Local Governments' Changing Power in South Africa's Energy System:

Reshaping the regulatory space for renewable energy, from the bottom up

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Abstract

In 1994, South Africa's post-apartheid government inherited a highly-centralised energy sector, in which all aspects including planning, procurement, generation, distribution, pricing, and management were determined through top-down institutional arrangements and investments, centred around Eskom. In 2016, however, following rounds of energy sector reform, and the successful implementation of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), this centralised configuration of power showed signs of disruption. Municipalities began to ambitiously redefine their role by building on opportunities related to renewable energy, resulting in an emergent challenge to centralised energy policy and planning. This dissertation sought to explore how this contestation took shape and to explain how seemingly ad hoc actions have created new possibilities, as well as new regulatory frameworks, by municipalities for municipalities. To achieve this, an analysis of the evolution of decentralised renewable energy generation in South Africa between 2008, when it first began, and 2016, was undertaken, applying the method of process tracing to two case studies. In order to contextualise these bottom-up processes within the national political economy of energy, process tracing was also applied in a high-level analysis of countervailing movements that consolidate centralised energy planning and procurement during the same period, with a particular focus on national plans to undertake massive investments in nuclear energy. It was found that municipalities' bottom-up actions have positioned them to drive renewable energy in such a way that seriously challenges the historical configuration of power that has determined South Africa's energy future up to now.

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Acronyms

AMEU	Association of Municipal Electricity Utilities
BRICS	Brazil, Russia, India, China and South Africa
CEO	Chief Executive Officer
CCT	City of Cape Town
CJ	City of Johannesburg
CSP	Concentrated Solar Power
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEADP	Department of Environmental Affairs and Development Planning
DoE	Department of Energy
DME	Department of Mining and Energy
DWS	Department of Water and Sanitation
ERLN	Economies of Regions Learning Network
ED	Electricity Department
EDI	Electricity distribution industry
GW	Gigawatt
GWh	Gigawatt-hours
GTAC	Government Technical Assistance Centre
GHG	Greenhouse Gas
IPP	Independent Power Producers
IEP	Integrated Energy Plan
INEP	Integrated National Electrification Programme
IRP	Integrated Resource Plan
LED	Local economic development
MW	Megawatts
MECs	Municipal Energy Companies
MFMA	Municipal Finance Management Act
MSW	Municipal Solid Waste
NER	National Energy Regulator
NERSA	National Energy Regulator of South Africa
NEC	National Executive Council
NREL	National Renewable Energy Laboratory (USA)
NMBM	Nelson Mandela Bay Municipality
OECD	Organisation for Economic Cooperation and Development
(Solar) PV	Photovoltaic
PSGs	Provincial Strategic Goals
PPA	Public Private Agreement
PPP	Public Private Partnership

REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RED	Regional electricity distributor
SALGA	South African Local Government Association
SSEG	Small-scale embedded generation
SPV	Special Purpose Vehicle
SOC	State-owned company
SDGs	Sustainable Development Goals
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environmental Programme
USA	United States of America
USTDA	United States Trade and Development Agency
WCG	Western Cape Government
WTE	Waste to Energy
WEF	World Economic Forum

1 Introduction

In 2008, a few South African municipal governments began to explore the idea of localised renewable energy generation. It was a response to growing concerns over the country's energy security, its carbon-intense energy generation, and to the potential of new technologies, like rooftop solar panels, to change the way people consume energy. They began to engage the National Energy Regulator South Africa (NERSA) on what these new technologies might mean for local energy distribution and sales. At this stage, the country's energy sector was highly centralised. It was steered by the Ministry of Energy and Department of Minerals and Energy (DME), and the publically owned monopoly, Eskom. Eskom owned and operated more than 90% of energy generation, all transmission, distributed more than 50% of electricity, and therefore controlled energy sources, pricing, and access (OECD, 2015a). National Cabinet also played an important oversight role.

In this system, municipal governments played a critical and unusual role. They acted as local energy utilities, buying and reselling Eskom's electricity through local distribution grids. They used margins on these sales to cover infrastructure maintenance and other related expenses. Electricity fees and revenues were also a mechanism for cross-subsidising service delivery for low-income households. The result of these arrangements was that the viability of this centralised energy system directly impacted the financial sustainability of municipal governments.

The model worked reasonably well, while municipalities were supplied with cheap electricity, but as the economy grew and energy access levels increased, ageing infrastructure showed signs of strain. By 2008, the country had experienced its first controlled local blackouts to manage this pressure, for which local answers were being sought, in addition to national responses. Both the supply and price of electricity on which municipal finances depended, suddenly became volatile. Rolling blackouts commenced, and prices began a steep increase that continued into 2016 (Lucy Baker, Burton, Godinho, & Trollip, 2015).

The democratically elected ANC-led government of South Africa did not design the energy sector. It is a legacy system, inherited from the apartheid government: a coal-fired network of power plants, built to serve an elite minority; and a complex monopoly in a world that was seeing the benefits of more competitive sectors. Under apartheid, Eskom had also historically enjoyed a level of autonomy, shielded from external input by layers of secrecy (Public Affairs Research Institute, 2013). A 1998 Energy White Paper introduced a national energy planning process, to facilitate the development of more transparent governance as well as an optimal energy future for the country

(Republic of South Africa Department of Minerals and Energy, 1998). It proposed some privatisation and competition in generation, unbundling Eskom's assets and creating a new and more efficient configuration of structures, restructuring local governments' distribution roles, and setting the country on a pathway towards decarbonisation. The ambitious, wholesale reform envisioned by this policy has never been fully realised, but countrywide energy planning, some privatisation, and renewable energy generation have been successfully introduced (Public Affairs Research Institute, 2013). Since 2011, the Renewable Energy Independent Power Producers Programme (REIPPPP) has facilitated investments in utility and small-scale wind, solar, hydro and waste to energy infrastructure, making a small but critical contribution the energy system (Eberhard, Leigland, & Kolker, 2014).

By the end of 2016, the centralised institutional relationships that governed the sector, and determined South Africa's energy future, were still intact. Eskom continued to dominate electricity generation, with further significant additions to its infrastructure network made in the intervening years. The public utility also still controlled the national transmission grid and a proportion of distribution and sales. Municipalities too had withstood attempts at curtailing their role in the sector, retaining their local distribution function. For some local governments, electricity sales generated more than a third of revenues, with total municipal revenue from electricity sales at 28,8% for the quarter ending in June 2016 (StatsSA, 2016).

Throughout 2016, it was made evident that the plan to ensure the viability of the South African energy sector was hugely contested. The latest energy outlook, the Integrated Resource Plan (IRP) 2010-2030, updated in 2013, seemed to be moving towards greater decentralisation, incorporating small-scale renewable energy in the energy mix, in addition to REIPPPP's larger investments (Republic of South Africa Department of Energy, 2013).

Internationally, the rise and improvement of renewable energy technology, because these technologies are technically and financially feasible at many scales, has fuelled discourse on the decentralisation and localisation of energy systems (Riahi, 2015; World Energy Council, 2016a). In countries, such as Germany and Denmark, the United States, and Kenya, the benefits of localised renewable energy investments are being demonstrated and widely celebrated. The implementation of these technologies has brought the role of municipal governments to the fore, as citizens, renewable energy investors, and local governments have pushed for more locally responsive, equitable, lower-carbon and more affordable energy investments.

In South Africa too, a growing body of investments, local policies and regulations are tentatively redefining the role of municipalities, from the ground, up (AMEU, SALGA, & GIZ, 2016; Government Technical Advisory Centre, 2015). The first tentative steps to accommodate decentralised renewable energy generation could be described as ambivalent at best; however, this in no longer the case for many ambitious local governments such as the City of Cape Town or Nelson Mandela Bay Municipality. Risks to, and opportunities for, municipal financial security, the sustainability of local service delivery, and local economic development (LED) are motivating a new attitude and approach to the energy sector.

At the same time as this bottom-up experimentation has been developing, a top-down, large-scale nuclear procurement programme has been driven by the Ministry of Energy, the Department of Energy (DoE) that has replaced the DME, Cabinet, and Eskom. This investment in 9,600 MW of nuclear capacity sets South Africa on a distinct trajectory. Currently, it is in tension with both municipal efforts, and the widely celebrated REIPPPP. The contestation between two very different energy futures – one centralised and driven by nuclear, the other more decentralised built on renewables – is the context for questions explored in this research. The first of these questions is, how can decentralisation be understood in the context of South Africa's energy sector? Furthermore, why and how are municipalities pursuing this agenda? And finally, who has the power to determine South Africa's energy sector? While this research cannot offer a final answer to any of these issues, it draws attention to local governments, an often-marginalised level of activity, needs, risks, opportunities, incentives and decision making in this arena.

1.1 Methodology

In the 2013 IRP update, small-scale renewables, especially solar PV, was identified as a "path of least regret" for national energy investments, in the context of economic and other uncertainty. In the three intervening years between the two IRP processes, the projected annual domestic energy demand decreased dramatically from 454,000GWh[1]) to a more uncertain range from 345,000GWh

[1] GWh and Megawatt hour (MWh) are measures of energy used over a unit of time. In order to get to a certain amount of GWh for the year, a certain amount of installed capacity is required to generate that energy. Because this installed capacity does not operate at 100% efficiency, a measure must be applied to capture how efficient it is. This is required to ensure sufficient installed capacity to meet a target, as set out, for example in the IRP. If a 12MW wind farm produces an average of 6MW, then the capacity factor = 6 / 12 = 0.5 or 50%. Different technologies in different contexts can have vastly different capacity factors. The GWh or MWh generated in a year is equal to total installed capacity, multiplied by the capacity factor which is a measure of the efficiency of the technology being used, multiplied by the number of hours in a year. 1MW of solar capacity with a capacity factor of 25% will produce 1 x 0.25 X 8760 = 2190 MWh of electricity in one year.

to 416,000GWh (Republic of South Africa Department of Energy, 2013). What this meant was that the total required peak generation capacity dropped from 67,800MW to 61,200MW (-6,600MW). Fewer infrastructural investments would be needed than planned in 2010, and the IRP 2013 specifically proposed a myriad of small solar investments as a preferable alternative to any new large-scale nuclear.

In 2016, both small-scale renewable together with a menu of localised energy arrangement, and nuclear capacity are being pursued concurrently, by different actors. It is unclear which strategy will succeed, shaping the energy sector for decades to come. Without a clear national policy on decentralised renewable energy, and with no regulatory clarity, various municipalities have made significant steps towards enabled localised renewable energy investments. Given the ongoing work by municipalities in an unclear regulatory context, the hypothesis tested in this research is:

H1: Municipal policy, regulations, investments and facilitation are creating a bottom-up alternative to South Africa's highly centralised energy sector, in which energy planning, procurement, generation, transmission, and a proportion of the distribution, are all determined through centralised institutional configurations.

This hypothesis is about whether or not the transforming role of municipalities in the energy sector is increasing their power to influence how the South African energy system functions, and to what extent this is disrupting centralised control over the direction in which the energy sector is evolving.

To test this hypothesis a ‘process tracing' approach was taken, to analyse the events from the municipal perspective, between 2008 and 2016. Process tracing was selected because it allows for the construction of a cogent explanation of a change or noteworthy outcome, like, for example, the state of play in the energy sector in 2016, by linking descriptions of key events over time in a causal narrative (D. Beach, 2012). It was applied by mapping out relevant information during this period, selecting key events, and situating them in an explanatory sequence. Process tracing involves a close examination of events under consideration to develop a fine-grain understanding and description of events.

In this research, a process tracing approach is first applied at a municipal level, tracing the evolution of bottom-up policy and practice around decentralised renewables, focusing in on two municipal case studies. The empirical research was carried out in the Western Cape Province. Many of the NGOs that are supporting local government capacity development for renewable energy are also based in Cape Town. Among these is GreenCape, affiliated to the provincial administration. The forms of data collection included:

- Document analyses using publically available, as well as internal strategic communications from various government administrations
- Semi-structured interviews
- Telephone and email exchanges with different organisations, including representatives of national, provincial and local government, NGOs and energy consultants

This bottom-up story is, however, in incomplete. Without fully contextualising the narrative, it was possible to overstate the extent and sustainability of municipal activities, as well as any consequent gains in authority or transformations of their mandate on energy.

Given the tenacity of the nuclear procurement process, proceeding without a clear policy or a fully articulated economic justification, it was necessary to consider that the opposite of this hypothesis could be more accurate. As this research evolved, it seemed increasingly feasible, that:

H2: The development of a top-down nuclear procurement programme is crowding out any space for the development of decentralised renewable energy.

This secondary hypothesis was considered in conjunction with the first, as a supplement. Process tracing was applied again, to develop an understanding of the role and influence of major stakeholders and events over expanding and contracting municipal agency. Again, this methodology was useful because of its emphasis on historical context and the identification of path dependency created by contingent events (Derek Beach, Pedersen, & Collier, 2011). This second application was undertaken to link historical bottom-up (municipal) and top-down (national) actions from 2008 onwards, to the configuration of actors and strategies shaping the energy system in 2016. Information was drawn from policy documentation, academic literature, as well as news reports. This part of the narrative, while pointing to the relevance of certain key individuals, is limited in depth, because no in-person interviews were carried out. Consequently, a certain level of description, of interpersonal dynamics shielded from public view, were not accessible. It is, however, much better documented than municipal work.

1.2 A Decentralised Energy Future for South Africa?

The contest in South Africa can be understood at a very high level as a contest between a centralised and decentralised future for the energy sector. To get to the analysis described above, Chapter 2 develops a simple framework through which to view energy sectors in terms of: a) whether or not energy generation infrastructure is publically owned and centrally managed, or whether there is any diversity of public and private ownership; and b) whether or not policy, planning, procurement, transmission, and distribution functions are centralised or decentralised. This framework is illustrated in **Figure 1** in Chapter 2.

With reference to this framework, this chapter provides a brief overview of international movements towards greater decentralisation, building on the characteristics and opportunities provided by renewable energy technologies. I review relevant literature generated by leading influential energy policy organisations, selected national governments, and various other analysists, to surface the patterns, risks and opportunities associated with this trend. Chapter 2 sets the stage for an analysis of the South African energy sector. Chapter 3 applies the framework developed in Chapter 2, to the analysis of the transforming role of municipal governments, pulling the sector in the direction of a more decentralised configuration of actors and power. Working with the same scheme, Chapter 4 contextualises this bottom-up narrative within the national political economy of energy, top-down strategies for energy sector reform, and various energy procurement initiatives, focusing on nuclear procurement.

In this work, particular stakeholders emerge as key role players, broadly coalescing around three movements shaping South Africa's energy landscape emerged, promulgated by different stakeholders. These movements are:

- The drive for renewable energy generation, planned, procured and managed from a national level through the REIPPPP office;
- The drive for decentralised renewable energy generation (not necessarily opposed to REIPPPP), planned, procured and managed from a local government level; and
- The drive for nuclear energy, planned, procured and managed from a national level through Eskom.

Taken to their logical conclusions, these three movements imply very different configurations of power within South Africa's energy landscape. Chapter 4 provides an overview relevant stakeholders and key actions in support of these various strategies for a low-carbon, energy-secure future for South Africa. These movements for and against centralised and decentralised determination of the country's energy future are drawn together in Chapter 5, which provides a summation of the findings of this research.

2 The Case for Distributed Electricity Generation, Driven by Local Governments

2.1 Introduction

This chapter lays out the general case for decentralised renewable energy generation, with a particular motivation for an active municipal government role in driving and managing localised grids that support this. The case for a transition from fossil fuels to renewable energy generation is well made. Most major international energy and sustainable development policy organisations are advocating for this change. Among these advocates are: The World Energy Council, the International Energy Agency, the Organisation for Economic Cooperation and Development (OECD), various agencies within the United Nations (UN), the World Economic Forum (WEF), as well as the USA National Renewable Energy Laboratory (NREL), ODI, GIZ, ICLEI, WWF, Bloomberg New Energy, and various other NGOs, think tanks and consultancies. For this reason, the broader case for renewables is only given very limited attention here. The more pertinent argument considered is for the implementation of renewable energy that is decentralised, both in the sense of being governed at more local levels, as well as being owned and operated by public and private investors other than a national public utility.

This chapter begins by constructing a basic conceptual scheme for understanding centralised versus decentralised energy sectors, considering both the above-mentioned dimensions of "decentralisation". Within this scheme, decentralised renewable energy is energy generated from a variety of renewable sources, at various scales from small to utility, with diverse ownership, and accompanied with some degree of localisation of policy development, planning, governance and procurement. Within this project, the case for decentralised energy systems will be made with reference to international trends towards greater decentralisation, incorporating views from recent research on the successes, potential and risks associated with these systems. Particular reference is made to the German case study, a well-established example of multi-level policy support and implementation of decentralised renewable energy generation.

The second part of this chapter argues that decentralised renewable energy implies a greater involvement of actors and decision-makers closer to local contexts. In particular, I claim that there is an important and beneficial role to be played by local governments. The benefits of decentralised renewable energy depend on strong local governance and management of this infrastructure and the grid that supports it. There is a clear argument, introduced here, for municipal governments to wholly fulfil or at least to support this function, and to coordinate efforts with each other as well as national actors.

2.2 The Case for Renewable Energy as an Alternative to Fossil Fuels

Globally, the case for a shift towards renewable energy sources, with greater levels of decentralisation of generation infrastructure investments and ownership, has been steadily gaining traction over the last two decades. This nascent shift in understanding of energy policy ‘good practice' was reflected in the South African government's 1998 White Paper on Energy. It can be seen in features, such as the introduction of privatisation, competition, and a diversity of energy sources into a system that was dominated by Eskom, fuelled mainly by its network of large coal-fired power stations. Carries by the increasing momentum of decades of investment and innovation in alternative energy, the current wave of shifts in energy sectors underway in countries around the world can be usefully characterised as an ‘energy transition'. It is an enduring, broad, structural reform in an energy system, referring to all aspects of that system, including energy sources, use, distribution, and ownership (Hauff, Bode, Neumann, & Haslauer, 2014). The most obvious reason for these transitions is to ensure a secure energy supply into the foreseeable future. While the real motivations, goals, drivers and governance regimes in particular countries are diverse, emphases on low carbon, resource-efficient energy, as well as greater decentralisation, are now fairly standard (Sovacool, 2016).

