The cognitive and normative rules of the system implemented by the Western Cape Provincial

Government served as a guide for action as discussed above. However, none of the actions that followed from this, at this stage in the niche, was an exercise of hegemonic power. Instead, the Western Cape Government used a combination of relational agency and networked agency to achieve the goals that they set out. Look for example at the processes of the CCMSP (Price, 2013). The active alignment of actors around municipal financial models including actors not formally part of the municipal structures was the main methodology for the coordination of resources. In this case the resources that were coordinated were mainly knowledge and skills participants that could facilitate the process. Network creation in this instance consisted of three interlinked phases: stocktaking; cycles of evaluation and cycles of solidification. The first phase is relatively stationary and done by the steering actor alone. The second and third phases are on-going cycles that arguably never stop in the life of the network and involve multiple actors.

### *Stocktaking*

Stocktaking is a necessary prerequisite before networked action can be accomplished. The steering actor in this case is driven to action by both the risks relating to the deterioration of the dominant regime and the added complexity that new options outside of the dominant regime offer in the accomplishment of the traditional outcomes of the dominant regime. Should the actor choose to explore the new options outside of the dominant regime in obtaining the goods and services that the regime once yielded, she now has to realign the actions and perceptions of other actors in such a way that successfully accomplishes this. Enrolling other actor's means creating new rules of conduct, new ways of thinking and new ways of connecting them with one another. Before this can be accomplished, the steering actor, wishing to create these pathways, needs to fully understand what already exists. This includes taking stock of the existing knowledge and skills needed to perform the new tasks required to generate the determined outcomes. Important to note here are that often the actual outcomes of the new network and of the niche are the same as the outcomes of the dominant regime (sufficient, affordable electricity). However the risks produced by the traditional method of generating this outcome is what the new methodology is attacking. Thus the outcomes here are the mitigated risks in the operation of the system. In mitigating the risks, as I will show below, the question of how and by whom is less important than the creation of a stable network along which this can take

place. The variables of the network are interchangeable; they are merely a means to an end.

The steering actor also takes stock of the existing tools at the disposal of other actors, and of themselves. This means understanding exactly what it is that they can and cannot do. In the case of state actors, such as the Western Cape Government, much of this required a full evaluation of what legal stumbling blocks exist that lock them and other actors, such as municipalities, into the paths of the dominant regime.

Most importantly, the steering actor must take stock of the mentalities that exist in other actors and once again within themselves. This includes finding out whether other actors view the same issues as problems as they do, and how they think it could best be solved. It also includes testing the appetite of key actors to participate in network actions.

#### *Cycles of Evaluation*

The initial evaluation that takes place is a departure from the stocktaking phase. First, for the steering actor this means distilling their role in producing the preferred pathways of the new network. Secondly it includes the mapping of existing stakeholders based on the knowledge, skills, tools and most importantly mentalities that these actors possess. One important factor that identifies an actor as a possible network participant is their appetite for addressing the same issues that the steering actor wishes to address.

Thirdly, informal connections need to be established between actors and some form of discussion needs to take place between them. Agreements and issues highlighted by this discussion will allow, predominantly the steering actor, but also the other actors, to begin to measure and quantify new variables in the processes that lead to outcomes for the new network. This means that the problems experienced by a group of actors, including but not limited to the steering actor, needs to be understood better by the entire group. Lastly, this preliminary level of understanding will allow the group to discuss different approaches or pathways for solving the problem. Often, more than one pathway will be tested and evaluated for its methods before a pathway is chosen.

Thus in the beginning a network has various weak paths of which the better choice will survive.

Network creation in niches often happens through the creation of smaller networks that spill into one another at a later stage, however, the amalgamation of all of the sub-networks is not a prerequisite. The example presented here depicts the creation of various smaller test networks in various municipalities by the same steering actor, but with different network actors in each case. Geography and the availability of resources means that municipalities experience electricity issues differently, and that these differences are likely to persist even after the creation of a new network for action. Cycles of evaluation are ultimately the processes of trial and error that keep on taking place within a network; it acts to refine the scope of the network and direct action better and better as the network develops.

#### *Cycles of Solidification*

The first step to solidifying the network is formalising the connection between at least some of the stakeholders to some extent. This can happen through agreements or through the cooperative participation in programmes of change. This said, the connections within a network will remain rather fluid, more so the further the actor is removed from directly impacting the outcomes generated by the network. In order for some solidification to take place, there has to be a relative amount of certainty about the new pathways for action, or about the new outcomes produce by the network. At this point one can see which actors are closer to the production of these outcomes and which are further away.

Beyond the solidification of connection of actors at the centre of the network, the other important facet of solidification is the alignment of mentalities. This is by no means a once-off exercise but rather a continuous cycle in reaction to new selection pressures and new environmental stimuli.

## 6.5.2 Developmental Trajectories within the Niche

The conducive environment created through provincial activity for the reformulation of municipal financial models and the electricity master plans do rely to some extent on hegemonic power, because of the hierarchical relationship between the Provincial Government and municipalities. This might seem to be a contradiction of the statements made above, however, one must take note of the fact that, if this process of change was implemented by a third sector actor or market actor, there may be a higher risk of falling out of touch with the determinations of national government. As I show in the next chapter, the third sector plays an important role in facilitating the growth of the embedded generation and energy efficiency market within the province, however very little of this is toward the creation of regulative rules held by formal public institutions like municipalities. When acting in that capacity they follow the guidelines for action set forth by Provincial Government. Thus one cannot disregard the hegemonic agency of actors that act in a top-down manner in the absence of immediate regulatory rules even if the rules and the consequent activity of the steering actor function through relational and networked agency.

### 6.5.2.1 Steering Actors Contributing to the Properties of the Niche

The contribution of this actor to growing the niche remains steering and allowing other actors to row. The steerer, in this case, does not offer much more than shielding by proxy, however the network shields the actors within and surrounding municipalities by creating a space in which trial and error exercises can take place with minimal long-term damage. Much of the shielding offered by the network lies in the reinforcement found in the perpetuation of new routines and thought patterns by a variety of actors. The Western Cape Government thus initially employed a passive form of empowerment, which allowed them to also then nurture the market. An important aspect of the nurturing role here was the identification, quantification and measurement of the aspects of new value chains. For the niche, this initial identification of new value chains was not necessarily the identification and development of path-breaking innovations, but the identification of terrains for these innovations to take place, because it altered the balance of selection pressures by making these newly identified issues important for the niche. Once again framing

emerges as an important tool for development within the niche. In the same way that an actor's framing of a problem within the dominant regime can restrict the critical reflection of other actors, so too can the reframing of a problem at niche level become a podium for critical reflection.

The steering actor in this case was more concerned with the mechanisms of change than with the outcome. Nurturing change in a Darwinist manner, they relied on natural selection, as their nurturing processes were often accompanied by the exploration of many pathways concurrently to avoid lock-in to a specific path. Crucial to this was the long-term thinking and the alignment of a variety of actors toward socially acceptable outcomes and required thinking in multiple domains with a philosophy of learning *en route*. This, taken with the results of Chapter 5, show that different principles can guide the creation of policy in one country. Similarly, here policy, much like the regime, relies on a set of stable norms through which the public enrolls the private. Thus, part of what is being nurtured in niches is this philosophy. If the narrative falls away, the whole network will disassemble. This does not take away from the fact that the narrative is constantly evolving, however this evolution needs to happen in relative synchronicity within the various elements of the network or it will not survive.

#### 6.5.2.2 The Articulation of Selection Pressure

Empowerment here involves the processes that help innovations to become competitive within unchanged selection environments or processes that change the selection environment to favour path-breaking innovations. Smith, Stirling and Berkout's (2005) understanding of the role of selection pressure articulation does not only explain the grand narrative changes. It can also be used to explain how certain actors bring about change at a smaller scale. In addition to this, this conception often explains why some efforts at problem solving in regime transition are successful and why others are not. Selection pressure articulation takes place at various levels.

Even though the provincial government is mainly a thinking participant in the decentralisation of electricity in the Western Cape, the results of their shifts in ideology causes tangible problems for the dominant regime. This is in line with the

second requirement that Smith, Stirling and Berkhout (2005) set forth for the effective exertion of agency through the articulation of selection pressure: the coherent orientation of selection pressure needs to be strong enough to illicit a reaction from the dominant regime. These problems come in two forms and the reaction from the dominant regime is specific to the shape that the problem takes: first, a problem can be created through incremental advancements or problem solving at the periphery of the system and secondly problems can be created at the centre of the system through outright opposition posed to one of the important functions or structures of the system. Problems at the periphery of the system, including the instillation of small-scale embedded generation and sustainability technologies might not have immediate opposition, but the snowball effect of these changes adds up to bigger issues in the future. Changes required within the internal functioning structures of the system (such as changing the rules for municipal procurement) are much harder to bring into operation, however they elicit an immediate response from the dominant regime.

#### 6.5.2.3 Regime Membership

In contrast to the developments of the IPP project, the renewable energy developments in the Western Cape can all be regarded as decentralised. There are some important characteristic differences between actors that act toward renewable electricity development alongside the dominant regime and those that act toward renewable electricity developments that contrast the dominant regime. According to Geels, the power that an actor holds is to be found in their resources and in the way in which their interests are aligned with the interests of other actors (Geels, 2004b: 909). Aligning one's interests with that of other key actors in the sector is of utmost importance to the actor that wishes to exist harmoniously alongside the dominant regime; this can however not be said for more decentralised development.

In processes of decentralised development power lies in an actors ability to align other actor's interests with theirs and in contesting the structural alignments in the structures that underpin the system, especially regulation. The alignment of the decentralised actors' interests with other key actors, in the way that the IPP programme did it, means very little. What is more important in this context is the way in which selection pressure and institutional arrangements have been moulded to the narrative of the Western Cape Provincial Government.

According to Smith, Stirling and Berkhout (2005), regime membership can be measured and understood by looking at the degree to which an actor or a group of actors participate in the activities within a socio-technical system that reproduce lock-ins and path dependencies. Viewed in this light, the Provincial Government presents as quite an interesting case. It certainly perpetuated the outcomes of the dominant regime through its regulatory structures historically, however, can one actually say that as an actor, the provincial government contributed to the creation of path dependency and lock-in in the electricity sector? Only by proxy - only through the strengthening of other related institutions in the processes of building the economy.

#### 6.5.2.4 The Importance of Field-level Rules

One of the major critiques of the MLP that underlies the work done in this thesis is the lack of attention that the theory gives to the underlying politics and power at play in the processes of creating rules within a socio-technical system. The MLP emphasises the activity of core regime actors, such as policy-makers, large firms and incumbent beneficiaries of the outcomes of the dominant regime, focussing specifically on the role that recursive action and reflexivity plays in the processes of rule maintenance and the acceptance of new rule. As such it pays insufficient attention to the processes through which new rules are created and the role of collective action, especially as it relates to non-core and external regime members. Geels acknowledged that field-level rules and resources could be shaped through monitoring, defence or alteration tactics by collective actors (Geels, 2014). However in explanation of this he reverts back to the high-level categories of actors captured in political economy concepts, such as the minerals-energy complex, carbon capital and carbon lock-in (ibid.). This disregards the way in which field-level trajectories shape the rule-forming process at niche level. A trajectory within a socio-technical system is viewed as a sequence of four successive mechanisms: the structural conditioning of actors in the system by rules and institutions, social interaction between actors, structural elaborations where rules and institutions are shaped, and lastly the acceptance and retention of these rules and institutions (Geels et al., 2016: 897).

Because niche processes are shielded to some extent from the rules and selection pressures of the dominant regime, niche advocates are able to disregard the functioning of existing regime-dependent alliances, such as the minerals energy complex in the South African case. Of course there can never be a complete disregard of these rules as they still provide certain boundaries for niche advocates. An example of this is the small-scale embedded generation market, which the next chapter will show is the net consumer model for small-scale embedded generation in the Western Cape and that effectively allows for the preservation of municipal financial models in accordance with the dominant regime. However, beyond the boundaries created by these rule systems, the agency for niche advocates is derived from ground-level interactions with one another. This morphogenetic cycle involves the initial structural conditioning by rules and existing institutions setting boundaries for development as explained above, however the social interactions between actors is a pivotal podium for processes that resemble Geels's strategic games (Geels et al., 2016) rather than outright conflicts and power struggles. Arguably these conflicts and power struggles that are depicted by Geels as a part of the sequential cycle of field-level trajectories only occurs once rules have stabilised within the system. The elaboration of rules and institutions takes place as a result of the network formation during strategic games and the acceptance and retention of rules and institutions is, just like the formulation of networks, the result of collaborative action.

### 6.5.3 Steering Actors and the Three Core Processes of the Niche

Geels and Schot discussed four different evolutionary mechanisms that contribute to the generation of radical change (2007). One of these evolutionary mechanisms, namely natural selection, resonates to some extent with the process of niche formation discussed above. The ability to attain a level of independence from the dominant regime through technologies, such as small-scale embedded generation and energy efficiency technologies was a selection criteria generated and initially articulated in the broader socio-technical regime, outside of the niche. This level of independence was captured in the green ideology that set priorities for the development of the niche and established broad expectations for the niche, thereby contributing to the first process of the niche.

The action of steering actors within the niche then further articulated this selection pressure and allowed for the coordination of resources around municipalities. The coordination of resources and the formation of networks were to find a middle ground between the boundaries of the regime and the new selection pressure, thereby formulating social networks.

The monitoring and evaluation that took place in cycles of evaluation towards cycles of solidification accounts for the final process of learning and articulation suggested in the MLP. Thus the MLP's conceptualisation of the broad processes proves to be accurate. The work done in this chapter however elaborates on the finer nuances that lead to these broad processes within the niche, and in so doing, highlights one important missing link in the MLP argument. This relates to the regime bias that underpins the conception of niche-level developments in the MLP. Because of this bias, niche developments are contextualised in terms of their reaction to or their effect on the dominant regime. This is easily illustrated by reflecting on the MLP's analysis of the evolutionary mechanisms that lead to radical change.

Geels's conception of natural selection is one that presupposes the existence of a variant in the internal market niche that then links up with the dominant regime (see chapter 2) and produces tensions regarding the rules of the dominant regime. However the inverse took place here. A selection criteria from the dominant regime was amplified within the niche environment, however the niche environment was able to exist because steering actors were able to decouple the niche-level trajectories from the risks of the dominant regime and work around the boundaries created by the dominant regime. This resulted in a niche that is not completely shielded from the dominant regime but rather acts around the niche-level problems produced by the dominant regime.