The transition towards a larger share of renewable energy generation is happening, in part, because the imperative to respond to the threat of climate variability has become urgent (International Energy Agency, 2016; OECD, 2015b; Riahi, 2015; UNEP, 2015; United Nations Economic Commission for Africa, 2016). The switch from fossil fuels to renewable energy is seen as one of the most efficient mechanisms to achieve global greenhouse gas (GHG) reduction targets and mitigate against dangerous climate change (Bloomberg New Energy Finance, 2016; UNEP, 2015; World Energy Council, 2016b). This international commitment to dramatic GHG emissions reductions is articulated in the Paris Agreement, ratified by 116 countries (United Nations/Framework Convention on Climate Change, 2015). The Sustainable Development Goals (SDGs), signed by 150 world leaders, is similarly oriented. Goal 7 aims to, "Ensure access to affordable, reliable, sustainable and modern energy for all", incorporating a commitment to drive the uptake of renewable energy, clean energy technology, and "sustainable" energy sources (United Nations, n.d.). Renewable energy is not without any environmental impacts, but continuous technological improvement is addressing these. Taking an overall view of GHG, human health, ecosystem health, and land use into account, wind, solar and hydropower are still far more sustainable than any fossil fuel based generation (UNEP, 2015).

Not only is renewable energy the best way to reduce the climate-related impacts of energy systems, but it is also increasingly cost competitive with other forms of generation, already undercutting coal in some instances (Hirtenstein, 2016). A recent report by Bloomberg New Energy has forecast that up to 2040, US$11.4 trillion will be invested in energy, globally, of which US$7.8 trillion will be invested in renewables (Bloomberg New Energy Finance, 2016). This trend primarily attributed to the decreasing cost of wind and solar generation, in particular. Procurement and governance arrangements shaping global renewable markets, with competitive bidding or auctions contributing to falling prices. While 'greening' energy has historically been juxtaposed with economic growth, this is no longer the case. Increasingly, renewable energy is seen as a way of ‘decoupling' economic growth from fossil fuel consumption, at the same time as energy efficiency technology is decoupling economic growth from increases in energy consumption (Obama, 2017).

One of the main challenges of renewable energy remains the issue of intermittency (Lucy; Baker, Newell, & Phillips, 2014; Kemfert, Opitz, Traber, & Handrich, 2015; McLellan et al., 2015; UNEP, 2015; World Economic Forum, 2015; World Energy Council, 2016b). While waste to energy technology is an exception, wind and solar power are not consistent, because they only generate electricity while the wind is blowing or the sun is shining. This can be solved with storage, for which the technology is evolving and is also still expensive; or with a supplementary buffering electricity generation such as natural gas (McLellan et al., 2015). 'Extra' energy can be used, as needed, to ensure a constant base level of generation (base load) or for additional power during peak demand times (peak load) only. Investments in base load or peaking power push up the real cost of renewables. However, recent comparative assessments of the cost of new energy capacity in South Africa places the cost of renewables below coal (and well below nuclear), even if combined with natural gas (CSIR, 2016). Furthermore, given the rapid development of technology in the renewable sector is set to improve the quality and decrease the cost of storage, as forecast in Bloomberg’s New Energy Outlook 2016, which foresees significant gains already by 2020 (Bloomberg New Energy Finance, 2016). What this suggests is that energy policy should account for technological advances by avoiding locking into long-term infrastructure that will either crowd out better alternatives in the future or be left stranded as businesses and residential consumers opt for private investments instead of undesirable energy bought from utilities.

The rise of renewable energy is having far-reaching and transformative consequences for the structure of energy sectors. Transitioning to a greater share of renewable energy can increase decentralisation, or ‘distributed' generation. In South Africa, the Renewable Energy Independent Power Producer's Programme (REIPPPP) has introduced a small share of privately owned, competitively selected energy production. However, the entire selection process, overall planning and management, transmission, as well as purchasing transactions are still highly centralised under the control of the National Department of Energy (DoE) and the state-owned utility, Eskom (Fourie, Niekerk, Nel, & Department of Energy IPP Office, 2015). REIPPPP has not disrupted the structure of the country's energy sector. Where control of renewables has not been so tightly regulated, the proliferation of renewable energy infrastructure, from utility scale down to small-scale, to has fundamentally altered the structure of energy sectors.

The transformative potential of renewable energy technologies, including solar PV, wind, hydro and waste to energy, is a product of their technical and financial feasibility at a variety of scales. This size of a renewable installation can range from a single residential rooftop solar panel to a neighbourhood block, a whole community, commercial business parks, and up to a utility scale plant (Mendelsohn, Lowder, & Canavan, 2012). Small-scale installations are systems falling below 5MW generation capacity, but they typically fall well below 1MW[2]e scale variability has allowed households, communities, local governments and businesses of various sizes to invest directly in energy generation capacity, in addition to more traditional investments by public or private utilities owning and operating all large-scale infrastructure. The motivation for the uptake of these small systems is simple: there is an increasingly strong investment case for businesses and households, and even local governments. Investing in private generation is becoming cheaper than buying electricity from a large public or private utility (Obama, 2017). For households, businesses and local governments that are investing in small-scale renewable energy, the environmental motivation is also becoming stronger as risks associated with climate change becomes more real than hypothetical (Bauwens, 2016; CDP, National Business Initiative, & Incite Sustainability, 2013).

Renewable energy can also be used to achieve broader sustainable developmental outcomes. Renewable energy can support more equitable energy access, and ensure optimal natural resource consumption and stewardship (Brooklyn Microgrid, 2016; Ulsrud, Winther, Palit, &

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[2] According to the Solar Energy Industry Association (SEIA) of America, the current national average for the number of households powered by 1MW of installed solar PV is 164 (Solar Energy Industry Association (SEIA), 2015). This figure based on the average performance of systems divided by the average annual electricity consumed by households.

Rohracher, 2015; Ververis, Schecht, & Donahoe, 2015). These benefits result from both the cost competitiveness and also the down-scalability and adaptability of small-scale renewable systems. The use of smaller solar PV systems, a collection of connected PV panels termed a 'microgrid', can be implemented in well-developed urban areas, but has a particular value in countries or regions with significant energy infrastructure deficits. The suitability of microgrids to these contexts stems from their functionality, with or without access to a centralised distribution grid. In developing countries such as Kenya, Nigeria, Liberia and Ghana, this small-scale renewable energy infrastructure is being used as an opportunity to respond to energy poverty. Microgrids meet energy needs in the absence of adequate conventional utility scale generation and grid access (Mohammed, Mustafa, Bashir, & Mokhtar, 2013; ODI, GOGLA, Action, & SolarAid, 2015; Ulsrud et al., 2015). In this way, renewable energy is a potential mechanism to leapfrog beyond the older fossil fuel or nuclear-dependent infrastructure trajectories of many developed nations, directly to cleaner, and progressively cheaper energy sources (United Nations Economic Commission for Africa, 2016).

2.3 The Case for Decentralised Renewable Energy Generation

Eskom is but one of the electricity utilities around the globe facing enormous pressure. New technologies, energy efficiency and a move away from centralised and dirty coal-based generation is" causing what some (but certainly not all) predict will be a "Utility Death Spiral" - (de Vos, 2016)

A useful way of thinking about energy systems for this analysis is in terms of the relative centralisation of energy generation on the one hand, and energy planning, transmission, distribution and procurement on the other. An energy system that falls into Quadrant A, below, would be a system in which there is a monopoly in charge of generation, governed by highly centralised energy policy-making and regulation at a national level. Quadrant B would include systems in which there are many energy generators, but the planning, management, procurement, and transmission and distribution of this energy is all centrally controlled by a national government department or regulating agency, or both. The reality is that energy systems can fall along a continuum from A to B, or even have different clusters of investments and strategies that fall into different quadrants.

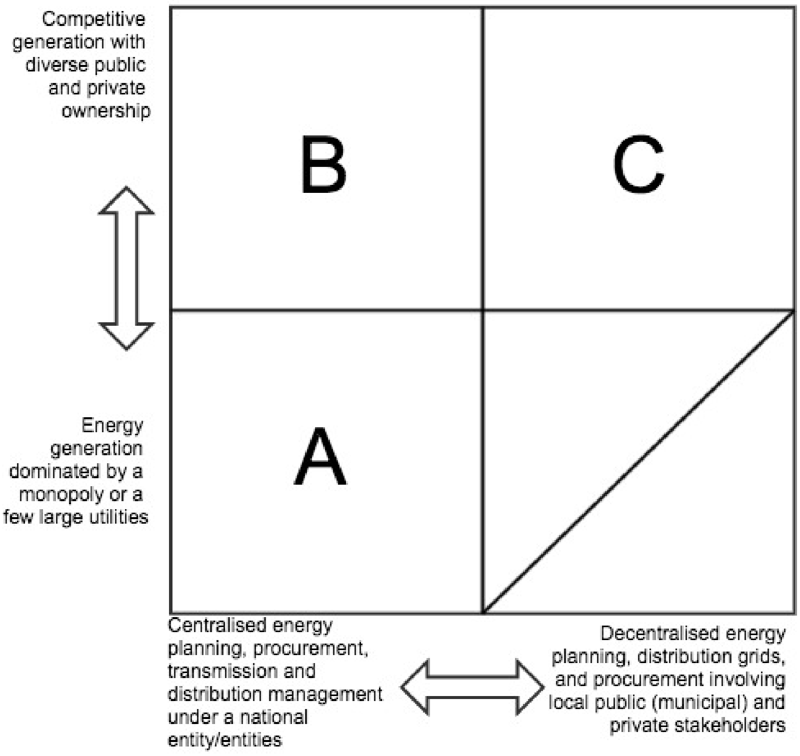

Figure 1: Conceptual Framework for the Structure of Energy Systems

Similarly, energy sectors with some degree of competitive can fall along a continuum of centralised planning, procurement, management and from quadrant B to C. Quadrant C includes decentralised energy systems in which there are many different sources of power generation at various scales that feed into local distribution grids. It is widely understood that the uptake of renewable energy implies some movement along from A to B, and from B to C, towards greater decentralisation (McLellan et al., 2015).

In Quadrant C, the most extensively decentralised systems are modular, consisting of households, neighbourhoods, businesses (agricultural, industrial and commercial) and local governments generating energy for their own consumption and feeding surplus energy back into the shared grid. These systems include companies producing energy for sale. This kind of dynamic system of distributed energy demand and supply has been called "transactive energy", consisting of many diverse consumers, producers, and "prosumers" that both consume and produce energy (World Energy Council, 2016a). While some of these transactions may be peer-to-peer, this myriad of small to large intermittent energy sources still requires a shared grid to facilitate energy trading and to ensure uninterrupted energy supply, as well as to ensure that electricity goes from where it is supplied to where it is demanded. This ‘smart' grid would allow for accurate metering, monitoring of energy security, dynamic distribution, and tariffs (Sharifi & Yamagata, 2016). As a result, a utility of some kind is still required to manage this shared infrastructure, even if that utility plays a more complex energy ‘service' role than simply selling a good to a captive market. This utility could feasibly take many forms. It could be a private company, a municipal agency, or some other kind of organisation, such as a cooperative (Becker, Blanchet, & Kunze, 2016; Hoppe, Graf, Warbroek, Lammers, & Lepping, 2015; ICLEI, 2015; Julian, 2014; Riahi, 2015).

The case for greater decentralisation is twofold. On the one hand, from a government or public interest perspective, there are significant technical and socio-economic benefits to decentralised energy generation; on the other, there is a financial case for private investment for both households and businesses driving private investment for those that can afford it. Organisations such as the EIA, UNEP, other UN agencies, WEF, the World Energy Council, and the OECD have moved well beyond whether decentralised renewable energy as such is a good idea. Instead they examining the extent to which energy could/should be decentralised, how best to achieve an optimal set of local and national policy arrangements to support it, and how to manage both positive and negative social, economic and environmental consequences of this structural reconfiguration (International Energy Agency, 2016; Riahi, 2015; UNEP, 2015; World Economic Forum, 2015; World Energy Council, 2016a). Behind this work, there is a growing body of both academic and policy/advocacy research to better understand and develop this development, by analysing the experience of countries on the forefront of this global trend (Adil & Ko, 2016; Aldridge, 2008; Beaulieu, Wilde, & Scherpen, 2016; Esteban & Portugal-Pereira, 2014; Goldthau, 2014; International Energy Agency, 2016; Julian, 2014; McLellan et al., 2015; Riahi, 2015; Sharifi & Yamagata, 2016).

Decentralisation is seen by many as the best way of managing the increasing complexity of matching energy generation and supply to energy demand (International Energy Agency, 2016; Julian, 2014; Riahi, 2015). Flexibility is a feature of these systems, composed of a myriad of smaller investments. Modular systems can respond directly to local energy context, whether these demand is growing or contracting, or changing in terms of peaking requirements, for example (Adil & Ko, 2016; Goldthau, 2014; Republic of South Africa Department of Energy, 2013; Sharifi & Yamagata, 2016). The modularity of these systems has a significant resilience benefit because of added redundancy in the system (International Energy Agency, 2016). When disasters strike, infrastructure damage can be contained, leading to improved service continuity and less expensive disaster response costs (Esteban & Portugal-Pereira, 2014). Another technical advantage is the ability to keep pace with innovation. Many small systems can be upgraded incrementally, rather than waiting for a single large power station to be decommissioned and then replaced with similar infrastructure. (Goldthau, 2014)

In terms of the socio-economic benefits of these systems, because they are comprised of many local investors influencing how, where and how much energy is generated, these systems can respond to specific or even idiosyncratic local challenges, unlike national energy planning (International Energy Agency, 2016; Riahi, 2015). A high level of specialisation to suit local conditions has been linked to greater potential for innovation in response to particular issues (Goldthau, 2014). In the United States of America (USA), several states and city level governments have been aggressively promoting localised energy transitions in the absence of a coherent national policy (Ochs & von Fiedeburg, 2014). This work has included facilitating shaping and incentivising local smart grid development, often working through or with Municipal Energy Companies (MECs), many of which have been privatised. It has also included using solar PV to respond to poverty or energy poverty in particular. Several cities, including Washington DC, are using subsidised, distributed rooftop solar to target low-income households with the aim of decreasing their overall energy expenses, potentially to zero (Ververis et al., 2015). Additionally, there are non-governmental projects underway, such as the Brooklyn Microgrid, modelling inclusive energy cooperatives that allow for collective solar investments for households of different income levels, and direct peer-to-peer energy transactions within these small systems (Brooklyn Microgrid, 2016).

A diversity of ownership of renewable energy infrastructure allows for many financial beneficiaries. For this reason, it has been very successfully used to foster public acceptance and support for renewable energy innovation. For this reason, the transitions in countries, such as Germany and Denmark have emphasised broad participation and ownership facilitated through national policy (Morris & Pehnt, 2015). Participation has encompassed several community energy cooperatives with stakes in local micro-grids (small-scale connected energy sources such as solar panels) and utility-scale infrastructure. The ability of ordinary citizens to shape and benefit from the transition to decentralised renewables leads some to see decentralisation as a ‘democratisation' of the energy sector (Julian, 2014; Morris & Pehnt, 2015). An augmented role for local government in shaping their energy sectors, rather than relying on top-down energy policy, is also part of the broadened participation in energy policy and decision making.

For national and local governments around the world, however, tasked to ensure a sustainable and secure energy supply for all citizens and for agriculture, commerce and industry, the most immediately compelling argument for decentralised energy is that it is already happening. Motivated by financial imperatives, or environmental concerns, decentralised energy investment is happening. This is true, even in entirely unconducive contexts such as in the City of Cape Town (Jones, 2016a). Large multi-national companies such as Walmart, also active in South Africa, have set targets for 100% energy consumption from renewables (Obama, 2017). As national energy grids grow and increase in complexity through this transformation in structure, localised management makes more sense than trying to direct this complex system only from the top down (Riahi, 2015; World Energy Council, 2016a).

Local energy planning management, together with diversified infrastructure and ownership, is undermining large centralised national or regional utilities like Eskom that cannot keep up with the pace of change of technology, nor the reimagined inclusive governance regimes that it is bringing (Goldthau, 2014). As decentralised energy was picked up in international debate and policy development, the pushback against it has come in waves. Because energy was traditionally a high centralised, regulated sector, the first rounds of decentralisation, were characterised as a "seemingly politically contentious form of activism" in the USA, Canada and Australia, at the World Energy Council's 2012 session on community ownership (Morris & Pehnt, 2015). Given the pressure on existing entrenched institutions and interest networks in the energy sector, this characterisation is not surprising. The 'activism' has continued undeterred, however. With it, municipal governments have come to the fore, pushing a localised renewable energy agenda, often in opposition to large existing public and private utilities (Becker et al., 2016).

2.4 Why is the Role of Local Governments in Energy Sectors Transforming?

Ensuring an optimal and equitable transition to, and operation of, localised, decentralised energy grids requires an active policy, governance and investment response (Beaulieu et al., 2016; Camp, Hedden, Bohl, Petersen, & Moyer, 2015; Goldthau, 2014; ICLEI, 2015; International Energy Agency, 2016; Julian, 2014; Sharifi & Yamagata, 2016; World Energy Council, 2016b). The governance requirement includes: planning to ensure the security of supply; coordination of system components; monitoring and optimising performance; developing context appropriate pricing strategies; enforcing local regulations; facilitating learning; promoting participation; and managing interaction with local developmental challenges such as poverty and inequality.

The role described above need not exclusively be played by a municipal government. However, there are some good motivations for extensive municipal engagement in driving, planning and administering the localisation of decentralised renewable energy generation. Many of the administrative and regulatory requirements for distributed energy such as local urban development planning, zoning and so forth, fall within local government mandates (Adil & Ko, 2016).

Furthermore, as outlined below, there are risks and opportunities related to equitable service delivery, local economic development, and climate change and resilience that also already fall within local governments' scope of authority to manage.

Without an adequate policy and pricing intervention, decentralised energy will disproportionately benefit those with the capital to invest in their own or shared infrastructure (Beaulieu et al., 2016; Jones, 2016a; Kotzen, Raw, & Atkins, 2014). Many municipalities are mandated to facilitate local poverty alleviation and access to service delivery. Especially in the transition from centralised to decentralised generation but also as ongoing management of the latter, special measures are needed to ensure equitable investment in and benefit from shared smart grid infrastructure that supports a local/decentralised energy ecosystem. City and town governments can ensure that decentralised energy does not deepen existing socio-economic inequalities, by using tariff design, as well as access to infrastructure grants and taxes (Adil & Ko, 2016). Municipalities, such as Washington DC noted above, are responding to local poverty and inequality by using solar subsidies to ensure that households of all income levels benefit from the transition to decentralised renewable energy. Even in the absence of policies to specifically target poverty, research into rooftop solar PV uptake in the USA suggests that middle income and not wealthy neighbourhoods are benefiting most from this technology. This research has allayed fears that wealthy households would benefit, to the detriment of middle and low-income households (Mazengarb, 2013).

Playing an active role in energy planning this would give municipalities more influence over is a critical enabler and constraint on local economic development (LED), local service delivery (as in DC), as well as better management of local risks and resilience (C40 & Arup, 2015; Riahi, 2015). This is partly because the environmental impacts of carbon-intensive energy development are increasingly recognised as having particular localised impacts, falling mainly to city governments to manage (Goldthau, 2014; International Energy Agency, 2016; Rodin, 2014). This includes increasing instances of extreme weather events causing wide-spread damage to network infrastructure. In addition to contributing to GHG mitigation, the resilience benefits of decentralised renewable energy reduce recovery costs in the face of natural or manmade disasters (ICLEI, 2015; ICLEI Africa, 2015). Cities are also keen to push local green manufacturing opportunities, to drive job creation; as well as to improve the quality of local energy access, especially for low-income, vulnerable households. This is providing the impetus for a bottom-up displacement of top-down entrenched pro-coal or pro-nuclear national level networks.

The rise of municipal activity in this policy area is strongly linked to the localisation of climate change and resilience agendas, and is being advanced through global networks as the 100 Resilient Cities, ICLEI Local Governments for Sustainability, C40 Cities Climate Leadership Group, and more (Bulkeley & Betsill, 2013). It is no surprise then, that the Mayors' Declaration on Renewable Energy, which lays out a transition to 100% renewable energy by 2050 was signed by 700 city mayors at COP21 in Paris 2015 (World Energy Council, 2016a). Each of these networks has provided a platform for collectively placing local government renewable energy issues and opportunities on the international political agenda, and has also allowed for resources to be directed to city and town-level sustainable development. Both 100 Resilient Cities and ICLEI have been actively working South Africa, along with GIZ and WWF South Africa that have been supporting local governments in their efforts to plan to accommodate decentralised renewables (AMEU et al., 2016; Gauché, Rudman, & Silinga, 2015; ICLEI, 2015; WWF, 2015; WWF South Africa, 2014).

While municipalities are using international and national platforms to learn and mobilise to increase their agency in local energy economies, they are still bound by national legal and policy frameworks. The formalisation of increased local government power requires reform of national policy, legislative and fiscal arrangements to enable appropriate local energy investment and management. While municipal activity in Germany has been supported by the national top-down policy framework, an example of the formalisation of municipal authority from the bottom up is unfolding in the United Kingdom (UK). Several UK cities now have "devolution deals" in place that formally extend powers and fiscal control down to the municipal level systems (World Energy Council, 2016a). In the absence of formal devolution of authority, municipal governments can and have still made significant inroads. The C40 report, *Powering Climate Action: Cities as Global Changemakers*, states: “two-fifths of all action C40 cities are taking on renewable energy occurs in cities with ‘limited’ power to affect energy generation” (C40 & Arup, 2015). One way of thinking about the success of these local governments is that they have exercised other ‘horizontal’ forms of power through their networks of influence, in the absence of direct delegations of authority. This includes, for example, international political influence through networks like C40, relationships with local industry, and direct engagement with local energy consumers (Bulkeley & Betsill, 2013).

2.5 Decentralised Renewable Energy in Practice: the German Energiewende

2.5.1 Driving decentralisation through national policy

The reception of renewables, early on, was limited by early iterations of available technology, assuming that issues such as intermittency and storage would continue to limit the extent to which renewable energy uptake could indeed result in a full transition away from other power sources. The German '*Energiewende*', is one of the most extensive and ambitious national energy transitions. Although not without challenges, it has stuck to its bold commitment. Extensive attention has been directed at extracting lessons from Germany's localised energy economies to inform other international energy policy (Becker et al., 2016; Beermann & Tews, 2016; De Melo, Jannuzzi, & Bajay, 2016; Goldthau, 2014; Hoppe et al., 2015; Julian, 2014; Kemfert et al., 2015; Morris & Pehnt, 2015; Nolden, 2013; Quitzow, Roehrkasten, & Jaenicke, 2016; Wassermann, Reeg, & Nienhaus, 2015). The German Ministry of Foreign Affairs and Economic Development is itself committed to monitoring and communicating progress of this transition (German Federal Ministry of Economic Affairs and Energy, 2015). An important theme that emerges in relation to the *Energiewende* is its focus on local community and small business ownership[3]. By 2012 47% of renewable energy was being generated by cooperatives and households.

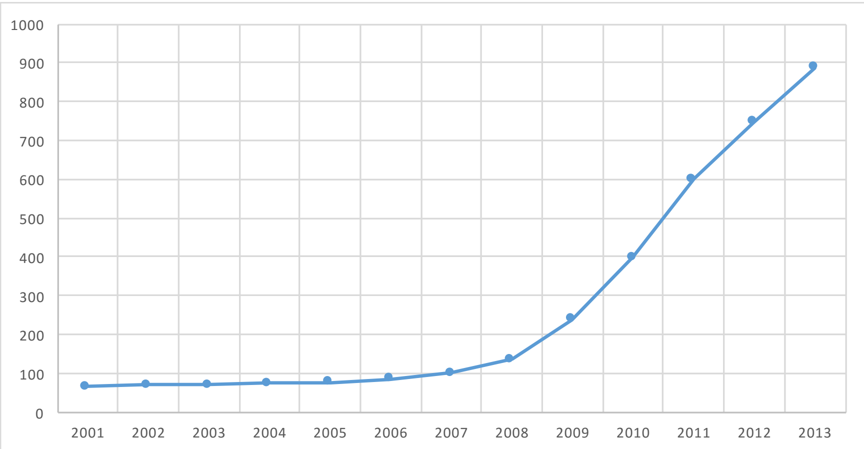

Figure 2: Number of German Energy Cooperatives by Year. Data Source: Morris & Pehnt, 2015

The desire to decrease the country's reliance on energy imports was also a strong motivator behind the Energiewende (Morris & Pehnt, 2015). In 2013, Germany spent approximately EU 90 billion on energy imports (11% of total imports), importing 100% of its uranium and 87.2% of its coal. The policy drivers for this energy transition included a legally binding greenhouse gas (GHG) reductions of 80–95% by 2050, together with a target of 60% renewable energy by 2050 (German Federal Ministry of Economic Affairs and Energy, 2015). Community ownership and local economic development as a mechanism for driving social acceptance of new energy infrastructure.

[3] NREL published a report in 2009 using wind power plants to build an argument that local ownership generated greater economic development benefits that larger foreign (or simply out-of-state) ownership (Lantz & Tegen, 2009).

The increase in renewables has led to the development of a ‘green economy’ sector based on the uptake of renewable energy, particularly green technology manufacturing, as well as substantial research and development investment has led to 370,000 new jobs (Morris & Pehnt, 2015). In terms of support national policy support for decentralised energy, the Renewable Energy Act allows for preferential tariffs to ensure that small-scale generation is financially viable. Furthermore, approval of energy projects is formally devolved to the local government level.

2.5.2 The role of municipal governments in the Energiewende

After a period of privatisation of local utilities, decentralised renewable energy in Germany has ushered in a wave of greater municipal influence in local energy systems and economies. A process of "remunicipalisation" with full or partial local government control reinstated, alongside strategies to allow for greater citizen influence over energy investments, including the formation of cooperatives to manage local smart grids (Becker et al., 2016; Beermann & Tews, 2016; Julian, 2014). In response to environmental concerns, citizen-led anti-nuclear movements, and national energy policy, local governments have set ambitious local targets. The city of Frankfurt, for example, has set a 100% renewable energy target and is using the integration of waste to energy and heat recovery to contribute to the achievement of this goal (Riahi, 2015). It has also established an independent Energy Agency that plays a research, advisory and coordinating role for energy stakeholders, including local utilities. This partnership between public and private actors seen as critical to enact effective city-level energy policy and investment.

2.5.3 Challenges with decentralisation

The German Energiewende has not been without its challenges. Without going into extensive detail, there are some salient lessons for other countries embarking on the same trajectory. Problems include a lack of coordination of bottom-up experimentation and investment leading to issues of national grid overload, as well as a remaining mismatch between where energy is generated and where it is required (Beermann & Tews, 2016). Local actors are responding to local incentives, rather than balancing the national energy system. This includes social opposition to private sector-owned utility scale infrastructure. There has also been a lag in local smart grid development, outpaced by private investment in distributed renewable generation (Wassermann et al., 2015).

2.6 Risks, Costs and Trade-offs in the Transition between Centralised and Decentralised Energy Sectors

Energy transitions to decentralised renewables based systems need not follow the same path. They could, for example, move directly from quadrant A to C along P1, or from A to C along P2. A country could first introduce a competitive renewable programme, with highly centralised planning and procurement (P1), as with South Africa's REIPPPP. In contrast, decentralisation can be built into a country's national decarbonisation strategy (P2), as in this case of Germany, discussed above. Even where national policy has moved energy sectors along P1 only, however, private sector investment, as well as municipal level politics is still moving some systems along a third pathway, P3, pushing from the ground up for broader and more localised distribution of power, in tension with national policy and regulatory frameworks.

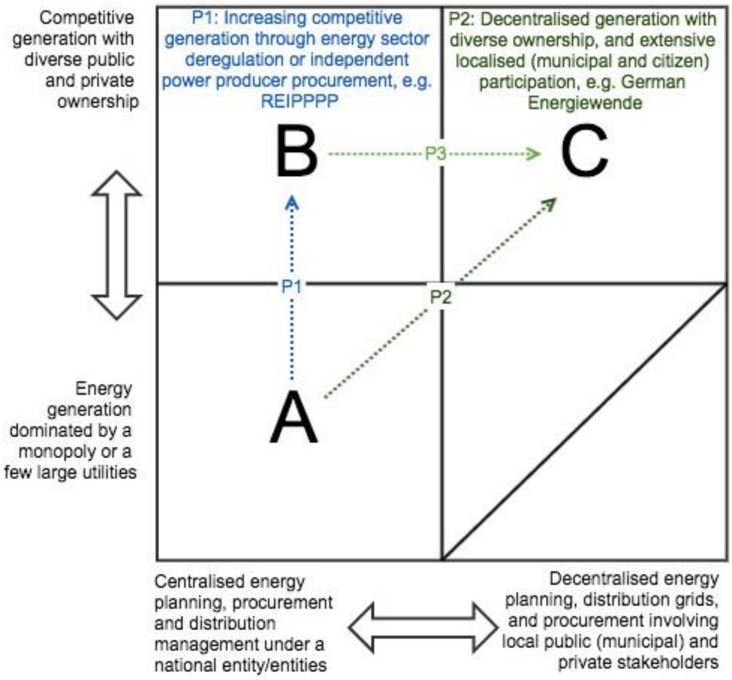

Figure 3: Pathways to decentralisation

Regardless of the path followed, the choice for decentralisation need not be seen as a zero-sum game. In fact, there are good reasons for maintaining aspects of national planning, with national energy sectors falling somewhere on a continuum between quadrants B and C. Reasons for this balancing act include: integrating existing generation networks with new energy sources; facilitating and monitoring adequate shared investments in peaking plants and transmission and distribution grids; and managing spatial disparities and inequality between subnational regions. Literature suggests that a combination of bottom-up local planning and overarching national policy is required for an optimal decentralised energy system (International Energy Agency, 2016; Sharifi & Yamagata, 2016). This issue will be relevant throughout the next two chapters, as the opposing interest groups in favour of centralised and decentralised energy generation in South Africa are analysed.

There are significant issues with rapid or consummate decentralisation that surface tensions between national and subnational level interests and priorities. What makes sense at a local level, within a city or province, for example, may not make sense at a national level. The German case shows that local incentives to drive energy infrastructure investment can be at odds with national infrastructure capacity. Additionally, considering the bottom-up proliferation of small-scale renewable energy, it should be noted that literature suggests that large utility scale infrastructure may well deliver better overall cost efficiencies, which need be considered when designing national energy policy (Morris & Pehnt, 2015). Some form of central coherent and inclusive facilitation and coordination of bottom-up decentralisation can allow for conflicts and trade-offs to be identified and managed (Beermann & Tews, 2016).

Furthermore, equitable distribution of the risks and opportunities arising from switching to renewable technology need to be considered. If the first households, companies and cities to benefit from distributed generation and procurement are those with the most capital and capacity, then the burden of financing less efficient exiting energy infrastructure and the public/private utilities that manage them, is left to those with the least ability with no choice to opt out (Beaulieu et al., 2016; Jones, 2016a; Kotzen et al., 2014). The greater existing inequalities within and between regions in a country, the more complex this challenge becomes. There are several challenges within this, relating to local data availability and internal capacity to manage urban energy systems (Sharifi & Yamagata, 2016). Within this, there is a specific need to consider the distribution of risks associated with managing intermittency in the context of improving technology. Despite the rapid pace of technological development, such as the possibility of solving the storage conundrum, there are certain large central investments in stable generation that are either required or have already been made in the interest of ensuring national energy security. This includes existing national networks of coal-fired power plants and natural gas investments intended to ensure continuity of energy supply. Most of the German regions that have adopted 100% renewable energy strategies have remained connected to the national grid (Beermann & Tews, 2016). As the intermittency problem is solved, there is the possibility that these investments will be left stranded.

2.7 Concluding comments

It is clear that the technological and financial viability of renewable energy generation from micro to small-scale, to utility scale, lends itself towards decentralisation. This refers to both the introduction of diverse energy sources and modes of infrastructure ownership, and to decentralisation of energy planning, governance, distribution, management and procurement. This second aspect of decentralisation necessitates more localised participation and influence, which is strongly connected to existing local government mandates and local government priorities directly. While municipal policy or management might be accompanied by private or non-governmental participation, it is clear that local authorities can support their climate change and environmental, LED and equitable service delivery mandates by playing a role in their municipal energy sectors. Local government participation can enable coordination with national energy policy, regulatory and investment, but this is not a necessary outcome, as demonstrated in the German case.

The answer to the question of how much decentralisation is optimal is bound by local context. In Germany, a pioneer not without challenges, decentralisation has been very extensive, driven by comprehensive and decisive national policy. Considering some of the tensions between bottom-up and top-down transformation or steering of energy systems, it is clear that these issues can and do manifest differently in different context. For the purposes of this analysis, looking at the South African case, Germany's wholesale sector reform strategy does not immediately make sense. Nonetheless, as explored in the following chapter, the historical role of municipalities within the national energy sector are still changing, and decentralised energy is becoming an undeniable reality demanding local and national responses. Local governments are tentatively pushing the energy sector in the direction of quadrant C in Figure 3. The existing role of municipalities makes them an obvious candidate to drive and plan for a reasonable share of localised private and public renewable energy generation and to manage local smart grids. The mechanisms for achieving this transformation are currently being developed, despite highly centralised, historically immutable sector that has resisted several rounds of policy reform.

3 Localised Energy Generation in South Africa: The Expanding Authority of Municipal Governments

3.1 Introduction

Building on the international case for decentralised renewable energy, the augmented role for local governments, and the particular opportunity for local governments in South Africa, this chapter explores the hypothesis that, through incremental experimentation and learning, municipalities in South Africa have slowly expanded their role in the national energy sector. It does so by tracing how various metropolitan (cities) and local (towns) municipal governments conducted research, pilot projects, and developed policies to prepare for local, decentralised renewable energy generation, between 2008 and the end of 2016. By carefully examining the parallel development of local investments and policy at local and national levels, it is argued that municipalities have extended their agency in the energy. The earliest actions were to enable local small-scale embedded generation (SSEG). This SSEG is mainly rooftop solar panels that businesses and households install to meet their respective needs, with surplus energy feeding back into the grid to be distributed along with conventional Eskom-generated electricity.

From these tentative initial steps, it is shown how, more recently, some municipalities have also been making direct investments in decentralised renewable energy for use in public facilities. This activity has been focused in four directions:

1) Developing the capacity, infrastructure, regulations and financial framework for residential and commercial SSEG;
2) Allowing ‘wheeling’ (distribution) of privately generated electricity directly to other private consumers;
3) Exploring opportunities for municipal investment in and ownership of renewable energy generation; and
4) Partnering with private entities to procure renewable energy for official municipal consumption.

The first two actions facilitate and promote others to invest in and benefit from localised energy projects. The second two are examples of municipal direct investment or ownership. All four clusters, however, decrease dependency on Eskom's network of large, mainly coal-fired power stations.

After examining the role of municipal governments in the energy sector in some detail, an overview of national regulations reveals that this work has not been pushed from a national level. In fact, the legislative and regulatory landscape are not supportive of these undertakings. This overview of relevant regulations defines the context in which municipalities have used small windows of opportunity to implement projects to determine local regulations, as well as influencing national regulations and policy, all while demonstrating an increasing potential of a workable alternative to Eskom's dominance. This narrative is established by tracing standardise engagements with each other and with NERSA, through platforms such as the South African Local Government Association (SALGA), with various local NGOs, and with assistance from other international city governments to implement a variety of decentralised renewable energy initiatives (AMEU et al., 2016). This work represents a significant departure from the historical role of municipalities in the energy sector. South African municipalities are constitutionally mandated to manage the local reticulation of electricity. This role envisioned for local governments in the energy sector is mainly administrative, with municipal governments acting as local utilities that buy and sell Eskom's power.