The MLP does take account of the fact that niches can form at different levels of proximity to the dominant regime, however the crucial interplay between regime rules and the processes of niche-rule formulation is left out of the equation. The MLP analysis begins at a point where niches are ready to 'break through' into the dominant regime or where the dominant regime has deteriorated to such an extent that the decay of regime rules created windows for the development of new niche rules. The case

study presented in this chapter is one of a niche that is neither ready to break through nor developing solely due to the decay of the rules of the dominant regime. This does not mean that the end result of the niche process won't resemble the breakthrough/replacement narrative presented in the MLP, but it does mean that, first, the MLP misinterprets the role of niche regime interaction in the decay of the dominant regime because the perspective does not consider that the rules of the regime provide nothing more than the outer boundaries for action within the niche, and that many of the new rules are created in the spaces between these boundaries. Secondly the MLP disregards the crucial importance of the positioning of actors in relation to one another, the initial organisation of network and alliances that might be just as effective in playing out the normative and cognitive rules set forth by the steering actor in the niche, without reliance on regime-level relational agency.

#### 6.5.4 Conclusion

Steering the initial formulation of rules does not necessarily require the immediate delineation of regulative rules. Cognitive and normative rules suffice for the initial steering practices within the niche. Often the process of creating regulative rules take place through the participation of an actor that wields hegemonic agency but enacts this agency without regulative rules. In these cases the role of hegemonic agency removes some of the risks of novelties that might not have been attempted by a group of actors without this form of agency.

Framing and discourse are incredibly powerful tools in the creation of developmental trajectories within a niche that initially functions with relatively few niche-conducive regulative rules. Even though framing and discourse cannot provide the same step-by-step guide that regulative rules can, the value of normative and cognitive rules lies in the liberating effect that it has on the market. It allows for the broadening of the mentalities of niche advocates and in so doing stimulates critical reflection. It stimulates cooperation and the formulation of coalitions and networks that then further acts to articulate selection pressures and coordinate the resources of niche advocates. This does not mean that there are no power struggles at play. However, when there are fairly few niche rules to contest, the main avenues for these power struggles are not inward but rather outward toward the boundaries created by the rules

of the dominant regime. The internal organisation that takes place in groups of heterogeneous actors in the formation of rules takes place along evolutionary principles rather than outright power struggles. I say that this process has an evolutionary character because various options for development are considered and the contestation that takes place is rather between these options than between the actors that advocate for them.

The strongest advocates for specific developmental trajectories, as I show in the next chapter, are rowing actors. Their contestation is with the regulative, normative and cognitive rules of the dominant regime and, at least in this case, not with the rules within the niche. This is because of the open-ended nature of niche rules, resulting in the absence of niche-conducive rules. The work of these open ended rules, even though they are bounded by the lock-ins of the dominant regime, is to put the issues of the niche advocate on the radar, albeit without direct solutions to the problems of niche advocates.

This open-ended process of network formation by the steering actor takes place in three loops: stocktaking, cycles of evaluation and cycles of solidification. These processes are, as explained above, evolutionary in nature. Stocktaking includes the evaluation of existing regime rules, the negative externalities of the dominant regime and the needs of rowing niche advocates. Based on this the steering actor justifies the niche. Cycles of evolution can be summarised as the initial process of role determination by the steering actor, based on the justification for the niche. It includes the continuing evaluation of problems but also the delineation of actor groups that could attend to these problems. Cycles of solidification are essentially the final steps of field-level trajectory formation, the acceptance and retention of rules and institutions. Here developmental trajectories begin to take shape and niche-conducive rules begin to form.

Stretch-and-transform empowerment is better suited to creating decentralised niches if the dominant regime functions on the principle of centralised production. The role of non-core regime members in offering stretch-and-transform empowerment is evident in this process. Even though the non-core regime member as steering actor must contend with the boundaries that regime rules create for the niche, being removed

from the processes that created and perpetuated these rules historically makes it easier for these actors to diverge from these rules.

## **Chapter 7** **Power Taking in the Niche**

*We live in a world where many centres of power both steer and row. And each steers its own rowing being mindful of the steering and rowing being undertaken by other private and public institutions. (Braithwaite, 1999: 90)*

### 7.1 Introduction

This chapter is structured around the work of the intermediary actor, GreenCape, but includes a variety of areas of development, mostly relating to the Western Cape. The goal of the data put forward in this ‘snapshot’ manner is to give special attention to the role of rowing actors in the niche. Up to now, steering has received more attention in the substantive chapters. The initial steering that took place was primarily toward guiding future action, rather than placing new requirements of immediate change on incumbent physical and institutional structures. What also became clear from Chapter 6 is that, even though there is an overarching ideology guiding long-term goals, there were some issues dealt with more immediate effect. The type of rowing that took place thus depended on the immediacy of the risk factor dictating the change. Considering the role of the empowering actor, or the steerer in network creation, an obvious avenue of enquiry for this chapter is how rowing takes place and how it contributes to the creation of networks in the niche space. This chapter considers the categorisation of actors, the modalities of rowing governance in stretch-and-transform niches and the contribution of this to the developmental trajectories of the niche.

### 7.2 The Problem with the Privatisation of Electricity

Cyril Ramaphosa, speaking at the World Economic Forum in Davos, said that “governments should look at getting the private sector to partner with them and eventually reach a point where the private sector generates power independently” (ESI Africa, 2017). The Vice-President further said that the South African case has proven the effectiveness of private sector involvement in electricity supply projects.

Having IPP's completely independent from the Eskom monopoly might be a difficult ideal to attain as there were, and still are, strong interests in keeping Eskom's monopoly. These interests are partially ideological, considering Eskom's role as a powerful utility in the 'developmental state'. Increasingly, however, other interests have come to light, including black empowerment and, unfortunately, corruption. The debates surrounding drastic shifts from the centralised dominant regime at the national level are not likely to yield any changes in the near future. Various of my interviewees said that the future of the electricity sector in South Africa should logically have Eskom, or a centralised regulator, in charge of the distribution and transmission infrastructure, and move toward a more open market of production.

This sentiment is complicated by the voices of political elite that are still lobbying for full-centralised control over electricity production and distribution as discussed in Chapter 5, and by other voices in civil society, such as the labour unions. Even though a national open market of electricity production might never exist in South Africa, one has to realise that there is a pattern of ideological shifts taking place in almost every group of actors that are involved in the electricity sector of South Africa. These shifts are not necessarily toward a decentralised market. There is a growing discontent with the failures of the dominant regime, which is evident when listening to the narratives of labour unions.

One example of this is the narrative and ideological changes that NUMSA, South Africa's National Union for Metal Workers, has publically undergone in recent years on the issue of electricity production. NUMSA has always posed strong objection to private-sector ownership in the electricity sector. They propose rather driving the renewable electricity sector on the principle of social ownership. The trade union was not persuaded by the mammoth amounts of social development that happened through the IPP programme, rather, they had lost confidence in Eskom, as explained in a statement on the resignation of Eskom's CEO. However, they blame state corruption in this case, on the state's involvement of with the private sector:

*Numsa has consistently opposed privatisation of public entities, called for the renationalisation of Arcelor Mittal SA and Sasol and the nationalisation of other strategic industries. But it is now clear that SOEs all need to be run in a*

*far more democratic and socially responsible way. Public utilities should have an entirely different set of objectives from private companies – to produce commodities and deliver services which people need, as efficiently, safely and economically as possible and to protect the environment and the economic prospects for future generations... The underlying problem at the heart of all Madonsela's allegations is that SOEs have become entangled with the corrupt private sector through outsourcing of ancillary activities and thus been infected with the disease of corruption, which is inherent in the capitalist system. (NUMSA, 2016)*

Beyond the socialist agendas of the labour force in South Africa and the stock energy mind set of some South African politicians, there is yet another issue with public private partnerships: there have been failures in the past. The Solar Home System Project, for example, was aimed at providing basic electrification to poor rural households that do not have access to the grid. This was achieved through subsidizing households and giving private contractors concession sites in rural areas (Prasad, 2007:05). Other small-scale efforts at introducing renewable energy also failed, including the Solar Water Heater Project. Failed efforts at procuring large-scale privately produced electricity include REFIT. Failed efforts by Eskom include the Pilot National Cogeneration Programme, the Medium Term Power Purchase Programme, and the Multisite Base-load Independent Power Producer Programme. An energy activist interviewed in 2015 expressed the sentiment that these failures carried on a national level in civil society:

*Well, that's why as a pragmatic thing some would say we will accept this thing. Civil society was not united in rejecting liberalization per se, some folks say, "well, given that Eskom hasn't delivered, this does have some potential". But there was always with this sense of trepidation. Liberalization is not the panacea to solve all ills, but not all were against it. Particularly organized labour. But a lot of the left said we have a state and we have a state-owned entity and we have policy to say we are going to do this, Eskom must get out there and deliver energy services and where Eskom cannot do it we will have solar home system, which we had that with the whole series of concessions, but what happened to the solar home system? It became public-private*

*partnerships, it started operating as IPPs and the whole thing failed.*

(Interviewee 5)

At this point it must be clear that the institutional arrangement of the procurement programme carries as much weight as the ideals upon which the programme is based. When it comes to forging a relationship between the state and the private sector, it appears that the best structure is one that is removed from the immediate mandate of the state. This has been successfully done through government, in the form of the IPP office. As an interviewee representing the office said:

*Yes, and everybody believes they own us and in fact we do not belong to anybody...* (Interviewee 1).

The developments in the electricity sector at national level were the catalyst for developments at subnational level. However these developments, at provincial and municipal level, differ drastically from those at national level. They move away from centralised electricity generation and consumption and toward decentralised, semi-independent systems. In the case of the Western Cape much of the ‘power taking’ was accomplished by a variety of actors and by an intermediary actor created by the state to facilitate the growth of the industry, GreenCape.

### 7.3. Hybrid Intermediaries: the Case of GreenCape

As discussed in Chapter 5, the initial role of GreenCape was to grow the renewable electricity sector around the IPP programme in the Western Cape. GreenCape is an important agency in the power taking governance of renewable electricity development in the Western Cape, and the rest of South Africa. They stand out from the rest, because they are neither private nor public, but rather a middleman between the two. Often, as I will show in this chapter, several of the ideologies of the Western Cape Government became evident in the work that they do, however they have managed to become more and more independent of their place of birth - the Western Cape Provincial Government.

### 7. 3.1 Institutional Structure

GreenCape was established in 2010 by the Western Cape Government, initially funded only by the Department of Trade and Tourism under the Western Cape Government. They have now diversified their funding pool, with the Western Cape Government funding them to around 50 per cent and the rest coming from sources like the World Bank, the Department of Trade and Industry, the City of Cape Town and international bodies. Their website describes their main activity as aiding the green economy in removing barriers to the establishment and growth of businesses, and in order to do this they work closely with the state, the private sector and academia.

They report to the Western Cape Government, however, unlike the state, their sole purpose is the promotion of the green economy in the Western Cape. The Western Cape Provincial government has various special purpose vehicles that are designed with a specific agenda and developed to become self-sufficient.

GreenCape is comparable to the IPP project office in this sense, and much like the IPP office, this hybrid structure is part of the reason for their success. The placement of GreenCape was no accident. As an interviewee from the Western Cape Provincial Government explained, the main advantages of their placement outside of government is easing interaction with the private sector, and that they can act as neutral middle man to the industry:

*There is that stigma around government, distrust of government, slowness of government. By having them outside of government structures they are seen as being independent of government, although they report to us. They are seen as a neutral body, as a body that can provide advice to business without vested interests. And I think that's why it works. (Interviewee 10)*

The risk of becoming obsolete does not seem to be a point of concern for them. They explained that while the ability to diversify their funding pool remains high, it means that they remain useful to their funders, which is currently the case. This institutional setting, answering to the Western Cape Provincial Government, however, could potentially place a fair amount of political risk to their survival. According to them,

the biggest political risk that they are facing is in accepting projects from outside of the region, as explained by an interviewee from GreenCape:

*We're increasingly asked to do work in other areas, so Northern Cape, Eastern Cape – and I think from my perspective a much bigger risk is how do you separate out if we do work in some of those other areas, from our perspective it's the right thing to do and it only adds to the argument that the Western Cape is this hub; but then from a political or from a more petty political perspective, it can have more issues. (Interviewee 13)*

### 7. 3.2 GreenCape as Problem Solvers

The special purpose vehicle does not only act within the bounds of the IPP project. The procurement programme can be considered as the catalyst of further renewable energy developments in the Western Cape, and the reason for the creation of GreenCape. This sequence of events has had crucial knock-on effects for the industry as a whole. GreenCape view their work in the green economy as a networking and informing agent within a very good network, geographically. They view their network as their customers and they view their main task as rendering a service to the network. Their 'customer base' consists of people that want to do business in the green economy of the Western Cape. They work across government, foreign investors, local businesses, local banks, and all three levels of government. It depends on what the opportunity is and what the barrier is and who needs to be involved to try to unlock it. When asked about what makes them succeed, they explained that the ability to make themselves useful is the main 'tool in their toolbox'. This means understanding what every actor that they work with is trying to achieve and leveling with them rather than directing them. They have "no carrots and no sticks". Further, their methodology relies on a snowball effect of their growing legitimacy in the market. Being invited to participate in discussions and standard-setting bodies, such as the wind and PV localization strategies is the *best symptom of success* for them. In order to do this they realize that they need to become useful to more than one body, they need to wear different hats at different times. They can be seen – strictly speaking, as an independent not-for-profit company, but they are seen as a government agency when it suits them, as a municipal agency when it suits them, and they are seen as

researchers when it suits them. Further, they are also the storytellers of the market. They publish annual reports on key developments in various market areas. The intention of this is that anyone from outside of South Africa who would like to understand the market could go to their website to read and understand that there are opportunities in the Western Cape economy.

They view themselves as the problem solvers of the industry. They understand that their capacity to solve problems hinges on the relationships that they have formed with various key actors in the industry and with the way that their services are received. Thus the legitimacy of the information and network that they provide is key to their functioning. Even though government employs them, they do not see themselves as an extension of the state, in fact, they described their interaction with state bodies as being as much of a problem solver to the state as they are to the private sector:

*And 95% of what we do is to help the City and the province realise what is in their control and what is not in their control. And there is a huge amount that is not in their control. So once you've accepted that then you have to have a different set of tactics to achieve the things that are not within your control. I think we've been very good at helping them see that and then do a lot of work to influence things that are outside of the control of the provincial government; and that's where we get to actually quite autonomously.*

(Interviewee 13)

## 7.4 Small Scale Embedded Generation, Energy Services and Large Scale Renewable Energy in the Western Cape

### 7.4.1 Small-Scale Embedded Generation

Initially, metros such as the City of Cape Town did not place much emphasis on the uptake of small-scale renewables. This is understandable, as an increase in the uptake of renewable energy technologies by high-end consumers could result in financial losses for the metro, as explained earlier. There was however a clear realisation within the municipal authorities of the Western Cape that 'add-on' solutions are doomed to

fail. They realise that the electricity system is so intertwined with municipal functioning that shifts in electricity dictates shifts the entire institutional structure that supports it. They also realised that the bigger issue is the underlying institutional structure and how that is leading to suboptimal outcomes, and that if one really wanted a better outcome you have to change that.