To concretise the argument that municipalities are defining a new *de facto* energy mandate from the bottom up, this chapter traces the evolution of decentralised energy policy development and implementation in the City of Cape Town, the Western Cape Province in which the City is situated, and Drakenstein Municipality. It is argued that initiatives driven at a local level have increased the range of possible municipal actions in the energy sector, as well as formalising these through local policy, and slow but possibly enduring impact on national energy policy and regulation. The chapter ends with a brief overview of the current state of play in which municipalities find their decentralised renewable energy work in opposition to new national nuclear power procurement.

3.2 The Case for Municipalities to Drive Decentralised Renewable Energy in South Africa

There is a strong case for the promotion of decentralised renewable energy generation in South Africa, steered by municipal governments, as an active component of the overarching national energy sector. South African municipalities find themselves with access to technology, and models of enabling finance and policy to reform their electricity service delivery models to enhance their promotion equitable energy access. There are specific opportunities for municipalities to utilise locally appropriate strategies for SSEG to directly benefit middle or low-income households as well as to change the way that they deliver electricity to households that qualify for a free energy allocation under the Free Basic Energy Policy (Republic of South Africa Department of Minerals and Energy, 2003a) [4].

Decentralised energy planning and management would not require ‘remunicipalisation’ as in the German case explored in Chapter 2 because municipalities already play a significant role. 184 Local governments in South Africa already exploit their mandate to invest in, maintain and upgrade local electricity distribution grid infrastructure, and manage associated tariffs, fees and equitable access issues. It makes sense that as these local continue to be developed, that the infrastructure can accommodate decentralised energy infrastructure. Nationally, the grid is currently designed to facilitate the transmission of energy from large, stable generation (like a coal-fired power station) (Camp et al., 2015; Jones, 2016a). As local grids gradually become ‘smart’, South African municipalities can play the energy planning and servicing role required for optimal management of localised electricity production and consumption (ICLEI, 2015). Keeping this ‘distribution' role as a public function would allow for the administration of equitable service delivery and infrastructure finance, a significant concern in the context of South Africa's deeply unequal cities and towns.

Existing policy has created space for low-carbon growth and decentralised energy. It has allowed South African local governments to work with the NERSA since 2008. Both metro and non-metro municipalities have been experimenting with the incorporation of SSEG into their distribution of Eskom-generated electricity (AMEU et al., 2016; Jones, 2016a). Returning to the conceptual framework introduced in Chapter 2, this activity can be seen as pushing the South African energy sector in the direction of Quadrant C in **Figure 3** (p27). Responding to both this local experimentation and international trends and models, NERSA attempted to standardise this through the *Standard Conditions for Embedded Generation within Municipal Boundaries* (NERSA, 2011). Though these guidelines are woefully inadequate, and progress has been frustrated and slow, they can be improved, and local governments in South Africa have the benefit of learning from the experiences of local governments in diverse countries, as well as an enhanced menu of technological options, compared with early movers in this area.

[4] It has been estimated that the cost of delivering free energy for a metropolitan municipality can exceed R1 billion annually (Janisch, 2016).

3.3 Evidence of Bottom-up Municipal Energy Sector Transformation

South African municipalities have expanded their role in the energy sector, from a very narrowly defined base, developed for a context before the rise of renewables. They have historically had little official or legislated power to determine where, how and how much electricity is generated, as well as the cost, procurement and financing of that generation. These functions have always been centralised, first, shrouded in secrecy, with Eskom under the apartheid administration. After 1994, the policy-setting role for the Department of Minerals and Energy (DME), which later became the Department of Energy (DoE), was made official. Despite various attempts at reform, first formally proposed in the ambitious 1998 Energy White Paper, Eskom remains mandated to, "provide electricity in an efficient and sustainable manner; this includes the generation, transmission, distribution and sale thereof" (Eskom Holdings SOC Ltd, 2016). Under the DoE and the Minister of Energy, with input and oversight from the Minister of Public Enterprises and Cabinet, Eskom maintains a dominant position. There is no aspect of the energy sector in which the state-owned company (SOC) does not play a substantial role.

Within this centralised configuration of power, local electricity reticulation falls under the service delivery functions over which municipalities have executive and administrative authority. This mandate is stipulated in Sections 156 (1) and (2) of the South African Constitution (Republic of South Africa, 1996)[5]. In practice, the definition of this authority has included a few instances of local governments operating coal-fired power stations, which they own and which were already established pre-1994. The City of Cape Town (CCT), for example, revived the now defunct Athlone Power Station to provide additional capacity during peak demand periods, between 1995 and 2003; and the City of Johannesburg (CJ) still operates Kelvin to meet local energy demand (de Vos, 2015; Government Technical Advisory Centre, 2015). More generally, however, reticulation means buying Eskom's electricity for local resale. The power to invest in municipal electricity generation, or even to benefit directly from the national government or private energy investments within or adjacent to municipal boundaries, has remained a matter of national level discretion, and it is not a legal mandate of local or provincial governments.

Municipalities are dependent on the governance, decisions and infrastructure of Eskom. The SOC sells 48% of the energy it generates, through the national transmission grid that it owns, to 184 licensed municipalities (out of a total of 278) that choose to exercise their right to distribute

[5] These local government functions are stipulated in Schedule 4 Part B.

electricity (OECD, 2015a). Those municipalities that do not have the capacity to perform this function relinquish this role to Eskom. Those that do then sell on to residential and commercial clients, at a margin that is intended to recover costs associated with the distribution grid. Within a given municipality, however, Eskom may still engage in direct distribution to industrial, commercial and some residential customers. The price of electricity and proportional contribution to revenues is unique to each particular municipality, but at a national level, the overall contribution to municipal revenue was 28.8% (StatsSA, 2016). These revenues fund municipal functions beyond only electricity. The idiosyncratic pricing strategies of various local governments have been criticised for being unclear and resulting in inflated electricity costs.

As electricity distributors, municipalities face several ongoing challenges: the inadequate collection of electricity bills; inaccurate metering; and no real-time user data to enable time-sensitive charging[6]. Eskom's increasing tariffs directly impact local governments. Having become dependent on artificially low electricity prices under apartheid, these increases, while necessary, have not been easy to manage.

Table 1: Annual tariff increases versus inflation. Data Source: Parsons, Krugell, & Keeton, 2015

Year	Average approved tariff increase %	Average yearly inflation %
2008	27.5	11.5
2009	31.3	7.1
2010	24.8	4.3
2011	25.8	5.0
2012	16.0	5.7
2013	8.0	5.7
2014	8.0	6.1

Many municipalities are in arrears on their payments to Eskom. By 31 March 2016, the amount owed had increased to R6 billion (including interest), from R5 billion a year earlier (Eskom Holdings SOC Ltd, 2016). As a result, 60 municipalities have signed payment plans with Eskom (19 of the top 20 defaulters). Some municipalities are paying as little as 18% of their total electricity

[6]. Accurate information is required to implement different pricing for different times of the day. The result is that utilities can charge more when the demand for electricity is highest. Flexible pricing supports more extensive revenue collection, while also encouraging more moderate consumption when the grid is under the most stress during peak consumption times (morning and evening).

bills. Whether this full amount is, in fact, recoverable is questionable. Eskom's financial position, as well as historical under-pricing of electricity that failed to account for the cost of upgrading and replacing old infrastructure, has led to several successive price increases since 2008. For 2015, NERSA approved increases of 12.69% for Eskom's direct customers (effective 1 April) and 14.25% for municipalities (effective 1 July 2015) (Eskom Media Desk, 2015). Eskom made an application to NERSA to raise tariffs again within the same financial year, which would have resulted in a cumulative 25% increase. Eskom sited capital expenditure of R22.8 billion needed to avoid load shedding as the primary reason for this increase. Because NERSA rejected the request, Eskom made a further submission in November, which followed a process of stakeholder consultation with unions, energy users, and government, across six provinces. An increase of 9.4% was approved in March 2016, for the 2016/17 financial year.

Going directly against this trend of increasing electricity prices, the renewable energy investments that DoE has made under the REIPPPP has delivered cheaper energy over each successive round of procurement (GreenCape, 2016d). Because Eskom connects these privately-owned power plants to the national transmission grid, and to purchase their power for resale, the cost-savings associated with this relatively small proportion of energy generation, are internalised. Local governments do not feel them. Electricity purchases constitute the second largest category of expenditure for local governments. As costs increase, total spending is growing significantly. Total municipal spending rose by 21,9% to R87,5 billion in the June 2016 quarter, from R71,7 billion in the March 2016 quarter (StatsSA, 2016). Municipal electricity sales totalled R23,1 billion over the same period (compared with R18 billion spent).

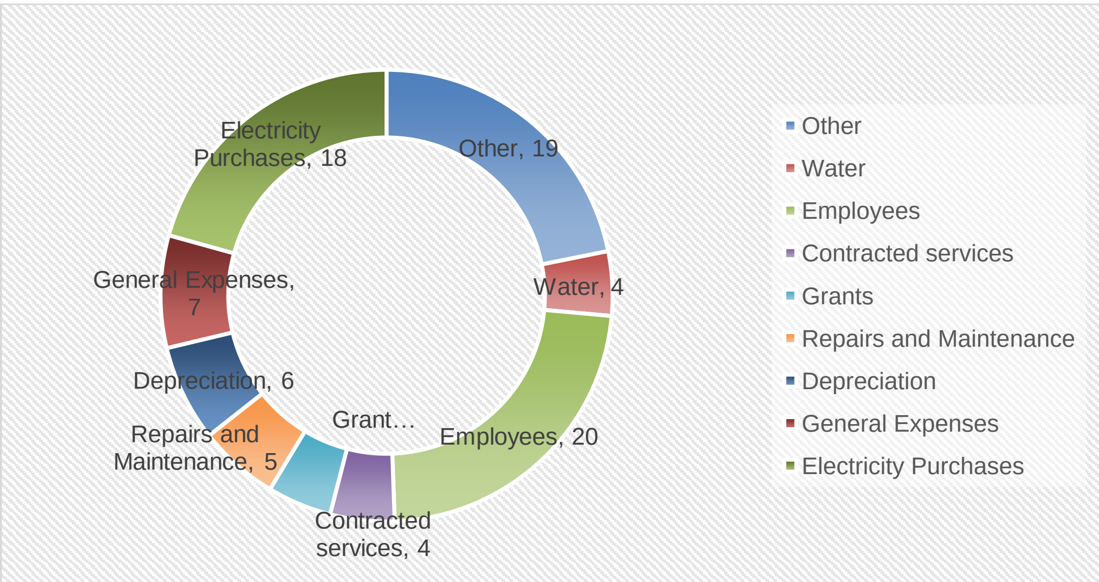

Figure 4: Municipal Expenditure by Category in Billions of Rands. Source: StatsSA, 2016

The relationship between Eskom and municipalities is not well designed. In addition to increasing overall electricity prices, there is a mismatch between the buying and selling price structures for local governments. Municipalities buy electricity from Eskom on a 'time of use' tariff, which is determined by the level of demand at different times of the day. At peak consumption times, in the morning and early evening, electricity costs local governments more. Municipalities sell this electricity to residential and commercial consumers using a different fee structure, an inclined block tariff, for which price is influenced only by the user's average level of consumption (Kotzen et al., 2014). This mismatch in pricing means they lose out on revenue at times when consumption is highest.

There is, however, a compelling motivation for using an inclined block tariff. It is one of few mechanisms to achieve increased local equity in access to services. This is because the level of energy consumption is used as a proxy for household income. The intended result is that relatively wealthier households pay more per unit of energy than poorer households that use fewer appliances. In practice, this cross-subsidises not only energy for low-income households but many other services too. Threats to electricity sales undermine current arrangements for local grid maintenance and service delivery for low-income households(Jones, 2016a).

The inefficiency of the role of municipalities in the energy sector has been a matter of concern for the country's new democratic national government from early on. In May 1997, Cabinet approved the proposal that the electricity distribution industry (EDI) should be consolidated to fix what was seen as the inconsistencies and problems of the current system. The 1998 White Paper expanded on this proposal, prescribing the consolidation of all distribution activities under five state-owned regional electricity distributors (REDs) (Republic of South Africa Department of Minerals and Energy, 1998). It also proposed tariff structure adjustments, with transparent costs for electrification, separating these out from other municipal service delivery. National government efforts to reform EDI were continuously frustrated but continued despite municipal pushback. In 1999, it was proposed that there would be six REDs, managed under a new SOC, EDI Holdings (Public Affairs Research Institute, 2013). This was the outcome of a strenuous effort to ensure an equitable distribution of subsidised energy distribution for low-income households and profitable distribution to commercial customers, within the functional operational footprint of each RED. Municipalities persisted in their resistance, and by 2004 there were still no REDS.

The death knell for this reform was sounded when the first RED was established in 2005. It was swiftly and successfully challenged on the grounds that it curtailed the constitutional authority of municipal governments. There was some renewed energy behind EDI reform in 2009, after the commencement of load-shedding. A constitutional amendment bill was proposed to enable the REDs to continue by re-stating municipal authority in this sphere. This was finally abandoned by Cabinet in 2010, with EDI Holdings closed, putting pay to the idea of EDI reform, and maintaining the complex role of municipal governments in the energy system.

This is the context in which localised renewables have been introduced in South Africa. Municipalities are exploring an alternative to an existing energy sector in which they play a passive role. They have had to be very cautious in this exploration of private renewable energy generation within their boundaries. The transition from being utilities that distribute Eskom's electricity, to a more sophisticated manager of a local grid in which many different energy sources are optimally distributed, involve dismantling and restructuring a major revenue stream. The fear is that increased private generation will result in decreased demand for conventional municipally distributed electricity, specifically from wealthier households and businesses that can afford the capital investment for solar PV or similar.

Despite this initial ambivalence, since as far back as 2008, some municipalities have been tentatively exploring options for SSEG – that is mostly rooftop solar PV for private consumption, with surplus energy feeding into the grid. The promotion of small-scale PV is part of a suite of subnational policy options to drive local energy security through decentralised energy generation (Fakir, 2015). Presently, private investment in residential and commercial solar PV is happening, but slowly and in a haphazard way, with households and businesses motivated by increasing energy costs. Also on the table is the possibility of municipal-owned infrastructure. Investment in municipal-owned energy infrastructure is legal, but subject to NERSA's slow regulatory process, and all new utility-scale generation (larger than 5MW) requires approval from the Minister of Energy.

Despite a variable historical performance, there is tremendous potential to build on this new area of energy planning at a municipal level, to arrive at a better set of arrangements to ensure adequate, sustainable energy to support LED and human development. Some municipalities are attempting to reimagine their role in the energy system in a way that preserves or possibly expands their power and revenue security. The greatest opportunity lies in facilitative both municipal-owned and privately owned small-scale, decentralised renewable energy infrastructure investment. That is infrastructure under the 5MW capacity threshold, although typically these installations fall under 1MW[7]. Anything larger is considered a utility scale installation, and subject to more complex regulatory processes, the immutability of which is evidenced by Eskom's enduring monopoly over energy generation. In practice, this includes a wide range of scales, from a single solar panel on a house, to a solar microgrid (collection of panels) to power a neighbourhood.

Table 2: Summary of typical renewable energy installation size in South Africa. Source: GreenCape, 2016

Scale	Infrastructure	Size
Small	Residential Rooftop Solar	Typically, under 10kW
	Commercial, industrial or community owned installations	Typically, 10kW-1MW
	Small-scale renewable energy installations procured under REIPPPP	1MW-5MW
	Other small-scale renewable energy installations, not defined under REIPPPP	Up to 5MW
Utility	Large-scale installations procured under REIPPPP	Larger than 5MW

It can also include a variety of sources: solar, wind, hydro, and waste-to-energy. Some municipalities are seizing opportunities and building legal procedures to procure renewable energy directly from REIPPPP independent power producers (IPPs) (Lucy Baker et al., 2015). For all this decentralised investment to have a social benefit for cities and towns, a proactive response is required from municipal governments to enable the energy to feed into the grid safely and legally (Camp et al., 2015). Widespread uptake of localised generation will require not only a well-maintained grid, but one that is upgraded to deal with distributed generation, higher levels of intermittency from these sources, and adequate metering to measure, plan for and bill privately generated electricity feeding into the local distribution grid[8] (Camp et al., 2015). This will require a dramatic improvement in the management of local energy infrastructure, and a plan to finance the investment backlog totalling an estimated R35 billion in 2012 (OECD, 2015a).

Despite a challenging environment, in which opportunities to influence national energy policy have been increasingly scarce, municipal governments are awake to the global shifts towards more

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[7] According to the Solar Energy Industry Association (SEIA) of America, the current national average for the number of households powered by 1MW of installed solar PV is 164 (Solar Energy Industry Association (SEIA), 2015). This is based on the average performance of systems divided by the average annual electricity consumed by households.

[8]. A 'smart' grid can redirect energy from wherever it is generated to where it is needed

decentralised, locally sensitive, diverse and resilient energy systems. Additionally, many municipalities are seeing energy sector crises as a signal of the inevitable transition to a greener, more decentralised system (Government Technical Advisory Centre, 2015; Greyling, 2016; Mkosana, 2016; WWF, 2015). Various stakeholders articulated this view in 2015, at the Economies of Regions Learning Network (ERLN), an initiative of the Government Technical Assistance Centre (GTAC), a part National Treasury. ERLN convened a learning exchange network on embedded generation and other renewable energy opportunities for local government that was enthusiastically received (Government Technical Advisory Centre, 2015). This event revealed the extent of local government activity in renewable energy. Despite a broadly disabling environment and a history of variable performance in the energy sector, stakeholders reported assistance from within the DoE, NERSA and National Treasury on a range of relatively successful projects. With this support, municipalities have identified and acted on investment opportunities in various stages of completion, both facilitating and directly investing in decentralised renewable energy. These opportunities are listed below in Table 3.