This institutional misalignment has been the main barrier to the introduction of small-scale technologies in the Western Cape. The lock-in created by policy was broken when municipalities partnered up with other key actors to solve their problems. They started investigating the possibilities for the electricity sector, and what they can do in their own right to ensure that they do not suffer as a result of changing tides. The City of Cape Town has set a target for sourcing 20 per cent of its energy needs from renewable energy sources by 2020 (Kilian, 2016).

The groundwork for getting this shift underway was mammoth. From a policy perspective the City was in a difficult position. NERSA had been awaiting the approval of their proposed rules and regulations for small-scale embedded generation from the Department of Energy, without which, technically, there is no national protocol for operations. NERSA was now in a difficult position, where there was no policy, but with applications coming in from various municipalities wanting to implement small-scale embedded generation. At the same time there was massive pressure on municipalities to implement small-scale embedded generation because of the risk that their high-end consumers might defect from the grid. Cape Town was the first city in South Africa to implement feed-in tariffs for embedded generation at household level and by 2016, 18 contracts had been signed with small- to medium-scale embedded generation with businesses. These installations had a couple of limitations, including that the consumer needed to be a net-consumer and not a net producer when calculated annually. They also had to generate less than 1MW. No licenses were required for these installations. This is how the City avoided licensing issues with NERSA. Rather than creating a podium for financial benefit for consumers installing small-scale embedded generation, they modelled it as an energy efficiency podium through which consumers could offset their consumption.

This has to some extent solved the problem for municipalities. The provincial government, as discussed in Chapter 6, is monitoring the risk that these developments pose to their financial model. Between 2013 and 2016 GreenCape also worked with the majority of municipalities in the Western Cape to explore possible future models for their business in electricity in the changing landscape (Basson et al., 2016). One example here is Stellenbosch municipality that approached GreenCape in 2014 because they were unsure of how the uptake of small-scale embedded generation would affect their financial model. GreenCape carried out a study testing various alternative financial models and from this, drafted a small-scale embedded generation policy for the municipality and assisted them with submitting this to NERSA for approval. They have since provided the same kind of support to other municipalities in the Western Cape based on the realisation that these solutions are specific to the municipalities for which they are designed, rather than pursue a ‘one size fits all’ solution.

The Smart Electricity team at GreenCape has enabled municipalities to leapfrog directly to more sustainable technologies while preserving their financial models. According to them, the renewables industry provides opportunities for municipalities to keep providing the social goods that fall within their mandates while growing in a sustainable manner. One key realisation that GreenCape brings to the table is that the risk landscape is constantly changing for municipalities. While the issues of supply shortfall have been mitigated, the next big risk is the rising cost of Eskom electricity. The results and projections have proven that the solutions that GreenCape has suggested to Western Cape municipalities are effective. The estimated value of rooftop PV between 2016 and 2019 is R2 billion, with the potential of creating over 3,000 jobs. Fifteen municipalities in the Western Cape currently allow for small-scale embedded generation (15 out of the 21 nationally) (GreenCape, 2017a).

Municipalities and provincial government were not the only actors that had to overcome lock-ins in bringing about small-scale embedded generation. The transactional costs of installing a PV system cannot be absorbed in the case of smaller installations. If a consumer is going to pay more for the transactional costs than for the technology, that is a large barrier for small-scale embedded generation. GreenCape and other actors attacked the transactional costs in the market by

developing a form of accreditation that allows technicians to show that they have the necessary knowledge to sign off on the installation of a system. GreenCape, together with local and international partners developed training for renewable energy technicians. SARETEC (South African Renewable Energy Technology Centre) was established through partnerships between GreenCape, CPUT, the City of Cape Town, SAPVIA and the National Skills Fund. Prior thereto SARETEC already provided training to the wind and solar industries and the processes of accreditation of these qualifications are underway. The SARETEC programme developed a test that will eventually be converted into a professional qualification or a semi-professional qualification, which will allow installers to sign off on the structural components of installations and is once again limiting the transactional costs, especially where small-scale installations are concerned. SAPVIA and the City of Cape Town have accepted the tests as industry standard. The process of getting the test and the qualification accepted is less about trial and error and more about lobbying with the right bodies.

Sola Future Energy is a critical private sector actor that contributed to the growth of the embedded generation industry in the Western Cape. In contrast to GreenCape, this is a profit-seeking private company that had different ideals in growing the market, but as I will show below, can be regarded as one of the catalytic actors in the growth of the market.

### *Sola Future Energy*

Sola Future Energy's parent company, Aurora, started looking at energy efficiency in the 2010s. Aurora Power Solutions ended up focussing on the procurement programme, lobbying specifically for the inclusion of solar energy technologies, such as PV. They subsequently had two projects successfully run through the IPP programme. At that time the media coverage of the programme raised the amount of public awareness- people were starting to realise that the South African market was reaching a point of price parity for solar energy, and they wanted to benefit from this new technology as well. This is why they created the subsidiary *Sola Future Energy*, specifically geared toward the small-scale embedded generation market.

The first phase of their first project, Black River Park business complex, was completed in 2013. This was done with the help of subsidies from the Standard Offer Programme of Eskom, through which 20 per cent of the cost of capital was refunded through a verification mechanism. A team comes on site, measures the savings and pays that back to the client. The subsidy was awarded in advance, and the project was paid off over three years. The savings were higher than expected so the client went for phase 2 in 2014 without the subsidy. The business model that drives their projects is based on a principle of offsetting demand with their production rather than making a profit for their clients from electricity sales. All of their clients do, however, end up selling excess back to the city, save for Woolworths, because they are such a large consumer.

#### 7.4.2 Finance

One of the biggest challenges faced by the renewable electricity industry is that of finance. The challenges are often related to the difficulty of making a case for the availability of finance for a new sector, one for which there is ample scientific support and examples in other countries, however one for which there is a lack of local test cases. Finding finance is part of the challenge of getting out of the starting blocks.

In the Western Cape the renewable energy finance issues often relate to non-utility scale renewable electricity projects simply because utility-scale renewable electricity procurement has been centralised through the REIPPPP. The incentives created by the REIPPPP and perpetuated by private sector banks, companies and lending institutions for utility-scale renewable electricity finance is evidenced by the mammoth investments that have been made in the programme. However when one considers finance issues in the green economy from the point of view of provinces or cities, the picture is slightly different. Questions here often relate to the uptake of renewable energy technologies at a smaller scale, or of energy-saving technologies, which do not come with as many guarantees as utility scale investments. As explained by our interviewee from the City of Cape Town, the City pushes for the uptake of energy efficiency technologies such as solar water heaters, however it's a futile attempt if the financial institutions do not come to the table.

*Yes Cape Town does look at this and we drive it forward on that front on new buildings. But on old buildings, and what I am going to try and do, and I do not know if I will get this right, but I want to go and speak to the banks, because to my mind this whole issue of solar water heaters is really finance issue, not an economic issue. The reason why people are not buying them in my opinion is they do not want to do the upfront cost of R12,000. They either do not have it or they would rather spend that on something else. Part of the way we may be able to solve the problem is to go to banks and say that (this should be included under) home loans... And if the banks can agree to something like that, then I think you will see a major uptake on solar water heaters. We have to make the financing easy for people. Banks like to push their green credentials as long as it doesn't cost them anything. Because it is mainly homeowners who will want to buy it and that's who we want to reach.*

(Interviewee 4)

Financing small-scale embedded generation and energy efficiency technologies present with similar issues because the key receivers of those technologies are individuals and not businesses. One solution that has been found for this problem is PV renting. This financial tool was set up by Maxx PV for schools, guest houses, public bodies and small- to medium-scale businesses. Two pilot projects are running in Cape Town producing 40 kWp and 14 kWp<sup>30</sup> respectively to a school and a guesthouse. This project has a variety of partners including the German Energy Agency and a variety of local installers. The business model is simple: an entity, the system owner, rents the system to a system operator and the system operator has the option of buying the system after 15 years. These pilots have allowed the system operators to lower their monthly consumption without any upfront investment (SAPVIA, 2016).

Another innovative financial model has brought off-grid renewable electricity to an informal settlement outside of Stellenbosch. The Ishack Project of the Sustainability Institute in Stellenbosch brought electricity to shack households that had never been afforded access to electricity. The original research was funded by the NRF through

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<sup>30</sup> Kilowatt Peak power, meaning the output power of a solar module achieved under full solar radiation

Stellenbosch University's TsamaHUB. After that the Bill and Melinda Gates Foundation allowed the Institute to develop the technology to upgrade 100 shacks in 2011. Later in 2013 the state Green Fund added to the pot with a target of supplying electricity to a further 1,500 households (Wild, 2015). The business model here differs from that of PV renting. It works on a pay-as-you-go basis, which is controlled by a 'sim' card in the distribution box.

The Green Finance Desk was established to create a financiers database with an investment and opportunities map for the Western Cape. It is also aimed at conducting a municipal revenue analysis and to drive energy efficiency in provincial buildings. To date the Green Finance Desk has developed a model to determine the impact of energy efficiency and embedded generation on municipalities and mapped the size of the main investment opportunities in the Western Cape (Western Cape Government, 2015: 39). Established in 2014, the Green Finance Desk was largely as a result of the Green Finance Investment Case Report that the Western Cape Provincial Government commissioned. The aims of the sector desk are in line with the provinces Green Economy Strategic Framework's intention of being private sector driven but public sector enabled. The sector desk serves a facilitators role in that it cuts across all of the other focal areas within GreenCape, connecting potential investors to businesses seeking finance. The Green Finance Database tool provided by GreenCape's Green Finance Desk is based on the recognition that there is a data gap between potential financiers and businesses. This tool was created in collaboration with GIZ and is being hosted on SANEDI's website. It is a database of financiers and the services that they offer and it is being continuously updated and holds at least 80 financiers, both public and private (Basson et al., 2016).

The GreenCape Green Finance Desk is aimed at understanding what the financial landscape in the province looks like, at identifying levers of change and how to act on these. This means going into discussions with banks and financial institutions in an attempt to understand how decisions are made in the banking world. What they have found is that decisions are rather irrational because it involves the quantification of risks that have not been around for long enough locally. Their solution has been to include international bankers to these discussions, from areas where the risk of lending for developments such as small-scale embedded generation, is not new. In

this way they have managed to attract international and local investment, such as Tesla and the French Capital Fund.

Training has often been a spin-off of green electricity projects. In both the PV renting and Ishack examples mentioned above, one of the ultimate goals or one of the stepping-stones was training at different levels. Daniel Conway, the director of the Sustainability Institute Innovation Lab, the implementing partner in the IShack project, explained that they want to train locals to do much of the installation, maintenance and client management work (Wild, 2015). According to him, distributed green technologies, such as off-grid installations, often do not rely on massive enabling infrastructure, so it's ideal for local job creation. The Maxx PV team also trains companies to install their products and many of these are located in the Western Cape (SAPVIA, 2016). Since 2011, engineers, architects and craftsmen have been taking part in the Maxx-solar academy, and many of them have gone on to work in the industry as certified installers. Over 40 of these installers are based in the Western Cape.

#### 7.4.3 Manufacturing

GreenCape's involvement in large-scale renewable energy procurement relates mostly to their dealings with manufacturing, equipment suppliers, technical advisors and financiers (GreenCape, 2017b). In line with this they engage with the IPP unit, often times specifically focussing on expediting communications between state departments (such as the DTI) and key industry actors. They also engage with related industries such as agriculture and agri-processing on the demand side and clean technology industries on the supply side to enable the uptake of clean technologies. Lastly they engage with potential manufacturers in the renewable energy industry towards establishing themselves in the Atlantis Special Economic Zone that will be discussed below.

#### *Atlantis Special Economic Zone*

In 2011 GreenCape proposed the development of a Special Economic Zone in Atlantis for the advancement of green technology in the Western Cape. The SEZ is a collection of industries related to the green economy that are aimed at growing the

industrial component of renewable electricity in the Western Cape. They accomplished this through networking with the Department of Trade and Industry, Wesgro, the City of Cape Town and investors. The Department of Trade and Industry has proposed various incentives to attract investment to the SEZ, such as a reduction in corporate income tax of 15 per cent (instead of the current 28 per cent); employment tax incentives toward hiring younger, less experienced workers through a cost-sharing mechanism with government; a building allowance with accelerated depreciation allowance on capital structure of 10 per cent per annum over 20 years; and a VAT and customs relief system.

From the manufacturing side it creates an opportunity for companies to understand what markets there are for industrial components, so they can position themselves to manufacturers. There's an opportunity for new manufacturers, but it's a fairly well established oligopoly style market with a few big meter manufacturers really dominating the global landscape. The issue with industrial and manufacturing development in the Western Cape is thus related to understanding the opportunities. Further there was a need for the establishment of a network for goods and services, and positioning actors along this network to strengthen it. This type of development often has positive spin offs, such as the Ankerling diesel power plant that GreenCape lobbied for turning into a gas-fired power plant. In Atlantis there's a peaking diesel power station and the IPP office is busy with this gas rollout. And there are a couple of arguments in favour of the conversion: the Atlantis region is already well interconnected, so to have gas to compensate for the variability of renewables is basically seen as the future grid. Ankerlig generates 1000 MW and is running currently off diesel at R1 billion a month and needs to be converted to gas. It's really expensive to build the pipelines from Saldanha to Ankerlig and 1000 MW of diesel power is just not enough to justify the infrastructure for the port and the pipeline. Basically it's the cheapest possible way of getting both gas and diesel replacement with the smallest impact on the final price to the customer.

From Eskom's perspective it will solve a headache they've had for seven years: getting the gas there is too expensive, but diesel is also not viable. From the IPP's perspective it solves a massive problem because there's really good infrastructure already there, so it's not that hard to evacuate the power and give it a place on the

grid, where it is really valuable to have additional generation capacity. Another argument for this upgrade is that it compensates for the variability in renewables, and it spurs on industrial development in Atlantis. So you've got a tiered argument for a number of different layers that all makes sense to do this conversion in Atlantis.

#### 7.4.4 Energy Services, New Business Models and Sustainable Thinking

The landscape of energy service providers in South Africa has changed drastically. Service providers in the energy space are increasingly providing holistic options to customers that include forms of own production but also relate to energy efficiency or a combination of energy efficiency and own production. According to GreenCape, a network of service providers have started emerging that attend to the needs of customers across the value chain (GreenCape, 2017c). An integral part of their role in growing this network is providing key actors with market insights given via their annual market intelligence reports. They also facilitate the connections between key actors in order to streamline the industry and affect the mind-sets of public and private actors alike.

Energy has been identified as a 'game changer' for the province and through it, the province strives to become the 'green-economy hub of Africa'. Even though the Western Cape Government aims to streamline their approaches to climate change mitigation with that of national government, they have taken an aggressive stance with regards to becoming less reliant on Eskom electricity and on actively pursuing a more diverse local energy mix. At city level, various measures have been taken to improve energy efficiency: all of the traffic lights in the city have LED light bulbs and over 25,000 streetlights have been retrofitted to be more energy efficient. This has saved the city over R100 million over the past six years. Beyond improving state-owned infrastructure, there is a serious drive toward decentralization coming from the Western Cape Government. This sentiment was evident in Helen Zille's 2017 State of the Province Address:

*If we want our economy to grow, we have to ensure energy security. We have learnt over the past decade that our country is overly reliant on the state monopoly called Eskom. This brings me to our energy game-changer, on*

*which we are working jointly with the City of Cape Town. South Africa's energy crisis requires a sustainable, low carbon and diverse energy-mix. Technological advances are enabling the Western Cape to pioneer the trend towards small, distributed suppliers of renewable energy, with flexibility and low costs. (Zille, 2017)*

GreenCape and the City are not the only actors facilitating the growth of this market. As I will show below with the example of Villiera Wines, some of the uptake of these technologies resulted from factors such as international market pressure to lower the carbon footprint on produce. The case of Villiera also shows a change in the mind-set of consumers of electricity that become producer-consumers. This case serves as an example of the kind of sustainable thinking that has been articulated by various interviewees.

#### *Villiera Wines*

The wine industry is not one of the obvious cases for investments in renewable electricity or energy efficiency technologies, when considering that the cost of electricity in wine farming is minimal and seasonal. The main reasons in the case of Villiera for investing in rooftop solar was based on: the poor quality of electricity and the interrupted supply that they had been experiencing; an increase in tariffs above the inflation rate and the projected increases for the future; avoidance of carbon tax in the future; and lastly because of their environmentally sensitive international and local customers that require a lower carbon footprint. All of these factors contribute to the profitability of the business. Woolworths have been one of the major promoters of sustainable consumption in South Africa and require a periodical business audit from all of their producers. Marks and Spencer is another chain with stringent requirements to which the wine farm has to adhere. According to my interviewee from Villiera, being indispensable or unique in the eyes of large supermarket chains does not only pertain to the quality of the product and the price at which you can produce it. Today these chains have short-term contracts that are under constant review. In line with this the farm is involved in diverse sets of social and environmental sustainability focussed projects such as clinics, schools, nature conservation, including having an

onsite wildlife sanctuary, and maintaining a practice of planting extra trees. They also have a programme for sustainable water usage.

In 2009 the farm decided to renovate their tasting room. As part of this they decided to make a statement by installing rooftop solar. Because of the price of the technology at the time, they decided it would only be worth their while if they installed it on their cellars as well. Within 5 years of the installation they had accomplished electricity savings of 46 per cent. Of these savings, offsetting their consumption by own production only accounted for 40 per cent of the total savings. The other 60 per cent was due to energy efficiency practices that they had started adopting on the farm. Energy efficiency in this case was more about behavioural changes than the installation of new technologies. They would, for instance, monitor the temperature inside and outside of the wine cellars based on the data gathered, manually open or close doors at different times to control the temperature, rather than using electronic air conditioning.

This was a self-funded project done without any external debt or subsidies. A year before the commencement of the project, they had a discussion with regional Eskom employees that knew that there might be intermittent electricity supply. An Eskom advisor that had subsequently retired advised the farm to get a generator. A lot of the initial planning of the system was done with the help of the old Eskom advisors. According to them, in the past they had great regional advisors that were willing to help their clients. This is no longer the case - my interviewee from Villiera referred to Eskom's current relationship with small-scale producers as being 'obstructionist'.

Sustainability, as explained by my interviewee from Villiera, was a way of living and functioning. Once you have started with little adjustments here and there, other possibilities become apparent:

*And then one day it was just like the light going on; all the stuff we've been involved in on sustainability and everything, I could just see the whole picture – BANG! – where you can get rid of everything, the whole lot can go. There are just little bits in the puzzle and they all fell into place and things changed to the extent that we could. (Interviewee 15)*

Sustainable thinking solved a whole range of problems for the farm as described by interviewee 15, some of which they only realised they had when they really started thinking about their consumption.

The Eskom power lines ran across their wildlife reserve. According to Interviewee 15 they were visually an eye sore and moreover their location away from the bustling movement at the farm headquarters made them an easy target for copper thieves. But they could not abandon the need for the Eskom lines because a house at the furthest part of the sanctuary and other functions, such as a neighbour's borehole, all required electricity. And yet there was a determination to be off grid. So they decided to put the house on solar power with backup batteries. They decided to use an old irrigation line instead of pumping to move the water from the old borehole dam to the new one on the neighbour property rather than using pumps, it was slower but it didn't use any electricity. Through this they managed to get rid of most of the transformers on the sanctuary, and by investing in one step up transformer they saved R160,000 per year - R100,000 saved in rentals for transformers that used to be paid to Eskom and the rest from electricity savings from their own production. In addition to this, the farm is now no longer affected by power interruptions; they can run independently from the Eskom grid off backup generators and solar power. They have also managed to bury the cables that used to hang overhead in the sanctuary because they simply do not need that much grid infrastructure anymore. This has saved Eskom a lot of money according to interviewee 15, and it has removed the eyesore created by the original cables.

## 7.5 Discussion

### 7.5.1 Power and Agency in the Niche

#### 7.5.1.1 The Coordination of Resources

GreenCape's agency can be described as a combination of relational agency and networked agency. Their main activities are coordinating the resources of various

actors in the sector toward building a network. There is an important distinction to be made between the way that resources are coordinated by hegemonic- networked- and relational agency. Pure hegemonic agency is descriptive about how resources should be coordinated because of the hierarchical differentiation between actors. A good example of this is the way that the price of electricity, determined through hegemonic agency, makes it more expensive for some consumers than for others. The coordination of resources through relational agency is accomplished when various actors combine their resources toward a specific outcome or when an actor falls in line with another actor that has access to more resources and in so doing amplifies the outcome of action. Networked agency and relational agency in the coordination of resources often go hand in hand because the podium for the coordination of resources happens along the network between actors. In order for the niche to grow, the development of a network is of utmost importance. This network should develop organically as actors recognise shared interests and goals, however, as I show below, one of the main functions of intermediary actors in growing the niche relates to their work as network builders. It lies in pre-empting the possible connections between actors and facilitating these connections toward solving the problems of the niche.

The coordination of resources for intermediary actors requires that they are able to identify problems, or rather selection pressures within the sector and that they then act, through the creation of networks, on the selection pressure with the resources of others. In this way they allow for the network along which industrial protection, technological protection and market protection can be provided by connecting the actors that can provide these forms of protection to one another in different cases, and by amplifying the agency of actor sets through the connections that they make. The only selection pressure that they directly affect in relative isolation from other actors is socio-cognitive protection by acting as information agents for their customers. Thus through indirectly affecting selection pressures and allowing other actors to act in a shielding capacity, they act in a nurturing capacity by identifying and developing path-breaking innovations both actively and passively. In the case of GreenCape, this ability to mediate stems from their clear goal of growing the green economy, which resonates on some level with most of the actors active within the niche. They are by no means a neutral participant in the sector, however their overarching goal resonates with many actors. Thus for the intermediary actor, alignment is simplified if their goal

is the common denominator of the goals of a large amount of heterogeneous actors that occupy the system.

#### 7.5.1.2 The Transference of Rules

GreenCape's hybrid structure, designed through the hegemonic agency of the Western Cape Government is perhaps the most linear example of steering and rowing taking place aimed directly at growing the industry. One must realise though that the motivation for their creation was in part an avoidance of one of the key shortcomings of hegemonic agency held by state actors: the disconnect between the public and private sector. As discussed in Chapter 6, steering actors that are also state actors have to contend with the boundaries created for the niche by the dominant regime. The existence of selection pressures in the form of regime rules make it difficult for pure niche advocates to find a middle ground with core regime members or with non-core regime members that are powerless in the struggle against the lock-ins of the dominant regime.

Hegemonic agency is best at producing regulative rules. Regulative rules are best transferred in a top-down manner. Of course one can consider the shifts in ideology that take place higher up in the hierarchy, however the transference of both normative and cognitive rules are harder to achieve through hegemonic agency. This is so because monitoring normative and cognitive rules is usually not something that can be done through most forms of hegemonic agency. This state of affairs left the niche devoid of regulative rules governing the outcomes of the niche in its formative years.

This is not to say that the steering of normative and cognitive rules do not take place at all. Look for example at the power that the international market wields in the wine industry. Their 'rules' might appear regulative but it has had a normative function and it has resulted in new cognitive routines for wine producers. This is because the rules that have been affected by these institutions do not function in the same manner that state law functions. These buyers have changed their operating procedures; they have essentially redefined what they want from a product. Their internal regulative rule system changed and resulted in normative and cognitive changes in the industry. The only real method of accountability is the creation of a new factor of competition in the

market. These types of regulative rules that act like normative and cognitive rules exist in the formative phases of niche development. However, as I mentioned, they ultimately result in a purer form of regulative rule, such as legislation and policy.

In these initial phases, intermediaries row by tapping into the power of steering actors such as the municipalities and national departments. In cases where steering actors and rowing actors are project participants, the hegemonic agency of steering actors translates into relational agency for other project participants. The outcome of this type of relational agency sometimes then re-assumes the form of hegemonic agency held by state participants. Consider for example the process through which standards were developed and accepted through SARETEC. The process of rule creation was driven by a wide array of actors and facilitated by the horizontal podium for networking through GreenCape. In processes of negotiation and testing the combined action of all parties led to the outcome of new rules in favour of the niche. Even though various actors participated in the creation of these rules, the act of accepting the standards set through the process is more powerful if done by a steering actor such as a municipality or the provincial government. In this case, acceptance of these standards by the City of Cape has more far-reaching implications than if the standards were accepted, for example, by a single business.

#### 7.5.1.3 Rowing and Monitoring

The monitoring and evaluation activities of the Western Cape Government were discussed in detail in the previous chapter. One would expect that steering actors, or those that govern through hegemonic agency would be the only actors that take part in monitoring measures. In the data provided in this chapter that has not been the case. This illuminates another way in which intermediaries govern within a niche: through monitoring. A good example of this is the role that the Green Finance Desk plays in monitoring the financial effects and benefits of energy efficiency and embedded generation activities within the province. One of the streams that are monitored is municipal revenue analysis, especially as it relates to energy efficiency. The aim of the Finance Desk's activities remain facilitative, however, because finance is such a cross-cutting theme in the green energy landscape their activities often prove to be active facilitation rather than passively linking up key actors with similar goals. An

example of this type of action is the debates that they entered into with financial institutions regarding the risk-averse lending procedures that make it difficult for SSEG and energy efficiency technologies to be taken up by the market.

As networking agent, GreenCape is not a completely neutral participant in the shielding activities that they coordinate. Much of what they do centres on the making judgement calls about the actual ability of other actors to act within their networks, particularly as it relates to the state. This finding sets them apart from other actor sets, as they occupy spaces between public and private domains and act in all of the aggregations identified for actor categories, such as academia. Part of their role in niche building is monitoring the traditional steering actors, the state. This special role of intermediary actors has been highlighted in the literature (Hodson & Marvin, 2010; Avelino & Wittmayer, 2016; Fischer & Newig, 2016). In addition to confirming the findings highlighted in the literature, the case of GreenCape also shows that some forms of agency does not govern through the creation of rules, but rather through the creation of podiums for rule creation. This they do by guiding the rule-making activities of other actors, including steering actors.

## 7.5.2 Developmental Trajectories of the Niche

### 7.5.2.1 Innovation Deviating from the Rules of the Niche

Viewing governance as a linear process, with steering input and rowing output, disregards the non-linear power struggles that take place within the niche and beyond it. The relationship between steering and rowing is not a bipolar one. Different actors provide steering governance and different actors in turn row in response to these steering actions. The actions of rowing actors, like the actions of steering actors, do not take place in a vacuum. They are intricately linked with one another and therefore affect one another. In the previous chapter I showed how the Western Cape's narrative put certain issues on the agenda and how they affected the representation of the problems experienced within the province by physically quantifying, defining and measuring them. The Western Cape Government also identified certain avenues for development that are more acceptable to their frame of reference and actively made these avenues more accessible for rowing actors. One example of this type of avenue

is their preferred model for decentralised electricity production. That being a model by which small-scale embedded generation takes place in a grid-connected fashion where the producer remains a net consumer of the electricity that municipalities distribute. This goal was accomplished in most cases. However one of the cases that I reviewed deviated from this model: that of Ishack. Included in the Avelino and Wittmayer's third sector, they considered the role of academia as being similar to that of intermediaries, as they often occupy different aggregations within socio-technical systems acting between the state and the private sector (Avelino & Wittmayer, 2016). Within the SSEG market, the development of an off-grid system does not interfere with the rules set forth by other parties in solving the problems within the niche because it does not affect the financial model of municipalities and it has a relatively low effect on the carbon footprint of the country. However the action of establishing an off-grid system deviates from the rules created by municipal and provincial government. This finding shows that the relative proximity of third sector actors to steering actors determines the level at which they can deviate from the rules that already exist in the niche. In light of this, academia can then often be grouped with actor sets that aren't affected to the same extent by the monitoring measures of steering actors. In addition to academia, this grouping consists of actors such as international market participants and funders that are not really held accountable by the steering actions of provincial government and municipal government in the same way that local business and intermediaries such as GreenCape are. However, because of their distance from steering actors, they cannot mediate between steering and rowing actors in the same way that intermediary actors can. Thus academia can function in two ways as non-knowledge producing niche participants: by actively connecting with steering actors toward the establishment of a determined good outcome or through isolated action that does not necessarily disrupt the system but rather creates add-on solutions for the system in dealing with the problems created by the niche or by the dominant regime.

#### 7.5.2.2 Rowing and Framing in the Niche

Framing and discourse is one of the main methodologies that structure both the enablement of change and resisting change. SSEG in the Western Cape was enabled through the modification of various actors' framings. The problem at hand related

primarily to electricity security. The diagnostic framing of the problem was to an extent shared across actor sets, being that intermittent supply of electricity was a problem experienced by municipalities as distributors, business and consumers as users and the Western Cape Government as facilitator for development in the province. From this diagnostic framing, various personalised offshoots resulted. For municipalities the problem became the effect that electricity security issues had on their revenue model, for consumers the problem became the limiting effect that it had on their day-to-day activities including conducting business, their life styles and their security. The prognostic framing of specific social groups that make up the bulk of high electricity consumers in the province including high-income households, small-to medium-size businesses and some electricity intensive consumers, was not to fix the broken system but rather to employ methods of self-generation spurred on by the price parity that had already been achieved through large scale solar developments.