Table 3: Local energy generation options. Sources: Government Technical Advisory Centre, 2015; ICLEI Africa, 2015; Janisch, 2016; Mkosana, 2016; Resource Management Services, 2015; SALGA, 2015

Municipal Role	Local generation infrastrucure option	Scale	Grid-tied	Ownership options	Description	Regulatory requirements
Facilitation	1. Commercial, Industrial & Agricultural small-scale embedde generation	Up to 1MW	yes	Private (Business)	Predominantly solar rooftop PV (but can be alternative source) grid-tied generation to supplement own consumption. Limited implementation in several municipalities (including City of Cape Town case study).	Requires approval by municipality in line with municipal small-scale regulations & NERSA
Facilitation	3. Residential rooftop embedded PV	Typically less than 10kW	yes	Private (Household) Private (Company or non-profit)	Rooftop PV installation with grid connection to supplement consumption; surplus energy FIT. Limited implementation in several municipalities.	Requires approval by municipality in line with municipal small-scale regulations Covered by NERSA's Standard Conditions
Facilitation	4. Community microgrids (sma scale)	Up to 1MW if grid-tied	can be off-grid	Private (Household) Private (Company or non-profit) Public (Municipality)	Rooftop or centralised micro-grid system to supply power to a cluster of homes. This can be a cost-effective way of providing power as nano-grids can deliver some of the benefit of being grid-tied without the expense of extending national grid infrastructure. It can also be funded through public or donor funding, or small individual contributions. Limited examples of implementation, including the Ishack in Stellenbosch Municipality. There are several private projects currently being developed. This infrastructure is currently being explored for broad implementation in the City of Cape Town.	For grid-tied installations, requires a case by case approval by the municipality in line with municipal small-scale regulations and NERSA For off-grid microgrids, only requires approval by municipality
Facilitation	5. PPA (wheeling agreement) with utility scale IPP (under REIPPPP)	% of total generation capacity to be determined	yes	Private (IPP)	Power bought directly from an IPP for distribution via the local grid to businesses or households. Implemented in Nelson Mandela Bay Municipality.	Requires approval by NERSA
Direct Investment/ Ownership	6. Public-private partnership (PPP) with Independent Power Producer for small-scale infrastructure	Up to 5MW	yes	Private (IPP) Public (Municipality)	Power procured directly from an IPP for distribution via the local grid to businesses or households, or for use by the municipality. Nelson Mandela Bay is currently in the procurement phase of a process for waste-to-energy facilities in this category.	Requires approval by NERSA Requires approval by National Treasury if done through a PPP
Direct Investment/ Ownership	7. Public-private partnership (PPP) with Independent Power Producer for utility scale infrastructure	More than 5MW	can be off-grid	Private (IPP) Public (Municipality)	This could include solar PV, wind, or waste to energy solutions. The scale and payback period (spanning more than three years) would, under the Municipal Finance Management Act of 1998, necessitate establishing a PPP between the municipality and the IPP (Technical Assistance Unit and Western Cape Government, 2014). Drakenstein municipality has designed a facitlity in this category (see case study).	Requires a Section 34 Ministerial Determination Requires approval by NERSA Requires approval by National Treasury
Direct Investment/ Ownership	2. Municipal small-scale embedded generation	Up to 1MW	yes	Public (Municipality o other government)	Predominantly solar rooftop PV grid-tied generation to supplement own consumption for government buildings. Feasibility study undertaken by Western Cape Government, funded by USAID.	Requires approval by NERSA

In addition to the ERLN, advisory work has also been undertaken by GIZ and WWF South Africa, as well as technical learning exchanges between particular governments, for example between the Western Cape Government and the Government of Bavaria in Germany. SALGA has been an important vehicle for this advisory support, along with the Association of Municipal Electricity Utilities (AMEU) (AMEU et al., 2016; SALGA, 2015). Together with Sustainable Energy Africa (SEA), SALGA has created the Urban Energy Support Website to allow for knowledge sharing and technical support for municipalities (SALGA & Sustainable Energy Africa, 2016).

3.4 Charting a way through the Limiting Existing Regulatory Framework for Municipal Energy Generation

The decentralised energy investments undertaken and enabled for local consumption are not illegal, nor are they explicitly regulated. NERSA oversees all energy generation licencing, pricing, tariffs, distribution, sale and infrastructure installations. In 2011, NERSA responded to the concerns and initial work undertaken by municipal governments since 2008, by publishing the *Standard Conditions for Embedded Generation within Municipal Boundaries* (hereafter "Standard Conditions"). The Standard Conditions devolved the power to register and connect private embedded energy generators up to 100kW (0.1MW) to municipalities, which were deemed the appropriate level of authority to manage this scale of generation (NERSA, 2011). These regulations allow small-scale generators to sell power to municipalities and to be compensated for energy generated without having to go through any national vetting or approval. They do not specifically speak to municipal investment in generation, nor do they accommodate community microgrids, nor larger commercial installations (like the small-scale infrastructure that is allowed to be procured under REIPPPP, which fall between 1MW and 5MW).

The document has been heavily criticised for its opacity, and by NERSA's account, "the document was approved without due public consultations and is not clear to most stakeholders" (NERSA, 2015b). The Standard Conditions leave systems between 100kW and 1MW entirely unregulated. Furthermore, the document requires municipalities to draft specific regulations to make these guidelines workable in their local environments. They have remained widely unimplemented for the past five years because municipalities were never confident as to the legal status of the guidelines, which also failed to provide guidance on critical technical and financial aspects of local embedded generation. As evidenced in the City of Cape Town case study, below, some of the larger metropolitan municipalities did go ahead with the development of local regulations, however, which were informed by their shared experiences with pilot small-scale solar PV installations.

In response to municipal requests and technical input, given that municipalities continued to work on decentralised energy, in February 2015 NERSA released a consultation paper entitled, *Small-Scale Embedded Energy Regulatory Rules for energy systems up to 1MVA (equal to 1MW)* (hereafter "Small-Scale Regulations"). The draft Small-scale Regulations specify national standards for municipalities to register small-scale energy generators up to 1MW to feed surplus energy into local distribution grids with guidelines for associated fees and compensation (NERSA, 2015b). Like the Standard Conditions (2011), the Small-Scale Regulations stipulate conditions for municipal registration of these systems, but with an increase in the generation capacity cap, now up to 1MW. The regulations specify, among other things:

1. Technical assessments of network capacity and total cumulative generated capacity to be undertaken and recorded;
2. Reporting requirements for NERSA;
3. Standards for generation systems, grid connection and metering; and
4. Tariffs structures to recover all fixed costs, including connection, metering and grid maintenance, as well as incentivising private investment

Essentially, the Small-Scale Regulations require that municipalities account, plan and invest for the increased local generation from private PV installations. The regulations propose a two-phase tariff system, with the first being simple net-metering of generators that also use the grid, and the second possibly requiring a single intermediary body, a Central Power Purchasing Agency to administer small-scale energy and compensation schemes on behalf of individual municipalities (NERSA, 2015b).

The improved Small-Scale Regulations would replace the ineffective 2011 Standard Conditions, with buy-in facilitated through extensive consultation with municipalities and other stakeholders. The regulations would create a solution for potential municipal revenue losses, and would also help to mitigate load-shedding risks. Many municipalities, private investors and other interested parties did provide extensive comments, eagerly awaiting this long overdue framework. Despite this enthusiastic response, NERSA overshot its May 2015 deadline and remained vague on the completion date for the regulations for next several months. While the legal status of this document is still unclear (as at 1 January 2016), the Standard Conditions are still the only 'regulation' in place for municipal actions for decentralised renewables. The document was used by various municipal governments to catalyse the range of activities listed in Table 3, which have also far exceeded its scope and intended focus on rooftop solar power (Jones, 2016a). In terms of defining the regulatory space for decentralised energy, municipal governments are bound by Schedule 2 of the Electricity Regulation Act, which allows for operation without an electricity generation license under the following conditions:

- Any generation capacity constructed and operated for demonstration purposes only and not connected to an interconnected power supply.
- Any generation capacity constructed and operated for own use.
- Non-grid connected supply of electricity except for commercial use. (Republic of South Africa, 2006)

In addition to the Standard Conditions, all municipal activities with respect to energy are governed by the Municipal Finance Management Act (MFMA), which governments all financial matters, including revenues and procurement (Republic of South Africa, 2004; Technical Assistance Unit and Western Cape Government, 2014). The MFMA is particularly challenging for energy procurement, because, under Section 33, it limits contracting periods to one year or three years in the case of sufficient motivation. Longer contracting periods are usually subject to the establishment of PPPs, with long lead times and arduous public participation requirements and external approvals. This is significant because it applies to all "Direct Ownership/Investment" initiatives in Table 3.

3.5 Tracing the Pathway to Expanded Municipal Authority in the Western Cape 2008-2016

The slow, but steady progress of municipal work on decentralised renewable energy generation is evident in the Western Cape Province. The Western Cape Government (WCG) is an opposition-led government. WCG sees energy as a major risk to the economy (Western Cape Government Provincial Treasury, 2015). To illustrate, the Western Cape Infrastructure Framework, May 2013, notes: “The current deficits and uncertainties lie in the capacity to generate and source electricity to support an increased growth in demand. The energy focus in the province is on lowering the carbon footprint, with an emphasis on renewable and locally generated energy” (Palmer & Graham, 2013). This has meant that there has been a climate of political support for decentralised renewable energy in the province, which has also been mirrored in many of the local governments that fall within its territory. The City of Cape Town (CCT) has led the way in terms of both capitalising on this political will and converting it into actual energy projects and regulations. CCT has also been influential in pushing NERSA for clarification, feeding into both the 2011 Standard Conditions and the 2016 Small-Scale Regulations. Together with WCG, and various other organisations, from 2008 to 2016, the growth of clear policies and regulations to allow for SSEG, and to implement other decentralised renewable energy investments has been significant.

The case studies below plot key events in the CCT (and relates this to progress in the rest of the province) and Drakenstein Municipality, respectively. Each case demonstrates how these municipalities have actively developed their agency by working locally, while working through various platforms to augment learning and progress, and to lobby NERSA for increased leeway to develop decentralised renewable energy, locally. Through these actions, they have expanded their role from a limited scope of electricity distribution and local implementation of the Integrated National Electrification Programme (INEP) – connecting off-grid households to local distribution grids – to a range of direct and indirect energy investments to meet local electricity consumption demand.

3.5.1 Case 1: The City of Cape Town Leading the Way

The CCT has been one of the most proactive municipalities in terms of SSEG in the country. This has been pushed from its Electricity Department (ED), which is responsible for electricity distribution to residential and commercial customers. Like with many municipalities, local electricity distribution is complicated by the fact that the municipality is not the sole actor in this area(Greyling, 2016). The City only distributes 75% of electricity within the municipal boundary, while Eskom distributes the remaining 25% electricity directly to particular customers (City of Cape Town, 2016). Since CCT began to look into localised generation and connecting this to the local grid, the solutions it has developed have never applied to the 25% of Eskom's customers. On the City-owned grid, however, there are more than 40 substations, which allow for energy to feed into the grid, which can then be redistributed and sold in the same way that all other municipal electricity is sold.

When ED officials began to think seriously about small-scale embedded energy in 2008, it was in response to international energy trends, and the increasing uptake of solar PV. Given the CCT's dependence on energy sales to middle and upper-income households and businesses for revenue generation, and specifically also to finance service delivery low-income households, this was the initial frame for investigations. The focus was on potential cost-recovery strategies that ensured continued equitable service delivery, adequate infrastructure investment, and the sustainability of Eskom's financial model. Despite these complications, the ED department saw an opportunity to purchase electricity from businesses and households with solar panels that are embedded in the municipality's local grid, (Jones, 2016a). The strategy was not to displace Eskom generation, but rather to capitalise on small-scale private investment in solar PV, biogas, and small-scale hydropower, to ensure local energy security. This was in the context of Eskom's failing infrastructure and load shedding, which commenced in the same year. Provincial and local governments have explored some creative energy demand-side management has been used to limit their exposure to load shedding, and SSEG was considered a viable strategy in this regard.

CCT was joined in their concerns by Nelson Mandela Bay Municipality (NMBM), which is also very active in the green energy space. Together, representatives from both municipalities approached NERSA to enquire about the possibility and potential of SSEG (SALGA, 2015). A regulatory gap was identified for SSEG, with early conversations focused on rooftop solar PV in particular. Neither the municipalities nor Eskom was directly mandated to buy surplus energy from private households or businesses that had invested in energy generation for their own needs. At a national level, these systems, and all systems falling under 1MW of installed capacity were excluded from Cabinet deliberations on IPPs and were not considered relevant to the IRP 2010. This regulatory gap convinced NERSA to allow for the first pilot system to be installed in NMBM.

CCT ED officials continued to work on developing the technical and financial models that would enable SSEG to be implemented locally. Officials agreed to a slow, phased approach. Any work had to conform to the both the MFMA and Electricity Regulation Act. The former stipulates that municipalities must avoid unnecessary regulatory losses and prohibits wasteful expenditure. The financial feasibility of SSEG was, therefore, critical to continued work in this area. Furthermore, because of limitation on the contracting terms to a maximum of three years, longer-term offtake agreements to purchase energy from embedded generators was not simple. Embedded generation is also subject to municipal bylaws. For CCT, the Electricity Supply By-law 2010, states: "No electricity generation equipment provided by a consumer in terms of any regulations or for his own requirements shall be connected to any installation without the prior written consent of the Director [of Electricity]" (Jones, 2016b).

With no regulatory clarity forthcoming from NERSA, CCT and other municipalities made another appeal for clarity on SSEG in 2010. It was this engagement prompted NERSA to develop the Standard Conditions, which were published in 2011. Despite being inspired by municipalities; no consultations were held to ensure that the guidelines were clear and useful to local governments. The document prescribed a role for municipal governments in the administration and management for small-scale generation up to 100kW within municipal boundaries. The Standard Conditions only applied to the 75% of local distribution undertaken by the municipality within Cape Town. It proposed a system of Net Metering, in which small-scale generators are rewarded for the energy they feed into the municipal grid by discounting their energy bill (energy consumed minus energy exported to the grid). This arrangement assumes that small-scale generators are still net consumers of municipal energy, and not being paid out by the municipality. The Standard Conditions set out some technical requirements for metering (smart meters with bi-directional metering), reporting, and setting tariffs. It is important to note, however, that the legal status of this guideline document has never been clear. Different municipalities have interpreted the Standard Conditions idiosyncratically, resulting in variable policy approaches towards PV and local renewable energy opportunities (Jones, 2016a). Its implication, however, was that generator licences required under the Electricity Regulation Act, were not needed for systems under 100kW. It opened a door for municipalities to work actively to enable these systems.

As research to update the IRP commenced, it became clear that the cost of small-scale solar would reach parity with municipal electricity over time (City of Cape Town, 2014b). This is reflected in the IRP 2013's inclusion of residential PV in national energy capacity planning (Republic of South Africa Department of Energy, 2013). At the same time, discussions were underway on how to make SSEG revenue-neutral for municipalities. CCT undertook internal cost evaluations to design a locally feasible tariff. This was subject to approval from City Council and NERSA. In parallel with this significant energy policy shift, a shift to low-carbon LED was also underway. In 2013, the Western Cape Government and the City of Cape Town both committed to a green economy agenda, for low-carbon economic growth, and to explore opportunities for business and job development related to environmentally friendly, resource-efficient manufacturing and other activities (Western Cape Government, 2013). Economic opportunities related to a national renewable energy rollout through REIPPPP were prioritised. GreenCape, which had been established in 2010 to facilitate investment in green economic growth in the Western Cape, was expanded with a particular mandate to stimulate and support opportunities related to the renewable energy sector.

This was an intense focus within the CCT in 2014, which turned out to be a critical year for progress on the City's SSEG work. The green economy provided a substantial economic and environmental policy frame for the ED team to continue to work to find a solution for SSEG. The rapidly evolving global technological context continued to inform CCT action. Brian Jones of CCT ED made a presentation to various Western Cape municipalities, as well as NERSA and Eskom representatives in 2014, at which he noted, "Grid connection of SSEG is happening! – It seems that PV will reach grid parity in 2015 (tomorrow)" (Centre for Renewable and Sustainable Energy Studies, 2014). The CCT recognised that energy planning needed to accommodate not only the present but also the future of energy generation, given decreasing costs and rapidly improving technology. Storage, for example, is a challenge for renewable energy from solar or wind power because they are intermittent (Centre for Renewable and Sustainable Energy Studies, 2014). However, as with the actual generation infrastructure, this is, as the ED team predicted, also significantly improving.

CCT began to work within the Standard Conditions and was very active in municipal networks to share learning between 2012 and 2014. The ED team participated in workshops organised by AMEU, SALGA, Eskom officials and GIZ, to develop workable financial models for SSEG (SALGA, 2015). Six other metropolitan and seven local municipalities participated in these forums. Together, these municipalities developed a system in which "net consumers", customers that buy more municipal electricity than they generate in a year, could feasibly feed into the municipal grid. This was based on several local trials. In the CCT, the ED implement four pilots: one commercial pilot with no reverse power flow; and three residential pilots with reverse power flow. These pilots allowed the CCT to learn and develop a generalised approach to technology, especially the challenges of metering and payment for SSEG. While industrial and commercial customers could be relatively easily connected to the grid, without any clear guidance from NERSA, the municipalities were still left without a workable solution for connecting residential 'prosumers' (Centre for Renewable and Sustainable Energy Studies, 2014).

The CCT had been gradually migrating consumers to pre-paid meters to manage issues of non-payment. Initially, this was not compatible with proposed metering solutions. However, to get buy-in from the City Council, it had to be worked into the system (Jones, 2016a). The City started working with suppliers to develop a prepaid meter that could register reverse power flow and credit accounts automatically. Grid cost recovery was worked into daily service charges. The same metering system as used for commercial and industrial consumers was prescribed for residential consumers (City of Cape Town, 2014b). The standards for metering were developed before any formal national guidance was issued, and they were, therefore, subject to any specifications in updated national building codes. In the absence of this national standard, the City required a case by case assessment by a professional engineer in the interim. Municipalities were part of a multi-party working ground with Eskom and industry representatives to address this gap. By May of 2014, the municipalities reached a consensus on a net-metering system that could work, and this was distributed for comment to all local governments via circular *Nb* 14/2014. This concept was approved by the SALGA NEC in July of 2014 and submitted to NERSA. Comments were also submitted, calling for an extension of the 100kW threshold in the Standard Conditions to 1MW.