The choice of consumer groups to defect from the traditional model or the threat thereof forced municipalities and provincial government to refine their diagnostic framing as the problems experienced with centralised electricity was now not only challenging the income models of municipalities. The reaction of consumers posed an even greater risk to the longevity of this model. Consequently the prognostic framing of state agencies became to limit the damage that their financial model had to absorb from different angles. Their rational for action was to a certain extent validated by the goal of sustainable consumption, however, the core reason for allowing SSEG was to safeguard the municipal financial model. In this way one can observe cycles of framing adjustment between rowing and steering actors. The effect that rowing actors have in governing steering actors is not necessarily a case of direct competition over the rules created by steering actors, but rather in responsive action typically allowed in terms of the steering actor's diagnostic framing, with an alteration in the rowing actors' prognostic framing. In the case of SSEG, because of the lack of regulative rules, and because of the new set of cognitive rules about the value of SSEG and solar PV in the minds of consumers (that was now seen as a viable option for solving the diagnostic problem shared in the minds of all actors- the problem of electricity security), the steering actor was forced to add to their diagnostic framing (that their financial model runs the risk of key users defecting from the grid), readjust their motivational framing (their rational for action) and find a prognostic framing that was

an acceptable middle ground for all actors involved (the net consumer model). This is also a good example of the dynamic interaction between rule-regimes, actors and the system.

Just as actors are bound in their actions by the rules of the socio-technical system, so too are their possibilities for framing adjustments. When an actor's goals have become tied into the outcomes of a socio-technical regime it has a limiting effect on the degree to which their diagnostic framing of the problem, their prognostic framing of the solution or their motivational framing (rational for action) will deviate from that of the rest of the regime. This hardness of rules at regime level translates into one of the main differences between the capabilities of empowering actors in stretch-and-transform and fit-and-conform niches. At regime level the direct action against non-regime actors, as shown by the example of trade unions on the topic of private electricity production, remains intact even while the dominant regime is deteriorating. These actors are not oblivious to the faults of the dominant regime but refuse to accept the non-regime actors in its place. This means that actors such as NUMSA refuse to change the rules captured in their ideology about what the electricity sector should look like. There were various case specific reasons for this which could arguably mean that this is not a replicable finding, however as mentioned earlier in Chapter 5, this same ideological stubbornness is evident in many spheres of the national level, another example being that of the presidency.

As much as discourse can drive change, it can also act to resist change. A good example is NUMSA's ideology of social ownership extending to the electricity sector. Their diagnostic framing of the problem is the same as the solution that the two identified niche's provide for the problem, at least in part. They view the involvement of the private sector in what they essentially consider public goods, to be the root cause of problems in the provision of these public goods. Their prognostic framing is simple - driving renewable energy on the principles of public ownership as their motivational framing is in line with their definition of the problem, being private-sector ownership within the electricity sector. This stands in stark contrast to the relationship that was found between regime and non-regime members at provincial level. Even though the actions of regime members were guided by the rules of the regime, their relative distance from the process of rule creation meant that it was

easier for them to change different types of rules, not least of which is their cognitive and normative rule sets. This is due to the fact that provincial actors have historically occupied a non-core member status in the dominant regime. This brings to light an interesting conclusion: non-core members are more likely to be stretch-and-conform empowering actors than core members and the potential deviation from the dominant regime that comes through non-core members is likely to be larger in magnitude, as Smith and Raven (2012) have suggested. However, as Smith and Raven have also shown, even if the potential for deviation from the dominant regime is higher, the cumulative financial value of the change remains lower than that achieved through fit-and-conform empowerment. This can be attributed to the boundaries set by stretch-and-transform empowering actors on the niche and will be discussed in detail later on in this section.

#### 7.5.2.3 Positive Externalities of the Niche

For the success of a niche, the political, social and institutional climate in which it operates is often more important to the success of the niche than the technology or range of technologies employed by the niche. These surrounding circumstances are also not always internal to the niche, or geared toward the outcomes of the niche. Consider the diagram further below, which is a schematic representation of the complexity involved in the creation of the two types of training mechanisms discussed in this chapter: professional training and lower level training relating to SSEG in the Western Cape. This diagram focuses on the chains of problems and solutions and starts with the problem of electricity security, ending with the creation of training. It disregards the tertiary training of professionals, such as engineers, producers, researchers and electricians, and focuses specifically on the training mechanisms that have been created purely towards growing the SSEG and energy efficiency sectors within the Western Cape.

At national level the problem of electricity security was attended to by the IPP programme that was one of a suite of shifts that had been implemented and can be attributed, at least in part, to the failures of the dominant regime. At regional level, the initial response of municipalities was to mediate the problem through short-term solutions as discussed in the previous chapter. The cost effectiveness of solar

technologies and the public awareness of this possible method of mitigating the risk of electricity security stemmed from the readiness of the technology, meaning that it had reached an acceptable price and level of affectivity in the utility-scale market. Beyond the technological-, socio-cognitive- and industrial protection that grew the market for SSEG, a spinoff of the IPP programme was cultural protection. According to Sola, the public awareness that was raised due to the success of solar projects in the IPP programme opened up a space in the market for them. The goals of the Western Cape Government as steering actor translated into a business model for Sola that allowed their clients to offset their demand through own production rather than making a profit. Thus the positive externalities created by another niche effectively acted to stimulate a similar developmental trajectory within the Western Cape niche.

The consequent framing shifts led to a cascade of reactive readjustments for all of the actors involved in the creation of the SSEG developmental trajectory as discussed above. This diagram shows further that the types of business models and the types of training that acted to shield the niche resulted from the same kind of messy reactive responses to problems. The problem of electricity security is a combination of landscape pressure and the deterioration of the dominant regime. The solutions developed at niche level were initially intended to solve the problems of the dominant regime based on economic considerations toward solving ‘small problems’. This transition pathway resonates strongly with Geels and Schot’s Reconfiguration Pathway (2007: 411). They describe a Reconfiguration Pathway as a transition where symbiotic innovations developed at niche level solve problems for the dominant regime and based on this, subsequent readjustments are triggered within the dominant regime because of a snowball affect created by the accumulation of intended and unintended externalities resulting from the breakthrough of various component innovations.

Viewed from the niche perspective, the problems solved through the introduction of component innovations had a delayed effect on the dominant regime and primarily affected the sub-system around which the niche formed. It had no immediate implications in terms of rule adjustments for all of the actors in the socio-technical system as the regulative rule changes only affected the Western Cape area. It also had no effect on the municipal financial model as this was, for the time being, mitigated

through the net consumer model. This also means that the symbiotic nature of the innovations were only so because of the way in which they were allowed to occur in the system by the steering actors. This type of innovation could potentially snowball into a bigger problem for the Western Cape Government and its municipalities, if a large amount of users were to employ the technology or if the acceptability of the net consumer model became outweighed by the possibilities offered by other forms of technology, for example viable storage, which could make complete off-grid systems a viable option. Important conclusions to be drawn from this are: the formation of rules in a niche when there is a relative vacuum in regulative rules is often the result of reactive adjustments rather than active debate.

Secondly, in cases where component innovations are symbiotic with the regime, this cannot be regarded as intended in all cases or a stable reality. Sometimes these innovations are symbiotic because of the minor regulatory adjustments that allow them to be so.

Thirdly, the boundaries created through stretch-and-transform empowerment sometimes creates (at least initially) a radius of effects for new developmental trajectories. Another example where the action of changing the selection environment through stretch-and-transform empowerment creates both the opportunities for the growth of the niche and limits growth is found in the geographical limitations faced by GreenCape. As I mentioned, this intermediary was created mainly through hegemonic agency. Hegemonic agency usually functions through the creation of regulative rules. However in this case, the hegemonic agency of the state created a set of cognitive and normative rules represented in the mandate of GreenCape. Rather than a set of operating principles, they were mandated with growing the green economy.

GreenCape does not have to adhere to the regulative structures that guide the interaction between the state and the private sector, which eased their interaction with the private sector and with the state. However the hegemonic agency that created GreenCape did not cease to exist after its creation. Because of their success, GreenCape had to start thinking about the geographical radius of their usefulness. Perhaps they started in the identifiers role, meaning that they were the ones

identifying problems and aligning problem solvers. As their success and reputation grew, they began to be sought out by other problem solvers, sometimes not within the Western Cape. One of the possible avenues for avoiding the political implications that this problem carried was the diversification of their funding pool, however, disconnecting financially from the City of Cape Town and the Western Cape Government might mean that they lose a critical part of the network through which they became established. This situation highlights the limiting factor of hegemonic agency in stretch-and-transform niches. Even in cases where hegemonic agency does not function through the creation of regulative rules, the normative and cognitive rules held by the hegemonic agent limits the potential for a niche to grow in specific ways. In this case a geographic limit was placed on the developmental potential of GreenCape’s network. In other cases the limit might relate to technological choices or population types.

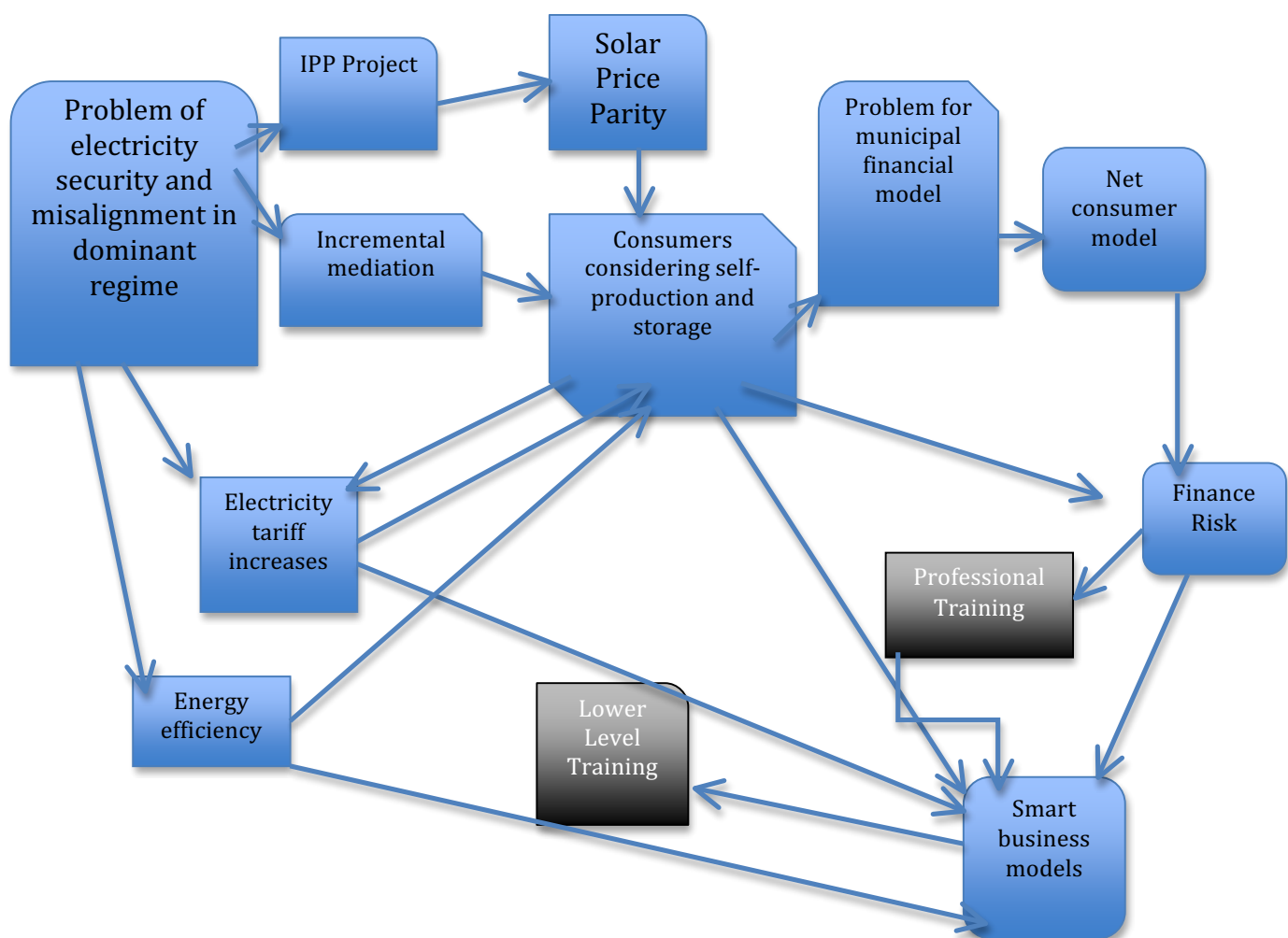


Figure 1 Creation of the two types of training mechanisms in the SSEG Market

Relational Agency lies in an actor's ability to alter the balance of selection pressure or their ability to affect the adaptive capacity of another actor. As Smith and Raven (2012) have shown, this results in the shielding attribute of the niche. Relational agency observed for rowing actors differs from that observed for steering actors. Rowing actors contribute in a very real manner to the shielding and nurturing properties of the niche. The private sector or the 'market' tends to be made up of shielding actors, at least in so far as a niche that resulted from stretch-and-transform empowerment is concerned. They do this through innovative thinking and competitive practices. Often taking a gap in the market means providing the right shielding conditions for a technology to flourish. By way of example, Maxx PV altered the balance of selection pressure through active shielding of market selection pressures that made the adoption of rooftop PV inaccessible for groups such as schools. The logic of the action for Maxx PV is clearly profit, however it resulted in opening up the market and the creation of a new rule: that credit is not a prerequisite in the process of funding SSEG.

#### 7.5.2.4 Rowing and the Three Core Processes of the Niche

There are two examples here of rowing accomplishing new developmental trajectories that steering actors have failed to do. The two financial models for small-scale embedded generation discussed here opened up a crucial barrier for the market caused by the risk-averse operating procedures of banks and finance institutions toward low-cost developments. As mentioned, the City of Cape Town aimed to solve the same problem with little success. This points to the role of external, private, for-profit actors in establishing developmental trajectories within the niche. Typically, as this case shows, these occurrences are easier to come by in niches where the traditional power-giving actors (the state) empower in a stretch-and-transform manner. What is more, it often becomes a podium for developments that go beyond the dominant regime, as with the example of Ishack, or snowballs solutions in other areas, for example the training provided under the funding mechanisms and the issue that Eskom has had with getting gas to Ankerling, which was solved by the addition of the SEZ in Atlantis.