The local policy context continued to favour the ED team's work on SSEG. CCT published *The Low-Carbon City: Central City Strategy* with the Cape Town Partnership and SEA in (City of Cape Town, 2014a). This strategy identified solar PV installation as an important component of the city's future sustainable development. In it, the City committed to developing general guidelines for installation and grid connection of small-scale systems by commercial and residential prosumers, providing detail on technology, tariffs, billing and other issues (City of Cape Town, Cape Town Partnership, & Sustainable Energy Africa, 2014). It also committed to supporting all national processes to enable SSEG. CCT recorded 550,000 residential consumers in 2014, of which 250,000 were paying middle or upper-income households (not subsidised energy consumers) (City of Cape Town, 2014b). Initial calculations suggested that based on an annual total electricity consumption of 11,000 gigawatt hours (GWh)[9], 100,000 household installations (each 3kW, generating 350kWh per unit per month) would be able to generate 3.8% of total consumption. If these households also install solar water heaters, the electricity that they need to buy from the municipality would be minimal and priced at low consumption/low-income rates.

Also in 2014, CCT reported that the increasing price of municipal (and Eskom's) electricity was driving increasing interest in small-scale generation (City of Cape Town, 2014b). The ED team was receiving almost daily enquiries as to how to connect private systems. Some illegal and dangerous grid connection were also identified. One PV supplier claimed to know of approximately 500 illegal grid-tied installations. In the same year, although a lack of established feed-in tariff was holding back demand, the CCT received ten serious applications from commercial consumers.

CCT worked towards signing the first SSEG contract with the Black River Park on 23 September 2014. This is a 1.2MW solar PV rooftop system, covering 14000m2. With NERSA's approval, it feeds surplus energy into the municipal (City of Cape Town, 2014b). This system is not eligible for the city's tariff scheme because of its size. As motivation in its interactions with NERSA, it made use of the Electricity Regulation Act's "own use" exception, for electricity generation without a generation licence. To obtain NERSA's approval, the phased installation was registered as two separate energy projects so that each fell below the threshold of 1MW (Jones, 2016a). This was the first deal of this nature in the country. Following this, a similar 542kW system was installed on a Vodacom building. The ED team has maintained open communications on progress with NERSA throughout and has been supported by officials with the regulator during this process.

Given the progress that had been made, CCT and other municipalities approached NERSA again in 2014. As pointed out in Section 4, NERSA was very responsive to the concerns of municipalities regarding the enduring confusion and lack of regulatory for SSEG. Municipalities were presented

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[9] GWh and Megawatt hour (MWh) are measures of energy used over a unit of time. In order to get to a certain amount of GWh for the year, a certain amount of installed capacity is required to generate that energy. Because this installed capacity does not operate at 100% efficiency, a measure must be applied to capture how efficient it is. This is required to ensure sufficient installed capacity to meet a target, as set out, for example in the IRP. If a 12MW wind farm produces an average of 6MW, then the capacity factor = 6 / 12 = 0.5 or 50%. Different technologies in different contexts can have vastly different capacity factors. The GWh or MWh generated in a year is equal to total installed capacity, multiplied by the capacity factor which is a measure of the efficiency of the technology being used, multiplied by the number of hours in a year. 1MW of solar capacity with a capacity factor of 25% will produce 1 x 0.25 X 8760 = 2190 MWh of electricity in one year.

with clear timelines for resolution by May in 2015. Unlike the Standard Conditions, the draft Small-Scale Regulations were based on very extensive consultation with municipalities like CCT, which had all been taking related but nuanced approached to SSEG. CCT delivered detailed comments to the draft published by NERSA in February of 2015 (Jones, 2016a). As it became increasingly unclear when the formal regulations would be published, CCT continued to work with GreenCape on local SSEG implementation and has shared its technical expertise, through GreenCape, with other less well-capacitated municipalities. CCT is also working through SALGA and the National Treasury City Support Unity to accommodate medium and long-term impacts on municipal revenue models. When it became apparent that the DoE had scuppered NERSA's process, and then later that the Minister was pushing for nuclear energy expansion, CCT continued to work to enable SSEG.

The City has learned from its own experimentation and lessons from other municipalities and is now allowing grid connection up to 1 MW without a generation license. It has undertaken to report all SSEG to NERSA in line with the Standard Conditions. There is the possibility that NERSA will override the City's procedures at some point with new regulations, and all private investors carry this risk. Despite this, in March 2016, the City published *Safe and Legal Installations of Rooftop Photovoltaic Systems: Commercial and Residential in Cape Town* (City of Cape Town, 2016). There are now guidelines and standards for rooftop PV installations, along with a process map for grid connection, outlining the approvals required from various municipal departments. Successful applicants are issued a letter of consent. Metering standards and a special tariff have been put in place. CCT now has more than 170 legal SSEG grid connections (and still more illegal connections). The City is also working with GreenCape to develop PV solutions for low-income households (Janisch, 2016).

CCT processes still do not apply to Eskom-supplied consumers within the municipal boundary. Even off-grid installations may require Eskom’s approval before operation, but this is unclear. The Standard Conditions may have created a formal mandate for municipalities to work in this space, but CCT has worked slowly and consistently over the past eight years to convert that mandate to an implementable local policy.

3.5.2 Knowledge Transfer and Regulatory Development in the Western Cape

CCT’s work has been supported by WCG, both politically and with research. Other municipalities, being less well capacitated than the metro, have followed its lead. Together, Western Cape municipalities identified the following challenges for localised renewable energy generation in 2014 (Centre for Renewable and Sustainable Energy Studies, 2014):

- Procurement processes, especially the MFMA, but also Provincial Treasury's regulations;
- The municipal revenue model;
- A lack of regulatory clarity about tariffs, technical standards, metering, and acceptable investments in energy generated by municipalities for municipal use;
- Acceptable models for local (municipal and private) offtake directly from IPPs (not through Eskom).
- Impacts on service delivery and equity resulting from an increasing share of privatised energy generation.

In March 2015, WCG and the CCT convened municipalities, industry specialists and business representatives to formulate a coherent provincial strategy to ensure local energy security. The opportunities and challenges of SSEG featured prominently. This meeting led to an intergovernmental programme, the Energy Game Changer, "[to] minimise the impact of power shortages and load shedding on the economy and employment over the next five years," for a lower carbon, more efficient, future (Western Cape Government, 2015a). At its inception, it targeted a 20% reduction in consumption of electricity generated from coal within the province. Building on the work of CCT, support for SSEG was one of the primary mechanisms identified to achieve this goal. The Game Changer has mobilised high-level political support for SSEG, but its ambitions have been somewhat tempered, targeting only a 10% reduction in grid energy consumption after its public launch early in 2016.

The metro, district and local municipalities in the province are working with GreenCape, a non-profit, special purpose vehicle (SPV) established by WCG to support resource-efficient economic development in the province. GreenCape secures most of its finance from WCG, reporting to the Department of Economic Development and Tourism (DEDAT), also working closely with CCT on specific projects. Building on the CCT's work over several years, the SPV has developed a generic set of draft guidelines to enable solar PV at a municipal level (GreenCape, 2016a, 2016b). These draft regulations are in line with the Standard Conditions and all relevant national regulations and local government bylaws. GreenCape has worked closely with self-selecting municipalities to tailor these guidelines to the local context. According to GreenCape, 13 Western Cape Municipalities (listed below) have now developed local regulations to allow small-scale embedded energy.

Table 4: Western Cape Municipalities that allow embedded energy, Source: GreenCape, 2016

Municipality	Allow small-scale embedded energy	Tariffs in place	Policies in place
Beaufort West	Yes	Yes	In progress

Bergrivier	Yes	Yes	In progress
City of Cape Town	Yes	Yes	Yes
Drakenstein	Yes	Yes	Yes
George	Yes	Yes	Yes
Mossel Bay	Yes	Yes	Yes
Oudtshoorn	Yes	In progress	In progress
Overstrand	Yes	Yes	In progress
Stellenbosch	Yes	Yes	Yes
Swartland	Yes	Yes	Yes
Theewaterskloof	Yes	Yes	Yes
Langberg	Yes	In progress	Yes
Breed Valley	Yes	In progress	No

This level of policy development is indicative of significant progress from the three municipalities that had clear standards and procedures in 2014 (SAMSET, 2014). The guidelines, as in CCT, allow for generation up to 1MW (not 100kW/0.1MW as in the Standard Conditions) (GreenCape, 2016b). The guidelines are also in line with Eskom's technical specifications to ensure compatibility with the grid. Despite the local policy frameworks, actual implementation remains relatively slow. While the CCT case study shows that progress has been made in negotiating some of the barriers to SSEG, the issues of revenue management and equitable access to energy services are by no means resolved.

3.5.3 Case 2: Utility Scale Ambitions in Drakenstein Municipality

The case of ‘waste to energy' (WTE) infrastructure in Drakenstein is an example of a municipality working within an existing municipal mandate to develop an opportunity for localised energy generation. Unlike other energy projects, municipalities have an uncontroversial waste management mandate that legitimises these investments. At the same time, most provinces have significant challenges regarding long-terms strategy for dealing with waste in a sustainable, legal, financially viable and locally beneficial way. Landfills are quickly reaching capacity, and because of their undesirable environmental impacts, are being supplemented with other waste management strategies, including generating energy through a growing menu of technological processes (CSIR, 2011).

As with SSEG, WTE is subject to complex financial management and procurement regulations. The Drakenstein WTE has not yet been built; however, the case is included here because the municipality has managed to successfully navigate the procurement processes that many local governments see as a significant barrier to investment in energy infrastructure (Technical Assistance Unit and Western Cape Government, 2014; Turley & Perera, 2014). It is currently being investigated by WCG to extract key lessons for replicability, either directly for WTE, or for other sustainable energy procurement. It is also selected because the planned scale of energy generation is unprecedented.

The WTE plant will have an energy generation capacity of approximately 12.6 megawatts (MW) (USTDA, 2016). Outside of the Western Cape, WTE projects have been implemented in Ekurhuleni (1MW) and Ethekwini (7.5MW). The respective municipal governments generated both projects, and both plants feed electricity into the local grid to be distributed as normal (AMEU et al., 2016). The City of Johannesburg also has a biogas to energy facility (1.1MW); however, electricity generated is consumed onsite. No WTE initiative has successfully been implemented in the Western Cape.

Drakenstein Municipality first formally began to investigate WTE in 2008. Aligned to the sustainable development focus of the provincial administration, there was an increasing interest in extracting local economic value and creating jobs in waste processing (Western Cape Government Department of Environmental Affairs and Development Planning, 2014). At the time, Drakenstein was faced with an immediate problem. The municipality has a single landfill site in Wellington, which also services the other towns within the municipal boundary, Hermon, Gouda, Paarl, and Saron (Western Cape Government, 2015b). In 2008, it was anticipated that this landfill site would need to be decommissioned by 2012. It was seen as a matter of urgency to find an affordable solution. At the same time, the municipality was concerned about local impacts of Eskom’s load shedding and price increases, which had commenced in the same year.

WTE addressed both problems at once. According to municipal officials, the project was successfully motivated because it will enable the municipality to keep waste tariffs at an affordable level. WTE is predicted to have a positive long-term impact on local electricity tariffs, by adding to the available local energy supply(Louw, 2016). Keeping service delivery affordable is a key concern for Drakenstein and many other local governments. Additionally, the operation of the project is seen as an LED opportunity to support job creation by unlocking value from waste. Jobs will be generated within the facility itself, with 116 permanent jobs expected (Drakenstein Municipality, 2015). There are further opportunities for job creation in the processing of by-products.

Drakenstein, in 2008 and to date, manages all waste (Solid Waste Services) internally. It was quickly recognised, however, that the design, construction and operation of a WTE facility, required external expertise and capacity, as well as finance. Officials determined that a long-term relationship with a service provider would be necessary to develop a suitable, sustainable solution (Louw, 2016). The scope of service would cover the finance, design, construction, management, operation and maintenance of a WTE plant, as well as operation of the municipality's waste treatment and disposal services. The establishment of the project had to be structured as a PPP to allow for an adequate contracting period between the municipality and the service provider (Republic of South Africa, 2004). Many municipal activities for sustainability and resource (e.g. renewable energy generation and ecosystems management) have an investment payback periods that are longer than three years (Technical Assistance Unit and Western Cape Government, 2014). This is the time threshold beyond which a PPP is mandatory. A complicated and lengthy process is prescribed to establish this kind of agreement.

The procurement process began in 2008 with a Request for Proposals (RFP) for "The Development of a Waste to Energy Project at Drakenstein Municipality" for "*a medium to long term Public Private Partnership with a preferred bidder in the planning, designing, financing, construction and operation of a Waste to Energy Project*" (Jan Palm Consulting Engineers, 2008). The detail of the technical solution was left to the service provider to specify. The preferred bidder was chosen on the basis of having the strongest technical solution. The municipality reports that legislation technically requires that the idea is put through viability testing before a preferred bidder is selected. However, a deviation from this process was allowed because it was recognised that the design needed to be developed in partnership with the municipality, rather than choosing from a list of fully predetermined infrastructure choices (Louw, 2016).

Because waste management is defined as a municipal service[10], a PPP requires compliance with the MFMA, Municipal Public-Private Partnership Regulations, 2005, and the Municipal Systems Act (specifically Chapter 8, Sections 76-78) (Technical Assistance Unit and Western Cape Government, 2014). This entails the following process:

1. A review of current services as administered by the municipality (including a cost-benefit analysis, a municipal capacity assessment, administrative impact assessment, a community impact assessment, and a review of national and international trends relevant to the service area)
2. A process to consider external service provision, leading to formal council approval

[10], A different process applies if the activity under the partnership falls within a municipality's legal competence, but does not constitute a municipal service. An example would be partnering with a service provider to have solar water heaters installed in low-income households.

3. A feasibility study
4. A competitive bidding process

The PPP also required consultation and approval by WCG and National Treasury, in advance of seeking the approval of the Municipal Council. WCG has been supportive of the project. Drakenstein worked with National Treasury's PPP Unit, to structure a deal that is an effective and affordable service delivery mechanism. The process followed by Drakenstein is summarised in the table, below.

Table 5: Key milestones in the PPP process. Source Drakenstein Municipality, 2015

Date	Milestone
2008	RFP issued
2011	Bid Adjudication Committee established
2011	Treasury approval
2012	Memorandum of Agreement in place
2012	Drakenstein Waste to Energy Section 78-1 Assessment Report Draft issued
2013	Treasury Views and Recommendations (TVR1) letter issued
2013	Feasibility Study Report issued
2013	Final Consolidated Report on Comments received
2014	Council decision in terms of Section 78(4) (23 April 2014)
2014	Interwaste appointed (Appointment Letter issued)
2014	Draft Scoping Report
2015	Final Scoping Report released

In 2011, there was a change in political leadership, following a local government election. This change delayed the project, as municipal officials had to secure approval from a new local council that was not immediately in support of the project (Louw, 2016). Only once this was secure, could officials proceed to draw up a Memorandum of Agreement with Interwaste, the successful bidder. To manage the complexity of a comprehensive waste management solution with a large WTE component, Interwaste established a Special Purpose Vehicle (SPV), that has drawn together all the necessary knowledge, skills and capacity to implement required activities under a 'joint venture'. The SPV will manage the facility, which will include the following components:

- Wellington Material Recovery Facility ("MRF") – handling clean or dirty waste
- Municipal Solid Waste (MSW) Pressing Plant ("VMpress")
- Anaerobic Digestion ("AD") Plant
- Direct Combustion ("DC") Plant.

To realise this project, the PPP agreement with Interwaste contains several detailed schedules, including agreements for the following: the operation and maintenance of the existing municipal waste treatment and disposal services; a project site land lease; the build, ownership, operation and transfer of project components; and an energy power purchase agreement. The PPP will last for 20 years to allow adequate time for cost recovery (Louw, 2016). While the agreement is drawn up, it still depends on the successful obtainment of the following approvals:

Table 6: Environmental Permissions Required. Source: Drakenstein Municipality, 2015

Requirement	Authority
Environmental Authorisation (through a Scoping and Environmental Impact Assessment (SEIA)	Department of Environmental Affairs (DEA)
Waste Management Licence	Western Cape Government Department of Environmental Affairs and Development Planning (DEADP)
Atmospheric Emissions License	Cape Winelands District Municipality
Electricity Generation Licence (if pursued)	NERSA
Water Use Licence (not confirmed)	Department of Water and Sanitation (DWS)

The SEIA process has been complicated. By law, it has included extensive public consultation, which commenced in August 2014 (Drakenstein Municipality, 2015). Public participation was not easy. Initially, municipal officials struggled to elicit any substantive input from the public. Despite this initial lack of interest, members of the local community did eventually respond by forming the Drakenstein Environmental Watch (DEW), a registered non-profit organisation, to oppose aspects of the project. DEW was specifically concerned about the use of a private contractor to deliver a municipal service: "this hazardous activity will in future be in the hands of an outside company intent on maximising its profits" (Drakenstein Municipality, 2015). The result was that the final stages of the SEIA have been counterproductive and have further delayed the project.

Despite all hurdles, municipal officials and political leaders have remained committed to seeing the project through. The financial benefit will be significant. The municipality undertook 'value for money' assessment the project, which contrasted a WTE PPP with conventional landfilling. For the 20-year lifespan of the project, it is anticipated that the municipality will save R632,118,612 (Drakenstein Municipality, 2015). To finance a new landfill or make use of facilities within CCT, consumer waste tariff increases of 41,3% and 30.5% would need to be implemented in the two years after the closure of the current site (Drakenstein Municipality, 2015). With the WTE solution, tariffs will only increase at an average rate of 9% per year. It is anticipated that the WTE will extend the lifespan of the current Wellington Landfill to 2035, by reducing landfilled waste by 52%, and later by 89%, once all four components are fully operational.

MBHE African Power (Pty) Ltd is managing the energy component of the project. In 2016, MBHE was awarded grant funding from the U.S. Trade and Development Agency (USTDA) to finance its work (USTDA, 2016). This grant is part of the USTDA's work to enable 30,000 MW of renewable energy capacity in Sub-Saharan Africa. The WTE facility, because it will not technically be a small-scale power plant (under 5MW), is potentially subject to more complex licensing procedures than the SSEG in CCT. As things stand, however, the municipality plans to use all the energy generated for 'own use' (street lights, waste water treatment works, administrative buildings, etc.), thereby possibly circumventing the requirement for a generation license over the short-term (Louw, 2016). This is because, according to municipal officials, the plant will not initially have the full 12.6MW of generation capacity available. The lag buys some time to structure an appropriate arrangement with NERSA to register as an IPP and seek a generation license under the Electricity Regulation Act (Louw, 2016; Republic of South Africa, 2006; Republic of South Africa Department of Energy, 2015).