In the Western Cape niche studied, two types of networks were apparent: networks that yielded financial benefits and network that yielded systems benefits. The networks that yielded systems benefits often had networks yielding financial benefits as spin offs. In this way, the actors that created networks that yielded systems benefits steered the actors that created the networks that yielded financial benefits. Because this study takes place in the formative years of decentralised electricity development in the Western Cape, many of the actors appeared to act as an island initially, without a network. However, these actors have an incredibly important role in stimulating the creation of these spin-off networks, as I will show below.

### *System Building Networks*

System building networks are those networks that create the initial pathways for development to happen in a specific way. The steering actor provides the narrative while the rowing actor does the groundwork. GreenCape is an example of a rowing actor in this network. Technically, one of their main aims was to create the network. They actively sought to connect diverse actor sets and facilitate the development of the system - facilitate, not guide. They searched for problems and connected problems with solutions that already existed or created solutions where there were none. All of these actions are network forming. Their power does not lie in their ability to create rules, or make money, but their agency in the sector is undeniable. Their agency lies solely in their ability to modify the adaptive capacity of other actors. This proves to be an interesting case when considering how agency has been perceived in the literature up to now. They do not compete with other actors for agency, rather they enable other actors to become powerful.

### *Profit-driven Networks*

The initial pioneers within an industry always assume a certain level of risk, both financially and productively, that they remove from the shoulders of the businesses that follow their example. Both Sola and Villiere Wines can be regarded as industry pioneers. In cases of sustainable development, the successful industry pioneers often create routes from problems to solutions rather than directly connecting actors with one another. In doing so they force other actors to act in the same manner, they create new standards for living, thinking, operating and consuming. In the case of Villiera they created a competitive edge for their product that sets it above the rest of the

industry. Villiera installed PV at a time when the market was relatively unregulated by the South African government. The steering actor in this case is the international market, demanding a lower carbon footprint for products. The actions of Villiera had a dual effect: the initial risk within the market, which, once a successful business model, made it easier for other actors to follow. But by adopting the stipulations of the steering actors, they inadvertently started a process where new standards became a factor in the wine industry. The power of steering actors can be measured by the reactivity of rowing actors to their steering. And the initial process where new rules are adopted by a market by a few rowing actors establishes the starting point of a new developmental trajectory within the niche. In the case of Sola they created a podium for tweaking the way in which small- to medium-size companies or properties consume electricity. It once again offers clients the ability to compete on various fronts with other actors. These types of networks are thus stimulated by competition and are made up mostly of rowing actors.

The role of rowing actors in the three core processes of the niche relate mostly to the second process, the building of networks and the expansion of the resource base within the niche. However this chapter has shown, before the existence of niche-conducive regulative rules, that rowing actors are participants in the processes through which these rules become articulated in both active and passive manners. Passively, through first-order reflexivity the reactions of rowing actors impact the framing adjustments of steering actors. In this way rowing actors contribute, albeit unwittingly, to the holistic shaping of niche-conducive regulative rules. Actively, rowing actors do at times home in on a lock-in created by the absence of a regulative rule and rely then on processes of development through which the buy-in of steering actors solidifies the regulative rule.

### 7.5.3 Conclusion

The Western Cape Government's 'green ideology' has had an undeniable steering effect on the rest of the province. However the actors steered are all in relatively close proximity to the Provincial Government and include GreenCape and municipalities. Both provincial government and international market actors set up the monitoring and accountability measures required to measure the performance goals set forth, and both

of these actors steer the actors that they foresee rowing. In Chapter 6, I discussed the role of the Western Cape Government as steering actor within the niche. Both the Western Cape Government and GreenCape exert power through relational and networked agency. The core factor differentiating these two types of actors in stretch-and-transform niches lies in the automatic hegemonic agency that the Western Cape Government has over the network that they are affecting. The implication of adjustments in the search function for innovation in the steering actor's ideology has regulative rules as the envisioned end result. A new development trajectory identifier, such as GreenCape, merely facilitates network building. The transference of rules that takes place and is facilitated by the search function of the intermediary happens through actors other than the intermediary. As such one of the major roles of intermediary actors is the fertilisation of the processes of niche network creation that could arguably have taken place organically. In so doing, intermediary actors contribute primarily to the nurturing attribute of niche spaces and allow other actors to act in a shielding capacity. That said, intermediaries are not neutral participants in the processes of rule formation in the niche. There is a level of discretion involved in the identification of actors to be connected within the networks that intermediaries facilitate. They also at times assume some of the discretionary monitoring and evaluative roles usually performed by steering actors not only in exercising the search function in network creation but also in getting personally involved in the breaking of lock-ins through active advocacy on specific issues. Lastly, in the case of GreenCape as intermediary actor they actively participate in shaping the market through the provision of knowledge resources.

As rowing actor, the third sector provides the networked agency, which allows for the formation of alliances that a steering actor would not have been able to accomplish on its own. However the outcome of this agency toward the creation of a new rule is void if steering actors do not accept the rule created. This means that while steering actors do hold the bar for new rules at niche level, the creation of these rules are often not purely the outcome of steering action. Rules that have been created through this type of interplay between steering and rowing actors are then considered more stable, simply because a larger group of actors have agreed on the terms for these rules.

The relative proximity of third sector actors to the steering actor in a niche determines the level of deviation that they can attain from the rules that have already been created in the niche. In this way academia occupies a very different role in the niche than that of intermediaries. As seen in Chapter 5, academia can engage directly and sporadically with steering actors toward the adjustment of regulative rules or as seen in this chapter, they can act completely disconnected from the spirit of cognitive, normative and regulative rules in providing add-on solutions to the negative externalities of the dominant regime with the available technologies in the niche. This is a troubling realisation for academics, both as knowledge participants and niche advocates. The triple helix relationship described by Etzkowitz does not seem to exist within the South African context when academia produces non-knowledge outcomes (Etzkowitz, 2002). In the production of knowledge outcomes, the academic community has managed to support the plea of niche advocates in cases where it is necessary to improve performance and prices for specific technologies (see Chapter 5) or in cases that provide the knowledge basis for the facilitation of networks, such as in the final phases of the CCMSP, discussed in Chapter 6.

The cycles of framing adjustment discussed in this chapter describes the evolutionary strategic games that take place in the spaces between the boundaries that are created by the rules and lock-ins of the dominant regime. The distinction between outright power struggles and strategic games here lie in understanding that the actions and reactions of actors in the formative stages of the niche are examples of first-order reflexive rather than second-order reflexive (Grin, 2012). First order reflexivity relates to unintended consequences that occur during the processes of rule formation, retention or abandonment in socio-technical systems. Second order reflexivity is that critical process that actively evokes agency, direction and action. The result of first order reflexivity is very clear in the reactions of rowing actors in the representation of the creation of training mechanisms, mentioned in this chapter. The shielding activities for the niche often come from the first-order reflexive reactions of rowing actors to the rules that exist within and beyond the niche. This means that passive shielding provided by rowing actors results from their ability to find immediate solutions to system lock-ins and not from their contestation of the rules of the niche or the regime. Often this includes the incorporation of the positive externalities created

by another niche and altering them to suite context-specific problems or context-specific solutions generated through smart business models.

## Chapter 8

### Conclusions on Niche Governance

#### 8.1 Review and Background

We humans are dependent on the earth systems, which we used to think of as conquered and enslaved. The risks posed to ecological systems by our engagements with earth systems, for example, through the burning of fossil fuels, have manifested themselves in a variety of ways, including climate change. Our emerging realization on the impact of these engagements, and their implications for ecological securities that have long sustained humans and many other species, is beginning to be translated into new political and social responses as much new scholarly work focused on transitioning to less damaging engagements. This means that ecological harms have become embedded in our social worlds. The scientific problems that used to be solved by innovation and technology, have begun to manifest as social issues and are now, rightfully so, dealt with by the addition of social scientific thought. This thesis built on an increasingly well- developed socio-technical transitions literature, and specifically the Multi-Level Perspective on Socio-technical Transition, by considering the question: **How is agency constituted in the niche environment of a transitioning socio-technical system, which enables the establishment and strengthening of alternate developmental pathways, and what are the implications for socio-technical transitions?**

To better address this core question, a series of sub-questions were proposed around the theoretical framework that underpins this research:

- 1) At niche level, which are the categories of actors that can be differentiated?
- 2) What methods do actors use in niche environments to exert power?
- 3) Under what conditions do actors contribute to the formulation and strengthening of developmental trajectories within niche environments?
- 4) What are the conditions for ‘rowing’ and ‘steering’ within the niche environment?

These questions resulted from circular engagements with the theory on socio-technical transitions and were shaped by an evolving compendium of scholarship that was presented mainly in Chapter 2. The theoretical basis that underpins this study

makes suggestions about various modalities of agency within the niche and the larger socio-technical system; about the types of actors that occur within socio-technical systems; about the interactions between actors and other actors, and between actors and their environment in socio-technical systems; about the developmental trajectories of socio-technical systems; and lastly about the properties of niches or protective spaces.

In order to achieve theoretical coherence, and to address the question of actor governance at niche level, I borrowed from the governance literature that: focuses on the collaborative and networked elements of governance; with a distinct move away from command-control conceptions of rule-making captured in the observed dichotomy between the state and its citizens; toward a pluralised conception of rule-making as a communal effort among and between an array of actors (Castells, 2000; Shearing & Wood, 2003; Latour, 2005; Rhodes, 2007; Stenning, 2009; Zhong & Grabosky, 2009; Braithwaite, Charlesworth & Soares, 2012; Galaz et al., 2012; van Steden et al., 2013). In line with this conception of governance, one of the most important outcomes of this thesis was to consider the modalities of power in the exertion of agency as steering or rowing, power-taking and power-giving, toward the formation of regulative rules (legal or policy), normative rules (values and norms), and cognitive rules (symbols and ideologies) that underpin the developmental trajectories within niches.

Guided by theory in this way, this thesis went beyond most existing research that generally approach the research from a macro perspective, but which neglects the institutional and interpersonal aspects of governance in the socio-technical niche.<sup>31</sup> The research followed a methodological approach that hinges on continuous loops of interaction between theory and the literature, as delineated in Chapter 3.

The purpose of this chapter is to draw together the findings of this thesis and offer some reflections on the implications of these findings for theory and practice. Section

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<sup>31</sup> For example Schot and Geels (2007) focused on the mechanisms for radical change and characterized change in terms of four over-arching patterns dependent on the ways that the niche interacts with the regime. Others focused on active niche-building practices (Nill & Kemp, 2009), qualities of the niche (Smith, Stirling & Berkhout, 2005b; Raven, Schot & Berkhout, 2012) and conceptions of transition in its entirety, making the niche dependent on the regime and not considering the internal aspects of governance within the niche (Geels, 2005, 2014)

8.2 reflects on the research question posed at the beginning of this thesis and highlights some of the emerging themes that came from the research. Section 8.3 considers what this means for socio-technical transitions theory and reflects on some of the bigger questions and debates that was touched on in Chapter 1. Section 8.4 reflects on areas for future inquiry, based on the findings of this research, and lastly, section 8.5 offers some concluding remarks on this study and the state of socio-technical transitions research.

## 8.2 Emerging Themes from the Research

### 8.2.1 The Deterioration of the Dominant Regime

In Chapter 5 I showed that the deterioration of the dominant regime was a crucial preceding factor to the development of the niche. This deterioration was observed in the actions of actors that no longer contributed to the positive feedback loops that fed the developmental trajectories of the regime. It was also observed in the accumulation of experienced negative externalities and problems within the regime by core regime members. These misalignments were neither aimed at supporting the niche environment nor were they prompted by the existence of the niche environment. The niche in this case, could be considered as the manifestation of a level of coordination that took place toward the articulation of selection pressures and the coordination of resources in a specific direction.

The key attributes of this initial misalignment lies in unequal *perceptions* of selection pressures and negative externalities on the part of regime actors that lead to inconsistencies in the actions and mentalities of regime members. The outcomes of the regime, which were usually perceived in relative unity by regime actors, now became contested terrain. One of the manifestations of these contestations is regulatory rules that contradict the developmental trajectories of the dominant regime. Again these rules usually do not topple a regime, but rather play an important role in producing further misalignment of actors and results in divergent action on the part of regime members. Chapter 5 also showed that the availability of alternatives can only

aid in the production of misalignment once a fair amount of alignment already exists within the dominant regime.

### 8.2.2 The Interaction between the Niche and the Regime

In the fit-and-conform niche discussed in Chapter 5, boundaries for the development of the niche were set both through the regulatory mandate of the procurement programme and through the existing rules of the dominant regime. One of the most important factors in fit-and-conform niches is this tightrope of development in parallel with the developmental trajectories of the dominant regime. Smith and Raven (2012) found that fit-and-conform empowerment often results in improved alignment in the niche, especially as it relates to the existing industrial norms of the dominant regime. However, this they warn could be detrimental to the goals of sustainability focussed socio-technical transition due to the trade-offs that are made to 'fit in' (Smith & Raven, 2012: 1030). This was echoed in the findings of Chapter 5 where the dominant regime served to create boundaries and facilitate the alignment of actors along the norms and goals of the dominant regime. In addition to this, and building on the conceptions of regime deterioration discussed above, a niche can obviously not serve every aspect of the regime. Those aspects or issues where the deterioration of positive feedback loops has resulted in enough stagnation to produce minimal resistance from regime actors, should they be challenged, are the aspects that fit-and-conform niches build on.

In stretch-and-transform niches this type of alignment with the deteriorated aspects of the dominant regime becomes less important. The boundary work of the dominant regime still encapsulates niche development, however the development within these niches is based on the deficiencies of the regime and on finding ways to develop in the spaces between these boundaries, with complete disregard for the effect or the reaction of the dominant regime. Those actors that have been dependent on the outcomes created by the dominant regime, including core and non-core regime members, mostly observe the boundaries set by the dominant regime in stretch-and-transform niches. In contrast to fit-and-conform niches, stretch-and-transform niches exist only when steering actors in the niche are able to decouple niche-level

developmental trajectories from the risks, rewards and developmental trajectories of the dominant regime by working around them rather than in alignment with them.

### 8.2.3 Actor Proximity to the Regime

As shown in Chapters 5, 6 and 7, non-core regime members occupy a special role in the empowerment of stretch-and-transform niches. Within these niches, the type of development that results deviates more from the dominant regime than the type of development that takes place within fit-and-conform niches because these actors can distance themselves from the regime processes, by which they were always guided but to which they never really contributed. The regime membership status and niche actions of the Western Cape Provincial Government and municipalities are testament to this. From Chapter 5 one can conclude that a non-core regime member can be created (the IPP office) by the regime in the presence of enough regime deterioration.

Both the steering champions discussed in this thesis (the IPP office and the Western Cape Provincial Government) were non-regime actors and both of these actors' steering ability rested to an extent on their regime membership. It would be nearly impossible for a core regime actor to accomplish the deviation from the regime within a niche achieved by these actors, and in the same light it would be nearly impossible for an external actor to steer with the same level of legitimacy and reach that these actors had as a result of their existing presence within the socio-technical system. An external actor would first have to accomplish this level of acceptance and reputation before they could steer niche developments.

### 8.2.4 Steering Governance Practices

In the fit-and-conform niche, the steering actor was an artificial non-core regime member that resulted from the inertia within the regime and the deterioration of the regime. As such, this steering actor only steered within the niche. In contrast, the steering actor in the stretch-and-transform niche steered more broadly and the steering that happened within the niche is a result of broader ideologies and a broader adoption of sustainability goals. This confusing difference lies in the absence of hegemonic agency held by the IPP office. They articulated and adjusted expectations, set forth

the monitoring methodologies for the ideals of the niche, and delineated this to other niche participants, however they did so, not through hegemonic agency, but rather through relational agency. When one considers the way in which the programme was established and the rules that came out of this process (see Chapter 4) it becomes evident that the shaping of the programme was more of an abandonment of hegemonic agency of top-down implementation of rules in favour of cooperative input.

Even though the steering actor in the stretch-and-transform niche occupied a more hegemonic role within the system historically, the main methodology for steering in this case was also not through hegemonic agency. In contrast to the IPP office, the Western Cape Provincial Government had no strict set of rules for rowing actors, but rather adopted a narrative for change. As mentioned in Chapter 6, this narrative will possibly result in some form of regulation or regulatory rules, however, the initial work in this narrative has been incredibly important for this steering actor.

The work done by this framing, opened up both their own mentalities and the mentalities of other actors. The observations made in Chapter 6 were made at a point where the steering actor was busy delineating the direction of the niche, creating meaning, goals and values, before they could convey this to rowing actors. In short, they were figuring out what they wanted. The cycles of stocktaking, evaluation and solidification are testament to this process. In the absence of regulative niche rules, the steering actor implemented a set of cognitive and normative rules to guide the realisation of regulative rules. This was done through relational agency, by identifying, connecting and tapping into the networks within the niche. Often the second action - connecting actors onto a network- is a major part of this process and thus the steering actor also exhibits a level of networked agency. The main purpose of this type of action lies in finding the most acceptable blueprint for action, for the most possible actors. Because of the inability of the niche to absorb internal contestations, niche steering actors tend to avoid this. In this way state actors behave very similar to market steering actors. Look for example at the steering of the international wine market that was discussed in Chapter 7, here the 'rules' might appear regulative but they have a normative-cognitive function, making new things important in the market and changing the ingredients of 'the competitive edge'.

### 8.2.5 Rowing Governance Practices

Because of the relational and networked agency exerted by steering actors within the niche, rowing actors are, from the very beginning, participants in the governing processes of the niche. However these actors do not have to be concerned with regulation as a necessary outcome of their action. Often, these actors produce cognitive and normative rules through the choices that they make. For these actors the development of networks and the coordination of resources are of utmost importance.

The processes of network-building accomplished by rowing actors coincide with the processes of network-building by steering actors. Therefore, many of these networks will overlap and feed off one another. Because of the absence of regulation as an ultimate goal for rowing actors, steering actors need to tap into the needs of rowing actors in order to benefit from their networks. Because of these interdependencies, the relationship between steering and rowing actors is not a bi-polar, command-control relationship. Rowing actors also guide steering actors by responding to the normative and cognitive rules that they put forth, and by responding to the larger selection pressures within the socio-technical regime. These responses then prime reactions from the steering actors within the niche, minding the boundaries set by the dominant regime.

The relational agency exerted by rowing actors differ from that exerted by steering actors. Rowing actors contribute in a very real way to the shielding and nurturing properties of the niche. Often the ability of a rowing actor, especially an external market actor, to realise a gap in the market and successfully act on it requires that they actively shield and nurture the segment of the market that they want to develop. This has no immediate implication for the creation of regulation and might never have regulatory consequences, however it allows for further offshoots and progress to be made.<sup>32</sup> What is more, through this type of activity they also develop corners of the market that were previously left untouched.<sup>33</sup>

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<sup>32</sup> See the example of Maxx PV in Chapter 7.

<sup>33</sup> See the example of Ishack in Chapter 7.

## 8.2.6 The Importance of Framing

At the formative stages of the niches observed in this thesis, one of the most critical findings was that framing is incredibly important. A lot of agency is rooted in the way in which a problem, or a solution, is framed. Framing is also one of the main methods for structuring a niche and translates into normative and cognitive rules in the absence of regulative rules for the niche.<sup>34</sup> The entire methodology for the development of the Western Cape electricity sector niche relied on the narrative that was created for the niche. This narrative framed problems and solutions, justifying the place of the niche and priming actors to explore a variety of different possible developmental trajectories. The evolutionary development of the niche was grounded in the framing that was set for by the steering actor.

The reactive nature of framing shifts between rowing and steering actors, depicted in Chapter 7. This chapter shows how actors enable and resist change, starting with a shared diagnostic framing - often in the form of a shared problem with the dominant regime - and differences in prognostic framing, resulting in steering actors having to shift either their prognostic framing or their motivational framing of the problem or the solution to make it acceptable to rowing actors. The boundaries created by the dominant regime also translate into the framing possibilities available for actors in the face of regime deterioration. As proven by the example of NUMSA and various other change resistant core-regime actors, the adjustment of the framing of these core-regime actors is incredibly difficult to accomplish. Even in cases where they have already observed the negative externalities of the regime, their prognostic framing is unlikely to include the abandonment of the outcome that they enjoy from the regime.

At regime level, the observation of selection pressures and problems in the regime differs between actors because they no longer frame problems in the same way. If the majority does not accept the diagnostic framing that predates the creation of policy, then the prognostic framing of policy becomes contested terrain.

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<sup>34</sup> Here and above it is important to understand that by considering the absence of regulative rules for the niche, I do not assume that there are no regulatory rules governing the niche, as the regulatory rules from the regime that impact the niche have a profound effect on the development of the niche. This is discussed earlier in this chapter and in all of the substantive chapters as the boundaries for action. By observing a relative lack of regulatory rules I mean that there are no (or relatively few) regulatory rules specifically for the niche that governs the spaces between the boundaries set by regime rules.

### 8.2.7 The Formulation Developmental Trajectories

In order to understand the contribution of actors to the formation of developmental trajectories within the niche, I look specifically at the ways in which different rules are developed and transferred at niche level. For fit-and-conform niches, the transference of rules from the dominant regime provides the boundaries for action within the niche. There is also a critical alignment that takes place between some of the normative goals of the dominant regime and the objectives of the niche. In the niche fit-and-conform studied here, alignment happened with the normative goals of job creation and industrialisation, which also structured the regime. Transferring rules in this way, the niche actors were able to create motivations for its existence within the logic of the dominant regime. This logic is not likely to change any time soon so it is the most stable anchor that the niche could have cast. This anchoring in the dominant regime does not take place within stretch-and-transform niches beyond the normative goals of sustainability, which is much less stable. However these goals allow for more drastic deviation from the dominant regime.

Stretch-and-transform niches have an open-ended process of network formation, or at least the one viewed in Chapters 6 and 7. Because only one stretch-and-transform niche was observed, it would be difficult for me to conclude that all these niches will form their developmental trajectories in the same way, however, I can conclude that this is one of the ways that work. The open-ended cycles of stocktaking, evaluation and later solidification of steering actors allows for rowing actors to be very powerful in the creation developmental trajectories. This is so because rowing actors, especially external market actors, do not enter into as many contestations as steering actors do. The initial processes of rule formation rely on this non-aggressive, solution-finding mentality because of the heightened search function of steering actors.

The potential role of intermediaries in socio-technical transitions must not be underestimated, because they contribute in the purest way to this open-ended process of rule formation. They indirectly affect selection pressure by allowing other actors to act in a shielding capacity, while they themselves nurture the network by identifying and developing path-breaking innovations. The action of alignment is simplified by

their single-minded goal. They are thus specially adapted to the creation of rules that are in line with the needs of rowing actors, and of which steering actors would approve. As I have shown in Chapter 5, rules that are created in a top-down hegemonic manner that contradict the dominant regime, cause more problems than they solve for the regime. Rules that are created in this way will be just as problematic for niche environments. Rules created through the interplay between steering and rowing actors as described in Chapter 6 and 7, can be considered to be more stable.

### 8.3 Theoretical Insights

#### 8.3.1 Deterioration of the dominant regime

The MLP takes account of the role of the deterioration of the dominant regime, observed as both overt changes in the system and abstract new rules within the system and takes note of this in the expositions that are offered for developmental trajectories within the niche. The major difference between my research and the MLP lies in the point of observation: the MLP mainly and most attentively observes transition at the point when the niche breaks through into the dominant regime. I observed niches before they were ready to break through into the dominant regime.

The MLP conceptualises the niche as something that emerges at the fringes of the regime (Geels, 2005), and breaks through either because of the strength of the niche or because of the deterioration of the regime, or a combination of the two. There is thus a gap here in understanding how the deterioration of the regime leads to the initial formation of the niche before it is allowed to break through into the dominant regime. Again, MLP theorists probably won't argue about the influence of this factor as it is hinted at in various places in the literature (Geels & Schot, 2007; Geels et al., 2016; Geels, 2004b), however it is never adequately explored.

As explained above, the deterioration and misalignment of the dominant regime was observed as three inter-related loops of cause and effect: the unequal perceptions of regime actors of shifting selection pressures and negative externalities of the regime; the manifestation of the resulting contested terrains in the form of regulatory rules; and the availability of technological alternatives. These insights contribute not only to

the way in which the formation of the niche is understood by transition theorists but also to the way in which regime change is understood. The MLP provides key insights into the way that regimes usually respond to selection pressures and negative externalities - through incremental advancement (Schot & Geels, 2007). My findings describe the decay of the regime, should these incremental advancements not succeed. This realisation effectively adjusts the timeline of observation in transitions theory to include the initial misalignments of the dominant regime more carefully. It also decouples some of this misalignment from the work of the niche and provides a more precise point at which alternative technologies begin to be viewed as acceptable options to the members of the regime.

### 8.3.2 Niche Regime Interactions: the Creation of Boundaries

Path-breaking innovations, as argued by evolutionary transition theorists, tend to develop within niches that can shield these innovations from the selection pressures of the dominant regime. Niche scholars have studied the position of niches in relation to the regime, being either external or internal (Schot and Geels, 2007); the level of stability within niches in terms of rules and networks; and the processes of niche building (Nill & Kemp, 2009). In this conception of the niche, transition scholars take account of the fact that the regime does not always have the same level of impact on one niche as it does on another.<sup>35</sup> One of the most important factors of niche regime interactions, shown in the substantive chapters of this thesis, was the creation of boundaries for the niche by the regime.

For fit-and-conform niches, I have shown that the dominant regime provides boundaries, but also allows for alignment with the regime on specific issues. Those issues form the foundations of these niches and are considered as the positive feedback loops within the dominant regime, which has deteriorated to such an extent that niche development contradicting their pathways of development would not be contested by the dominant regime. This points again to the importance of

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<sup>35</sup> Schot and Geels postulated that there are four types of niches that develop from four types of evolutionary patterns (Schot & Geels, 2007: 618). In this work the different types of niches that resulted from different evolutionary processes were aggregated according to their 'position' within the market, relative to the involvement of the dominant regime or rather relative to the amount of 'shielding' that the niche achieves from the dominant regime (see Chapter 2).

understanding the initial misalignment of the dominant regime, especially in cases where fit-and-conform niches start appearing.

### 8.3.3 Actor Proximity to the Regime and the categorisation of actors

Just as actors can be defined by their proximity to the dominant regime, so too can they be defined by their proximity to the niche. This thesis has shown that the way in which actors cooperate to produce positive outcomes for the niche is key to the success of the niche. Actors have existing roles in society, that precedes the existence of the niche. These roles do not fall away because of the niche, and so inhibit and empower actors in specific ways to act toward the outcomes of the niche. It is therefore important to take into account the categorisation of actors in relation to the niche, in order to understand the levers of change toward developing a specific niche. In order for non-core regime members to successfully bring about change, coalitions have to form that actively seek to change strategies, initiatives and power relationships in the existing regime (Smith, Stirling & Berkhout, 2005: 1505). The type of inertia provided by non-core regime members represents a whole new power relationship that transcends the boundaries of the niche and the regime. The agency of these actors are not found within the legitimate structures within the dominant regime or within the possession of resources, rather, the regime structures provide the boundaries for the activities of these actors as discussed above. These actors in turn usually steer the development of the niche bound by the regime boundaries to which they are still linked. In fit-and-conform niches this level of steering is all that they can do. However, in stretch-and-transform niches, their non-core regime status makes it easy for these actors to also tap into external forms of authority and external resources and doing so begin bringing new issues to the table, that condition the structures of demand and supply in new ways. They can do this because they have historically not been core contributors to the outcomes of the regime; historically the regime has provided guidelines for action, just as it does in transition. This is in line with, and an elaboration on propositions made by Smith, Stirling and Berkhout, who suggested that an actors position within the regime, i.e. an actor's regime membership

status, affects the actors ability to alter the flow of events (Smith, Stirling & Berkhout, 2005: 1505)

For socio-technical transitions scholarship, this builds on the work that Avelino and Wittmayer started toward more nuanced categorisation of actors. They argued that most socio-technical transition theories are plagued by issues of ambiguity because of their large categorical boxes, which lack consistency in differentiations between aggregations of actors (Avelino & Wittmayer, 2016: 630). According to them, this lack of clarity translates into the way in which theories, such as the MLP, conceptualises power and empowerment. The differences in the ways that non-core regime members empower other actors within the niche based on their proximity to the dominant regime are concrete proof of this statement.

#### 8.3.4 Steering and Rowing in the Niche: the exertion of power

When studying niche environments, one must realise that the embedded pathways for producing outcomes in the dominant regime hold embedded power that is exerted by the actors that play out the roles of the dominant regime. Because of this, one of the first places to look for the exertion of niche building or niche supporting power, is in the deterioration of these networks. As Chapter 5 has shown, much of the agency to act toward the niche environment became available once the deterioration of the dominant regime had begun. These initial exertions of authority that make the niche possible might in no way be directed at the formation of a market space that is unfavourable to the dominant regime. Sometimes this deterioration can be the result of divergent action, all seemingly toward the dominant regime. Thus, the first method of power allowing for the niche, is disagreement over the core path dependencies within the regime, by powerful actors.