3.6 Where do Municipalities Stand within the Current State of Play?

It is clear that for municipalities, both money and political power are at stake in the energy sector. Despite the difficulty of depending on Eskom's energy tariffs and internal management issues, the current municipal revenue model offers municipalities a degree of autonomy from national revenue collection and distribution, as well as a direct mechanism to respond to non-payment (cutting off supply). This autonomy goes towards explaining the determination of municipalities to preserve and transform their role in the energy sector. What is clear is that none of the existing policies and regulations anticipated how new technological options allowing for small and micro-scale electricity generation would shape and augment the role of local governments within energy sectors, internationally, and certainly not how they could do so in South Africa.

The CCT's slow and steady progress in terms of SSEG regulations and implementation development have been critical to the localisation of a small but significant proportion of electricity generation. A combination of local experimentation, lateral engagement with other municipalities and technical advisory bodies, and lobbying NERSA have resulted in unprecedented small-scale private renewable energy infrastructure development. The trajectory from the first legal non-pilot installation late in 2014 to more than 170 installations in 2016 is limited by local capacity constraints, as well as the uncertain national policy context (Jones, 2016a). Despite actions carried out within the province, these issues remain unclear, and the sustainability of work undertaken so far is still vulnerable to backtracking of NERSA's ad hoc support, as well as high-level licensing reform by the DoE.

Drakenstein's WTE plant is being implemented in the same unclear regulatory space as small-scale SSEG. While waste management is a clear municipal mandate, the planned WTE component of the municipality's solution will exceed the capacity of any existing municipal WTE infrastructure. The fact that the project is being pushed through, in advance of a clear electricity generation licensing plan seems to indicate a high level of confidence that the regulatory space for the plant to operate will be successfully navigated. While this project has not led to any new regulations, it has modelled how to, and how not to, navigate the complexities of financial and procurement regulations applicable to energy infrastructure. It has also succeeded in drawing international donor funds into a municipal level energy project. WCG is disseminating lessons from this process to other local governments. NMBM in the Eastern Cape is currently adjudicating bids for a similar project and opportunities for two other plants in the Western Cape are being considered (Mkosana, 2016).

On 16 December 2015, NERSA announced that its process to produce clear regulations for localised, embedded renewable energy generation was officially delayed by the DoE's newly initiated comprehensive review of licencing requirements for all energy generation. Because this framework will determine the parameters of the Small-Scale Regulations, they cannot be released until the DoE's process is complete. No timeline for completion has been provided (NERSA, 2015a). It was shortly after NERSA's announcement that the conflict between the municipalisation of a broader range of energy mandates and national priorities became clear. A ministerial determination for nuclear energy was published, immediately sparking vehement opposition from academia, civil society and from within government, from vocal municipalities and opposition parties in parliament (Eberhard, 2016; Ensor, 2016; Republic of South Africa Department of Minerals and Energy, 2015).

3.7 Concluding comments

The regulatory space for municipal facilitation of SSEG, as well as direct investment in small-scale renewable energy, remains unclear. Tracing the evolving role of municipal governments in the energy sector, and specifically in the Western Cape, has shown how this lack of clarity has maintained a space for municipal action to promote, enable, facilitate and invest in decentralised renewables. Reacting to the inadequacy of these existing policy and legal frameworks, seemingly ad hoc efforts undertaken by individual municipalities have exploited regulatory gaps to expand direct and indirect control of localised renewable energy. Rather than waiting for top-down instructions, a few entrepreneurial municipalities, of which CCT has played a leading role have been redefining the range of possible actions, as well as local regulatory frameworks, from the bottom up, as far as possible. Cumulatively, these measures have shaped some new political space and a precarious yet hitherto effective regulatory framework for further expansion of municipal power in this area. While this has allowed for some significant progress, it remains uncertain, vulnerable to dismantling under the DoE's new licencing conditions.

Nevertheless, the story does not end here, and municipal efforts continue. The fact that more municipalities are now following the same approach, and that they are working together through SALGA provides the best security against any pressure from actors within national government or Eskom to squash decentralised renewables. The extent of investment, all legal and sanctioned by NERSA, cannot be quickly scuppered without resulting in significant wasteful expenditure. This collective action, as well as framing SSEG and other decentralised renewables as a shared financial imperative presents a viable alternative to large Eskom-dominated investments in nuclear or more coal-fired power. What can be done now is to take stock of, group, and consolidate ad hoc actions – investments and regulations – so that they can be viewed as a coherent policy alternative to the thin Draft IRP 2016. Further support is also required for those smaller and less well-capacitated municipalities, to ensure that they are a part of this transition, and not left shouldering the burden of an increasingly indebted Eskom.

Municipalities have a body of evidence, through their implemented initiatives, to show that SSEG can work in South Africa. They also have the support of small and large businesses that have and plan to invest in SSEG. Together, municipalities and businesses can make a clear case to enable decentralised renewable energy in South Africa, and to remove uncertainty by clarifying the national policy and regulatory framework for this work. The success of these efforts depends on their interaction with entrenched interest networks in a highly centralised national energy sector. This is the substance of Chapter 4, which follows here.

4 Building an Alternative to South Africa's Nuclear Future, from the Ground up

4.1 Introduction

Between the significant expansion of nuclear power and renewable energy, respectively, South Africa is faced with two distinct strategies for the decarbonisation of its energy sector. While on the surface, they are not necessarily entirely mutually exclusive, they are in tension with one another. Chapter 3 argued that what looked like ad hoc, bottom-up municipal actions to promote localised renewable energy amount to an unexpected and still precarious expansion of the role of local governments in South Africa's energy sector. By examining the full spectrum of undertakings, as they grew in scope and ambition between 2008 and 2016, what becomes visible is a new force driving the country towards greater decentralisation of energy generation, planning and management. This chapter contextualises pertinent municipal actions to facilitate and invest in localised renewable energy from Chapter 3, within the broader policy shifts and investment decisions made during the same period, from 2008 to 2016. The aim of this contextualisation is to surface contrapuntal political and economic interests shaping the country's energy landscape in very different ways.

Municipally driven decentralisation provides a potentially complementary strategy to REIPPPP, which, while introducing some private ownership of energy generation, remains a highly centralised programme. While this is one possibility, it is also entirely possible that an expanded REIPPPP could function to the exclusion of greater municipalisation of the energy sector. For this reason, the expansion of REIPPPP is represented as Strategy 1 (S1), and REIPPPP plus expanded municipalisation is represented as Strategy 2 (S2) in in Figure 5.

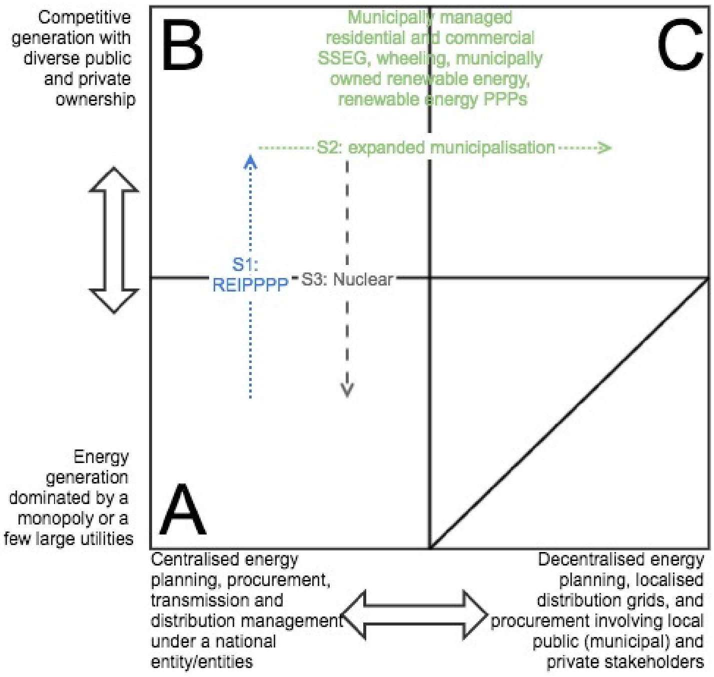

Figure 5: Tension between REIPPPP, municipalisation and nuclear procurement

What is clear, is that a large scale nuclear procurement programme (S3) runs contrary to REIPPPP (S1) and decentralised renewable energy (S2). A conflict arises because of the investment timescale (lasting several decades), and massive physical scale of infrastructure for nuclear power, is opposed to the diversity of technology and financial and ownership models for renewable energy, discussed in Chapter 2. What should be noted is that only S3, REIPPPP, is currently sanctioned in official national energy policy. Nuclear expansion remains in contradiction of the latest valid IRP, and municipalisation falls into a regulatory grey area.

What this chapter will illustrate, is how, despite rounds of white papers and integrated planning processes creating a formal and gradually expanded policy commitment to renewable energy generation at all scales from 1998 to 2008, the implementation of and preferred pathway for decarbonisation in South Africa remained highly contested throughout. Moving forward, distinct interest networks pushed for a nuclear expansion, first in parallel with renewable energy, then at its alternative, cloaked in a paper-thin discourse of national economic development. It will be argued, using process tracing, that between 2008 and 2014 the nuclear expansion lobby has been fortified by a nexus of financial interests that are embroiled with alleged networks of state capture. More critically, however, the particular events that followed between 2014 and 2016 point to the possibility of dislodging these nuclear interest networks, from the bottom-up. S3 can, therefore, be seen as a strategy to engage with renewable energy with a renewed, adequate response to the current technological and political landscape explored in Chapter 2.

4.2 Attempts to Introduce Renewables and Decentralisation: 1998-2008

As local energy distributors, municipal governments are embedded in a complex and often immutable set of institutional arrangements in the South African energy sector. Inherited by the ANC-led democratic government in 1994, it is composed of a highly centralised, dense configuration of actors and interests, which under apartheid was obscured by cloistered and opaque decision-making logics and processes. Ownership of energy related assets lay with Eskom, a state-owned monopoly that controlled every aspect of energy security, from generation to transmission, distribution and sale, all resistant to transparent governance processes (Public Affairs Research Institute, 2013).

In 1998, an ambitious technocratic policy reform was proposed in the White Paper on Energy, prescribing ‘good practice' solutions to untangle this political thicket and steer the country towards a modern sustainable energy system (Republic of South Africa Department of Minerals and Energy, 1998). For the purposes of this analysis, it is important to emphasise that the White Paper formally introduced decarbonisation[11]and aspects of decentralisation regarding generation only. It proposed separating transmission, distribution and generation functions. For the latter, it proposed introducing competition for the first time in the sector, prescribing the sale of some of Eskom's core assets (Republic of South Africa Department of Minerals and Energy, 1998).

It also proposed clear and transparent energy policy planning, which would be overseen by Cabinet and led by the governing department, then the Department of Minerals and Energy (DME). Transparent planning was antidote its observation that a "feature of the energy sector during the apartheid period was excessive secrecy, which made rational and public debate on energy policy nigh impossible" (Republic of South Africa Department of Minerals and Energy, 1998). The energy outlook and strategy for the country would explicitly support sustainable development goals for the young democracy. This White Paper provided a clear logic and imperative to fix inefficiencies in the system, to look to international 'good practice' for new models, and to find an alternative to the apartheid relic of Eskom's monopoly by introducing elements of competition and diversity of energy sources. While it proposed private sector involvement as well as renewables, it did not see the

[11] It notes: “South Africa is responsible for 1,6% of global greenhouse gas emissions and the country’s energy sector is the single largest source of greenhouse gas emissions in Africa, being dependent on coal for more than 75% of the country’s primary energy needs during 1997” (Republic of South Africa Department of Minerals and Energy, 1998).

municipalities as an integral part of the transition to this new, lower-carbon, configuration of infrastructure and actors.

From 1999, the DME, the national energy regulator (NER) and Eskom, did undertake various actions to implement various aspects of the White Paper, while publically denouncing its economic rationale (Public Affairs Research Institute, 2013). As these measures were unfolding, in the early 2000s, it was clear that the cheap and plentiful coal-fired energy provided almost exclusively by Eskom over the past three decades would not be adequate to meet the country's future growing demand (Public Affairs Research Institute, 2013). As plans to address a looming crisis were formulated, Eskom's prices began to increase sharply (Lucy Baker et al., 2015). It was in this context that the country's first multi-stakeholder National Integrated Resource Plan (NIRP) process was carried out between 2001 to 2002 by the NER. This plan provided a planning and investment roadmap, stating how much energy was needed, of what kind and by whom it would be generated. Under the DME's oversight, in 2003 a second white paper, the Renewable Energy White Paper, was approved by Cabinet (Eberhard et al., 2014). This second white paper gave more policy weight to the push for renewables by setting a target for the construction of 10,000GWh of renewable energy generation capacity by 2013 (Republic of South Africa Department of Minerals and Energy, 2003b).

The technocratic reforms proposed in both white papers did not anticipate the breadth and complexity of the challenge at hand, of coordinating the various efforts such varied stakeholders, including Eskom and the municipalities. As covered in Chapter 3, the municipalities successfully resisted the 1998 White Paper's electricity distribution industry (EDI) reform, until these efforts were finally abandoned in 2010. Still in 2003, the vigour of the 1998 White Paper plans to unbundle Eskom were tempered, with the state-owned company (SOC) claiming that this would undermine its financial viability (Public Affairs Research Institute, 2013). Organised labour also supported Eskom's continued monopoly, as these stakeholders believed privatisation would prompt escalating consumer prices. In response to pockets of resistance, different sets of reforms were reformulated in an attempt to make them more workable. Regarding private generation, a new plan targeted a 30% energy contribution from IPPs, representing a significant increase from only 6% of non-Eskom energy that was then in the mix. As the energy security outlook of the country worsened, rather than move forward with the establishment IPPs, in 2006, the DME and Energy granted Eskom a license to build Medupi, the first new coal-fired power station in more than two decades. It was set to be the largest in the world at 4,800MW.

In the same year, the NERSA began operating, absorbing the NER. NERSA had been established in terms of Section 3 of the National Energy Regulator Act, 2004 (Act No. 40 of 2004). NERSA takes its framework from the Electricity Regulation Act, 2006 (No. 4 of 2006), as amended by Act 28 of 2007, which sets out the parameters for determining the terms of electricity licensing and registration, generation, and distribution. It also oversees the following: energy pricing and tariffs; energy infrastructure; and any other regulatory reform. NERSA's mandates are critical to the municipal narrative because NERSA has been able to use its authority to enable the actions covered in Chapter 3 because of the scope of its mandate, for which it does not need to defer to the Department of Energy (DoE).

Another critical development during this time was the legal mechanism to procure privately owned renewable energy capacity. In terms of Section 34 (1) of the Electricity Regulation Act, the Minister of Energy, technically in consultation with NERSA, is empowered to make determinations for the procurement of new generation capacity. The Act also allows for the establishment of IPPs for the purpose of greater competition in electricity generation[12]. Further, these Ministerial Determinations may also make other specifications, in line with the Electricity Regulations on New Generation Capacity (published as GNR. 399 in Government Gazette No. 34262 dated 4 May 2011, as amended on 19 May 2015) (New Gen Regulations). Specifications include specifying the buyer (Eskom or other), and the procurement mechanism, for example, a bidding process for any new energy capacity (Republic of South Africa Department of Energy, 2015).

By 2007, the ageing and ailing infrastructure supplying electricity South Africa's growing economy failed to cope with demand. Eskom implemented controlled, localised blackouts termed "load shedding" to relieve stress on the national energy supply and grid infrastructure, and so avoid nationwide shutdowns. Despite the lights going out, as time passed, little was done to come close to reaching Renewable Energy White Paper target (Eberhard et al., 2014). Another renewable energy policy, Free Basic Alternative Energy Policy, for the delivery of renewable energy to low-income households, was added to the National Electrification Programme and Free Basic Electricity Policy (Department of Minerals and Energy, 2007). It was intended for municipalities to drive implementation. In terms of actual investments, however, in the midst of continued rolling blackouts, in 2008 procurement also commenced for Kusile, another coal-fired power station, also

[12] Ministerial Determinations are informed by the Electricity Regulations on New Generation Capacity (published 2011 and amended in 2015).

4,800MW in capacity. Both facilities flew in the face of environmental commitments undertaken by the national government, to reduce the carbon intensity of South Africa's economy, and address issues like acid rain (Rafey & Sovacool, 2011).

The cumulative result of the massive energy investments during this period was that the country's energy sector remained highly centralised in both the governance and procurement of energy and regarding generation and infrastructure management, with Eskom still a dominant power. This bold attempt at policy reform failed to be implemented, but the ideas it concretised, of decarbonisation and diluting Eskom's power, have been as enduring as contrapuntal movements against them.

4.3 Key role players and relationships for and against decentralisation

Globally and in South Africa, it is a high stakes game with significant financial resources changing hands. By 2009, South Africa's electricity market reached a record USD5.6 billion (Msimanga & Sebitosi, 2014). The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has generated a further R192 billion in investment, as of June 2015 (GreenCape, 2016d). It is not surprising that such significant investments have attracted powerful interest networks backing coal or renewables, respectively, and more recently, new nuclear capacity. There is tremendous potential for rent-seeking in the procurement of any of these energy sources that needs to be addressed in the design of procurement, as government opens and closes opportunities to invest with significant returns (Schmitz, Johnson, & Altenburg, 2015).

Determining this landscape, by controlling the scale and mechanism for energy procurement, are the Ministry of Energy, the Department of Energy[13], and Cabinet. Recent nuclear procurement plans reinforce the highly centralised configuration of the energy sector, also presenting rent-seeking opportunities on a scale that outstrips REIPPPP. The most commonly applied assessment for the construction costs for eight nuclear reactors with 9,600MW peak capacity stands (very conservatively) at USD40 billion to USD50 billion over six years (Yelland, 2016a).