Steering governance at niche level is likened in this thesis to the empowerment of actors. As discussed above, stretch-and-transform empowerment leads to innovations that undermine the dominant regime and transmit niche-driven institutional changes into re-structured regimes. Here niches influence their selection environments and favourably affect the subsequent changes to the socio-technical system. Fit-and-conform empowerment takes place when an innovation, that was originally viewed as

path-breaking, becomes incremental because of broader socio-political implications. In these cases, the cumulative economic impact might be broader than that of ‘path-breaking’ innovations, even though the innovations happen parallel to the dominant regime. Rowing is conceived of in relation to steering practices as reactions and interactions and as the groundwork governance done by actors that do not necessarily provide the structures for the functions of the niche but produce important outcomes within the niche, and in so doing affect the work of steering actors.

The data presented in this thesis shows a specific point in the lives of steering actors. For the fit-and-conform niche, the artificially created steering actor had to rely on relational methods of agency because they were devoid of any real hegemonic power. In the stretch-and-transform niche, the steering actor also had to rely on relational and networked modalities of agency. The reason underpinning this similarity lies in understanding the importance of negotiation in the niche space, and it also explains why non-core regime members are better suited to be steering actors in socio-technical niches. The establishment of regulatory rules within the niche is a risk because the niche has a low capacity to absorb any internal tensions. Thus, this process of negotiation is crucial to the formation of not only the rules that become solidified in regulation but also contributes to the formation of networks within the niche environment. This holds major implications for socio-technical transitions scholars as it indicates the place where positive feedback loops start forming within the niche. It also shows what the role of steering actors is in kick-starting these developmental trajectories.

The role of rowing actors in contributing to these positive feedback loops must be considered. As discussed above, the relational and networked agency of steering actors demands the participation of rowing actors. In order for this participation to be accomplished, steering actors must, to a certain extent, align themselves with rowing actors. During the formative phases of niche development, rowing actors are not as restricted by steering actors as they arguably become once regulative rules have been created specifically for the development of the niche. This gap allows rowing actors to act in unregulated spaces, form routines and translate this into normative and cognitive rules for the niche.

### 8.3.5 The Importance of Framing

Framing and discourse has different effects in different socio-technical contexts. From core regime actor's framings one can deduce what stock they place in the dominant regime, by looking at the facet of the regime that remains protected. In the case of NUMSA, this was the socio-economic ideal of job creation and socialist methods of financial accumulation. Focusing on the framing of actors in socio-technical transitions studies serves to provide at least some context to some of the messy reactions and interactions within socio-technical transitions. The unpredictable reactions of rowing actors at niche level can be better understood if one considers the ways in which they framed problems and solutions to these problems. Geels suggests that one of the major ways in which regime actors resist change is through the adoption of different types of framing (Geels, 2014). In line with this finding, the work done by this thesis extends the role of framing into the niche level, showing that one of the major ways in which niche actors implement change is through the adoption of different types of framing. I have also found different framing loops when looking at the role of rowing actors, which means that the decision to change ones framing can either be a first-order reflexive reaction or a second-order reflexive reaction.

### 8.3.6 Developmental Trajectories

A trajectory within a socio-technical system is viewed as a sequence of four successive mechanisms: the structural conditioning of actors in the system by rules and institutions, social interaction between actors, structural elaborations where rules and institutions are shaped, and lastly the acceptance and retention of these rules and institutions (Geels et al., 2016: 897). For niches, the structural conditioning by rules and institutions forms the boundaries of the niche. This is the extent of the structural conditioning of rules in stretch-and-transform niches; however in fit-and-conform niches this becomes a two-way process, with the niche establishing roots in the external factors that structurally condition regimes. The second third and mechanisms of trajectory formation are crucially important in niches: social interaction and structural elaboration.

These mechanisms for niches indicate the processes through which the niche developments diverge from regime developments, and take place in loops, with the last mechanism being the acceptance of rules and institutions. These loops mostly consist of interplays between actors that shape the normative and cognitive rules of the niche so that regulatory rules can be aligned with the outcome of these interactions. Crucial to these interactions is the network along which ideas, norms, things, and skills become communicated. This indicates that Geels's dynamic interactions between rule regimes and actors, observed in two feedback loops - actor structuring and social learning (Geels, 2004) - remain important at niche level, however the processes of actor structuring are at the core of the way in which niche rules are formed. Social learning, or the transferences of rules is only important in setting boundaries and in the later structuring of the niche and possibly at the breakthrough of the niche.

#### 8.4 Areas for Future Enquiry

The work done in this thesis builds on the work done by scholars of socio-technical transition, rather than breaking down the analytical frameworks that exists. In doing so it opens some specific areas for deeper analysis into the functioning of socio-technical systems and the ways in which they transition. The work is rooted in understanding the role of actor governance in the processes of socio-technical transition as observed in niche spaces, and consequently most of the theoretical additions provided in this thesis centres on issues of governance. There have, however, been chance encounters with the broader functioning of the socio-technical system as this precedes my understandings of the niche environment or as it informs the governance debates attended to in this thesis. In this section I elaborate on the avenues that have been opened up for analysis in socio-technical transitions scholarship by suggesting how this work could be built on in future scholarship.

One of the interesting findings of this thesis, which does not directly relate to niche level governance, is the importance of and mechanisms for the deterioration of the dominant regime that precedes the formation of niches. In this thesis I have merely laid the groundwork in this regard. The initial deterioration of the dominant regime probably includes more factors than the three discussed by me, and thus should be an

important avenue for research. The implications of a nuanced understanding of this process could be vitally important to policy-makers and regime actors that find themselves in the midst of a decaying regime.

The role of artisan training in stimulating niche driven outcomes has been explored to some extent in this thesis, however, this remains a very important area for future inquiry. This thesis has shown that much of the “groundwork” of niche formation happens through semi-formal training schemes that allow for the population of practicing professionals to grow substantially. Future research might focus on the effect that these schemes have on the stabilisation of developmental trajectories within the niche, and on the way in which practices and procedures are developed through these channels, that later become requirements in a market.

Another area for further elaboration relates to the categorisation of actors within transitions studies. As I have shown, the categorisation of actors in this thesis aided in providing analytical depth in understanding the way in which different actors in different niches interact with the regime and empower other actors within the niche. The categorisation of actors also had the important function of allowing me to differentiate between modalities of power observed as different types of agency. This was a good start, however, there is a lot of space for further investigation here. Future studies might conceive of different categorisations that, for example, completely discard the state-non-state dichotomy. The findings of such a study would be incredibly valuable, however very difficult to accomplish as this type of study would require an analytical distancing from the literature. That said, the categorisation of actors in the research and development space, especially with regards to the impact of the triadic relationship between the state, the private sector and the academic community could produce significantly important results.

Even though this research centred on the activities of rowing and steering actors, this can be elaborated upon, especially with regards to the role of rowing actors within the niche. These elaborations might include a stretch-and-transform niche for which regulative rules already exist. The limitations of a doctoral thesis meant that I was mainly able to consider rowing in stretch-and-transform niches. This type of work for a fit-and-conform niche would also be a relevant avenue for future scholarship.

## 8.5 Final Remarks

It is not possible to give a static definition for where a niche starts and where it stops, due to the specialisation and differentiation that takes place within the niche. More importantly, it should not be possible. The complexity of a complex phenomenon is artificially reduced the very moment it is artificially bound by a defined/closed analytical model. The boundary issue is more empirical than theoretical because the functionalities of social systems in different socio-technical sectors look differently:

*The advantage of looking explicitly at socio-technical systems is that the co-evolution of technology and society, of form and function becomes the focus of attention (Geels, 2004: 902).*

This thesis has created artificial boundaries for two niches, and observed the form and function that results within these observed structures through the creation of meaning and rules. It found that agency is constituted differently in different niche environments through the contestation of rules, initially relying more on normative and cognitive rule contestations than regulative rule contestations. This is so because, within a new terrain, the actors that steer the governance of niches have to undergo an initial process of goal delineation. This goal delineation requires broad ideological shifts, but also the definition and quantification of elements of avenues for change that can be monitored later. The major contestation for both types of niches here relate to achieving a level of synergy with the dominant regime. For stretch-and-transform niches this synergy dictates the boundaries of the niche. The synergy captured in the net-consumer model for SSEG was a matter of great contestation, but necessary for the survival of the niche. Fit-and-conform niches are much more dependent on these synergies that form; more so than just the boundaries for development. For this reason these niches anchor themselves outward in the spaces inside and beyond the dominant regime. The internal processes of rule formation rely on networked and relation agency rather than on overt expressions of hegemonic agency.

The implication for socio-technical transitions studies is a deeper understanding of the importance and mechanisms of agency at regime level in socio-technical transitions.

The differentiation between rules that form *because* of the existing regime rules and rules that are able to form *despite* the existence of these rules highlights the pluralised modalities of agency within the niche. From a relational perspective on niche formation, one must then add that networks within protected spaces do not create their own boundaries, but that the dynamic interaction with regime rules create these boundaries for them. The usefulness of these boundaries differs as explained above. A major implication for transitions studies lies in realising the absence of automated responses in the initial processes of niche formation. The amount of work that has to be done toward the agreements reached through networked and relational agency at niche level stands in stark contrast to the culmination of ‘small events’ and contingency in the processes that create lock-in. At the core of this lies the fact that niche rules have not yet gained ‘lives of their own’. These rules have not yet formed offshoots or become useful to enough actors that they become self-maintaining occurrences in socio-technical systems. Arguably, the point at which these rules exhibit the autopilot functions of regime rules is the point at which the niche could break through into the broader socio-technical environment and the point at which regime rules aren’t mere boundaries but become contested factors for the niche.

Crucially the findings of this thesis indicate that humans are not powerless in governing the way in which we have become dependent on earth systems. The goal of creating sustainable pathways for transition in the niche environment of electrical socio-technical systems is not enslaved by the boundaries for life and development dictated by the existence of carbon dependence. Rather this goal plays out in the spaces between these boundaries and feeds off the larger social, economic and political forces that keep our carbon-dependent regimes intact. This realisation should re-orientate sustainable transitions scholarship to focus on these crucial spaces for human intervention, rather than ponder the limits and problems set forth by the way in which humans depend on natural systems. The evolutionary implication of this argument also means that we might have to abandon our immediate concern with the exact products of sustainable transition beyond the normative goal itself, because the level of plural governance that goes into producing these outcomes necessitates processes of trial and error that can never produce the immediately defined sustainable goals. One must thus also realise that sustainable development is more of a means to an end than an end in itself, as the end becomes defined through the

iterative process of negotiating social trade-offs with the survival of the natural world, and consequently the survival of the human race.

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## Appendix 1: Actor Categories

### Actor Categories relating to Chapter 5

Actor	Group	Formal	Informal	For Profit	Not For Profit	Public	Private	Regime Membership
<b>Bill and Melinda Gates Foundation</b>	Market	x			x		x	External
<b>City of Cape Town</b>	State	x			x	x		Non-core
<b>CPUT</b>	3 <sup>rd</sup> sector	x		x	x	x		External
<b>Cyril Ramaphosa</b>	State	x			x	x		Non-core
<b>Eskom</b>	State	x			x	x		Core
<b>GIZ</b>	3 <sup>rd</sup> Sector/ Market	x			x		X	External
<b>GreenCap</b>	3 <sup>rd</sup> Sector	x	x	x	x	x	x	External
<b>IPP's</b>	Market	x		x			x	External
<b>Ishack</b>	Market	x		x			x	External
<b>Marks and Spencer</b>	Market	x		x			x	External
<b>Maxx PV Partnership</b>	Market	x		x			x	External
<b>NERSA</b>	State	x			x	x		Core
<b>Numsa</b>	Market/ Community	x			x	x		Core
<b>SANEDI</b>	State	x			x	x		Non-core
<b>SAPVIA</b>	3 <sup>rd</sup> Sector/ Market	x			x	x	x	External
<b>SARETEC</b>	3 <sup>rd</sup> Sector/ Market	x			x	x	x	External

<b>Sola</b>	Market	x		x			x	External
<b>Viliera</b>	Market	x		x			x	External
<b>Wesgro</b>	State	x			x	x		Non-core
<b>Woolworths</b>	Market	x		x			x	Non-core/ external

Actor Categories Relating to Chapter 6

<b>Actor</b>	<b>Group</b>	<b>Formal</b>	<b>Informal</b>	<b>For Profit</b>	<b>Not For Profit</b>	<b>Public</b>	<b>Private</b>	<b>Regime Membership</b>
<b>'National Gov.'</b>	State	x			x	x		Core
<b>Bergrivier municipality</b>	State	x			x	x		Non-core
<b>City of Cape Town</b>	State	x			x	x		Non-core/ external
<b>CSIR</b>	3 <sup>rd</sup> Sector	x		x	x	x	x	Non-core/ External
<b>DOE</b>	State	x			x	x		Core
<b>Helen Zille</b>	State	x			x	x		Non-core/ External
<b>SALGA</b>	3 <sup>rd</sup> sector/ market	x			x	x		External
<b>SANEDI</b>	State	x			x	x		External
<b>Treasury</b>	State	x			x	x		Core/ Non-core
<b>UCT (CSAG)</b>	3 <sup>rd</sup> Sector	x	x	x	x	x		External
<b>Western Cape Prov. Gov.</b>	State	x			x	x		Non-core

Actor Categories Relating to Chapter 7

<b>Actor</b>	<b>Group</b>	<b>Formal</b>	<b>Informal</b>	<b>For Profit</b>	<b>Not For Profit</b>	<b>Public</b>	<b>Private</b>	<b>Regime Membership</b>
<b>Academi</b>	3 <sup>rd</sup> Sector	x	x	x	x	x	x	Non-core

<b>a</b>								
<b>ANC</b>	State	x			x	x		Core
<b>CSIR</b>	3 <sup>rd</sup> Sector	x	x	x	x	x	x	Non-core
<b>Cyril Ramapho-sa</b>	State	x			x	x		Core
<b>DME</b>	State	x			x	x		Core
<b>DTI</b>	State	x			x	x		Core
<b>Eskom</b>	State/ Market	x		x	x	x		Core
<b>Google</b>	Market	x		x			x	External
<b>Guptas</b>	Communit y		x	x			x	Core
<b>IPP Unit</b>	State/ Market	x			x	x		External and non-core
<b>IPP's</b>	Market	x		x			x	External
<b>NERSA</b>	State	x			x	x		Core
<b>NPC</b>	State	x			x	x		Core
<b>President Zuma</b>	State	x			x	x		Core
<b>Public Prosecutor</b>	State	x			x	x		Core
<b>SAPVIA</b>	Market/ 3 <sup>rd</sup> sector	x			x	x		External
<b>SAREC</b>	Market/ 3 <sup>rd</sup> sector	x			x	x		External
<b>SAWEA</b>	Market/ 3 <sup>rd</sup> sector	x			x	x		External
<b>Treasury</b>	State	x			x	x		Core
<b>Weber Wentzel</b>	Market	x		x			x	External

<b>Western Cape Gov.</b>	State	x			x		x	Non-core
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