The table below summarises the actors and actions in support of nuclear (S3), REIPPPP (S2), and greater municipalisation (S3). The ambivalence of some of these actors is also reflected. It is critical to note that coalitions within these organisations have also displayed contradistinct roles.

[13] The Department of Minerals and Energy was split in 2009, with the energy mandate falling to the Department of Energy, in line with National Energy Act (34 of 2008) (Department of Energy, n.d.-b; Republic of South Africa, 2008).

Table 7: Stakeholders for and against decentralisation

Actors	Position on Decentralised Renewable Energy: S1/S2/S3/Ambivalent	Key Actions
Ministry of Energy	S3: Driving a 9,600 MW nuclear procurement deal, contradicting formal energy policy	• 2011: Enabled REIPPPP through ministerial determinations for renewables • 2013: Undertook nuclear procurement planning • 2015: Issued determinations for both nuclear and renewable energy capacity • 2015: Established a national nuclear procurement programme • 2015: Redrafted nuclear determination to appoint Eskom as procurement agent
DoE	S3: The latest IRP has rolled back support for renewable energy, leaving a gap for a case to be made for nuclear	• 2010: Released a national IRP calling for renewables and nuclear • 2013: Released an updated IRP calling for decentralised energy, and delaying nuclear • 2015: Delayed NERSA's Small-Scale Relations, pending higher-level licensing reform • 2016: Developed a widely-criticised IRP that accommodates nuclear energy
Eskom	S3: Obstructing REIPPPP processes, leading procurement for nuclear	• 2015: Signed up as nuclear procurement agent (rather than DoE) • 2016: Chairman / CEO both state the SOC's position to oppose the connection of future REIPPPP projects to the national transmission grid • 2015-2016: Public support for nuclear in parliament and media
Cabinet/War Room	S3: Supporting an Eskom-centred approach to energy security, no public position on decentralised energy	• 2009: Zuma commits South Africa to voluntary carbon emissions reductions • 2014: Established War Room in response to Eskom's governance challenges, and the national energy crisis • 2014: Approved nuclear procurement deal • 2016: President announced support for nuclear on the condition of affordability • 2016: Nuclear procurement announced in Budget Speech
REIPPPP Office	S1, no public position on S2: Driven a successful renewable energy procurement programme	• 2011-2016: Successful implementation of REIPPPP in partnership with Treasury
Treasury	S1, some support for S2: PPP unit in support of REIPPPP	• 2011: Established REIPPPP programme through PPP unit • 2014-2016: City Support Programme worked with municipalities to address financial sustainability risks of decentralised energy
NERSA	Supportive of S1 and S2: The regulator has played a cautious role that has	• 2008-2016: Assisted municipalities on SSEG • 2010: Allowed first pilot projects

	validated municipal efforts under S2	• 2011: Issued first SSEG regulations – Standard Conditions up to 100kW • 2013: Issued a renewable energy trading license to PowerX • 2014: Issued first SSEG licenses up to 1MW in CCT • 2015: Issued draft Small-Scale Regulations in 2015
Municipalities (and SALGA)	S2: Driving localised energy generation and management	• 2008: Began to engage NERSA • 2010: Piloted SSEG in NMBM • 2011-2016: Initiated various SSEG projects (see Chapter 3) • 2011-2016: Enabled other renewable energy investments and wheeling agreements (See Chapter 3) • 2012-2014: SALGA played an active knowledge-sharing role • 2016: Wider uptake of local SSEG regulations
REIPPPP IPPs and PowerX	S1, and S2: Interest in securing current investments and expanding opportunities	• 2013: PowerX obtained a renewable energy trading license, engaging directly with energy consumers instead of Eskom • Several IPPs have communicated interest in working with municipalities

4.4 Process Tracing: Renewables Gain Ground 2008-2014

This section applies the process tracing methodology to surface tension between the promotion of nuclear procurement and both REIPPPP and municipalisation of renewable energy. This narrative draws on interviews, formal documents, and newspaper articles. By covering events between 2008 and 2016, it will show how nuclear procurement has sidelined local governments, national energy security policy and planning, and renewable energy of all scales. It will also illustrate how the municipal activities covered in Chapter 3 are opening a pathway around this nuclear mire.

4.4.1 President Zuma Promotes Decarbonisation

2008 was characterised by energy insecurity and continuing steep electricity tariff increases. It also saw the beginning of municipal engagement with NERSA on the possibility, potential and management of SSEG. In 2009 President Jacob Zuma committed the country to reduce greenhouse gas (GHG) emissions by 34% by 2020 and 42% by 2025 (Lucy Baker et al., 2015). Because 45% of these emissions are attributed to the energy sector, this committed represented a further policy push towards decarbonisation, even as Medupi and Kusile were developing. The options for decarbonisation were renewable energy (solar, wind, hydro, waste to energy) and nuclear. At this stage, given the country's ambitions for long-term economic growth, the energy intensity of its economy, and the long-term, relatively cheap, stable energy supplied by nuclear, it could be reasonably defended as part of the energy mix.

4.4.2 IRP 2010 charts a course towards a lower carbon energy mix

Nuclear was included in a twenty-year energy outlook and investment plan. The NIRP was replaced in 2010 by the DoE-led Integrated Energy Plan (IEP) and Integrated Resource Plan (IRP), which together, set the comprehensive energy agenda for the country. It is a multi-stakeholder undertaking to develop the designed to so that the DoE can fulfil its mandate to ensure energy security for South Africa in line with the National Energy Act (34 of 2008) (Republic of South Africa, 2008) [14]. Following Zuma's voluntary international commitment to constrain carbon emissions, the IRP 2010-2030 allocated capacity to both renewables and nuclear, based on assumptions for energy demand, technological development and relative technology costs.

The IRP process was meant to be regularly reviewed, in terms of the appropriateness of infrastructure, institutional arrangements in the energy sector, as well as the impact of global technological change (Republic of South Africa Department of Minerals and Energy, 1998). An update would not happen for another two years, but something more impactful than another policy document was introduced.

4.4.3 Renewable Energy is Finally Introduced

A highly skilled and effective programme office broke through the inertia to procure the first utility-scale renewable energy. The now internationally lauded REIPPPPP was established in 2011. REIPPPP is a highly successful procurement initiative, which is run from an office in the DOE with extensive involvement from National Treasury's PPP Unit (Eberhard et al., 2014). It has worked by coordinating an open competitive bidding process in response to Section 34 Ministerial Determinations, which stipulated DoE as the procurer and Eskom as the buyer of energy. IPPs that wanted to bid had to secure 'energy off-take agreements' with Eskom in advance of submitting their bids for consideration.

Small-scale renewable energy also got a boost in 2011. As covered in Chapter 3, NERSA, playing its legislated role, released the Standard Conditions to allow municipalities to connect SSEG under 100kW (covered in Chapter 3) (Government Technical Advisory Centre, 2015). Eskom was also tasked to investigate opportunities, and in consultation with NERSA, Eskom launched its IDM programme, to pilot off-grid and grid-tied small-scale renewable energy solutions for industrial and agricultural electricity consumers (Redelinghuys, 2012). While the Standard Conditions were

[14] Other pertinent legislation not covered here includes the Central Energy Fund Act, 1977 (Act No. 38 of 1977) and the National Environmental Management Act, 1998.

problematic, they evidence NERSA's tentative support for these small-scale technologies, as well as the financial concerns of local governments.

The centralised procurement of utility and some small-scale renewable energy pushed on. In March 2012, the first 79 bids were received by the REIPPPP office (Eberhard et al., 2014). Four more successive bid rounds were conducted (including Round 3.5) between 2012 and 2016. The programme has provided increasingly cost efficient energy generation, reflective of global renewable energy technology improvement and cost efficiencies (Msimanga & Sebitosi, 2014).

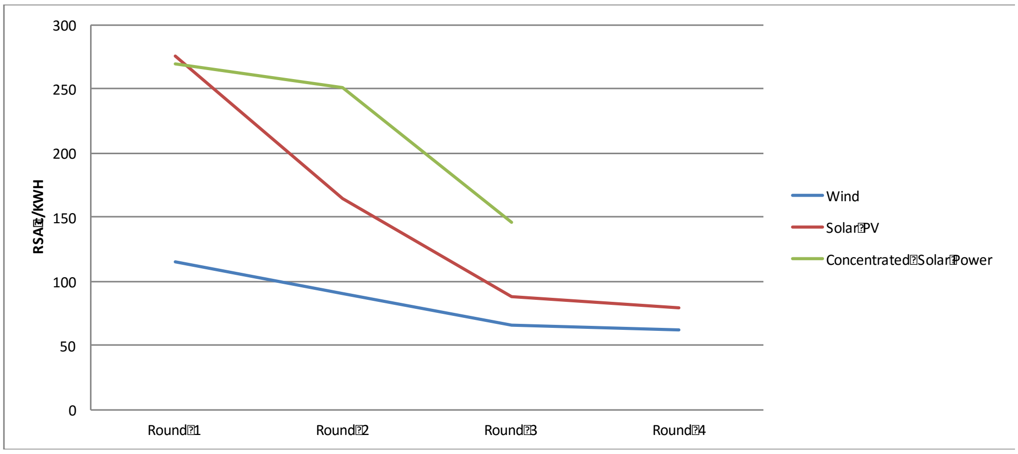

Figure 6: Year on year decreases in the cost of renewables. Data Source: GreenCape, 2015

REIPPPP introduced some diversity of ownership of energy generation capacity, but it did not seriously challenge the structure of the sector. The power to determine the scale and power source, and control the procurement strategy and off-take agreements, was still limited to the Minister of Energy. These decisions were certainly far out of reach of local governments. IPPs can only sell their electricity directly to Eskom, which is required to develop a take-off agreement (purchasing contract) with each IPP even before they are allowed to bid for the right to generate electricity. Consequently, the success of the programme was hinged on Eskom's willingness and ability to enable connection to the national transmission grid. Because Eskom serves as intermediary and gatekeeper, the REIPPPP's cost savings over time have been internalised in its complex accounting system, covering its many different functions.

Eskom's hold on REIPPPP began to show signs of shifting in 2013, however. NERSA awarded PowerX (then Amatola Green Power) an energy trader license, allowing it to buy electricity from IPPs and sell this on to consumers. Nelson Mandela Bay Municipality (NMBM) signed a 15-year 'wheeling' agreement with PowerX, allowing it to play this role within its boundary, using the local distribution grid to transport this electricity (ICLEI, 2015). The practice remained limited to just NMBM, with other metros uncertain of the regulatory implications. Still, an alternative to Eskom's procurement role was established.

4.4.4 Decentralised renewables: a path of least regret

In the same year, the policy context for decentralised energy got another boost when the updated IRP 2013 was released. After more than five years of municipal work on SSEG, and following the publication of the Standard Conditions, SSEG was now incorporated into official energy policy. The IRP 2013 sought to respond to an increasingly uncertain energy outlook, with significant decreases in projected energy demand, linked to increasing energy efficiency driven by price increases[15]. It did so by emphasising the need for adaptive energy investments, so as not to lock the country into a path that it could not afford to correct in time. Consequently, the case that had been made for nuclear was waning. SSEG through rooftop solar PV was specifically proposed as a less risky alternative to a massive public investment in new nuclear generation, planned back in 2010. SSEG was proposed as providing a "path of least regret" in an uncertain context (Republic of South Africa Department of Energy, 2013).

Also in 2013, the DoE initiated a New Generation Capacity IPP Procurement Programme for 100MW of capacity from SSEG, limited to systems between 1MW and 5MW. The programme left smaller systems unregulated, and providing a space for bottom-up municipal policy and regulatory development, undertaken in partnership with NERSA (see Chapter 3) (Department of Energy, n.d.-a).

4.4.5 Plans go nuclear

Official policies continued to promote renewables, and gradually to incorporate not only centrally procured and managed infrastructure but also municipally managed infrastructure. At this point, nuclear energy made a re-entry. In 2013, representatives of the South African Cabinet were officially engaging Russia to establish an international nuclear procurement deal, in the same year that the IRP update advised against making a decision on whether or not the expand nuclear capacity (Thamm, 2016). Negotiations with the Russian government and possible service

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[15] The IRP forecasts national energy demand for 2030 within a range of 345,000-416,000 GWh. This range represents an 8.4% to 24% decrease from the 2010 forecast of 454,000 GWh for 2030, made just three years earlier. To meet demand, the updated IRP sets a target of 61,200MW (down from 67,800MW) of reliable peak generation capacity (capacity that must function securely at points of highest demand).

providers continued despite public opposition to nuclear, and with no engagement with this objection.

By 2014, media reports were already alleging that rent-seeking and patronage were shaping the nuclear agenda. Harold Winkler of the Energy Research Centre at the University of Cape Town questioned: "Will it be based on the best available information or on the basis of geo-political relations with Russia, China and France?" (Kings, 2014). Also in 2014, reports were released claiming Zuma had made a deal at a BRICS meeting in Brazil, issuing an instruction for Minister Tina Joemat-Pettersson to establish a 9,600MW procurement programme to engage with Russia, exclusively (Qaanitah Hunter & Lionel Faull, 2014). The procurement programme was confirmed in a joint statement by the DoE and Russia's state-owned nuclear company, Rosatom.

4.5 Process Tracing: Nuclear in Conflict with Renewables 2014-2016

4.5.1 Municipal energy expands under the radar

From 2014, municipal activities in localised energy began to accelerate. With NERSA's ad hoc approval at every stage, the first commercial solar installations commenced in Cape Town. NERSA's Standard Conditions no longer defined the scope of legitimate projects. Seven metropolitan municipalities and five local municipalities participated in workshops hosted by AMEU, SALGA, ESKOM and GIZ over the next two years to share knowledge and develop local regulatory frameworks and financial mechanisms. The SALGA national executive committee (NEC) approved a metering concept that was delivered to NERSA. The concept informed the development of the draft Small-Scale Regulations through to 2015. The Small-Scale Regulations would formalise the emergent role for local governments in energy planning and facilitation, as well as managing revenue impacts through fee and tariff structures. NERSA was not wrong to act in line with the IRP, but the team that was pushing for these regulations was wrong in assuming that all stakeholders were working for the same outcome. Despite a clear policy directive, NERSA's attempts at clarifying SSEG were side-lined.

4.5.2 The War Room responds to Eskom's shortcomings

Oblivious to local government progress, and while nuclear continued to proceed covertly, what was happening in the public sphere was the establishment of the "War Room" by the Presidency in December 2014. Its purpose was to urgently address the energy security crisis and governance failures in Eskom in South Africa (Lucy Baker et al., 2015). The War Room is a government sub-committee that falls under Cabinet's Inter-Ministerial Committee on Energy, chaired by Deputy President, Cyril Ramaphosa. The War Room is co-chaired by the Minister of Energy and Minister of Public Enterprises, Lynne Brown. This structure is meant to cut across organisational and policy silos, ensuring collaboration between the Departments of Public Enterprises, Energy, National Treasury, Cooperative Governance and Traditional Affairs, Economic Development, Mineral Resources and Trade and Industry.

The War Room's focus has been rescuing Eskom from its internal mismanagement. It has been widely criticised for its lack of transparency, lack of regard for the IRP and blindness to global decentralised renewable technological innovation with its potentially broad economic benefit (Fakir, 2015; Pollet, Staffell, & Adamson, 2015). The energy crisis was used to frame a narrative to legitimise the emergency '5-Point Energy Plan' premised on centralised control of the sector. Previously powerful stakeholders have reportedly been excluded from decision-making concerning this plan. Excluded stakeholders include the unions, civil society and key renewable energy actors from decision-making processes.

During this time, Eskom also expanded into utility-scale renewable investments. The 100MW Sere wind farm and a 100MW concentrated solar power (CSP) plant were funded predominantly through World Bank and African Development Bank loans (Eberhard et al., 2014). The SOC has been granted 300MW Kleinzee Wind Farm in the Nama Khoi Local Municipality in the Northern Cape. Additional wind farms are being planned in the Western and Eastern Cape (Eskom Holdings SOC Ltd, 2016).

4.5.3 NERSA's regulations are scuppered

As covered in the previous chapter, NERSA's May 2015 deadline for developing the Small-Scale Regulations was pushed out, until the regulations were finally indefinitely suspended on 16 December 2015. The DoE's role in this suspension was revealed when it was announced that all licencing conditions for energy generation were under review. The DoE's actions have limited NERSA's role to the ad hoc approvals and advisory support for municipalities, which were left to develop regulations, from the bottom up.

REIPPPP's success continued to be supported, however. The Minister went on to issue a Section 34 Determination for a further 6,300MW of renewable energy capacity on 18 August 2015 (Govender, 2015).

4.5.4 Friction mounts over nuclear in the National Executive Council (NEC)

It has emerged that within the NEC itself there was not agreement on the nuclear programme. In fact, tensions arising with the Ministry of Finance have been particularly prominent. Then Minister of Finance, Nhlanhla Nene, was fired on 9 December 2015, just hours after Cabinet approved the nuclear procurement programme that Nene had suggested was unaffordable (Gosam, 2017).

In direct contradiction with the IRP 2013, and with no updated alternative plan in place, on 21 December 2015, a ministerial determination called for 9600MW of additional nuclear capacity in line with the IRP 2010-2030 (Republic of South Africa Department of Minerals and Energy, 2015). Following this, the new Minister of Finance, Pravin Gordhan[16], announced in the budget speech 2016, that the success of REIPPPP would be replicated in a procurement programme for nuclear energy[17]with funds already set aside to enable this procurement (Republic of South Africa National Treasury, 2016). The new Minister continued to question the project's affordability, however, and committed to supporting or opposing the deal on these grounds alone.

Several credible research agencies, together with the DoE's own previously communicated analysis and policies, suggest nuclear capacity is unnecessary. The question of affordability also continues to be contested, with the Ministry and Eskom arguing in favour, and opposition political parties, academics and civil society arguing against (Eberhard, 2016; Ensor, 2016; Yelland, 2016a). The CSIR, a publically funded research body, released a report comparing the relative cost of new energy generation for wind, solar, coal and nuclear. The cost of a new nuclear build is expected to even out to R1,30/kWh, more expensive than new solar, wind and coal (CSIR, 2016; Yelland, 2016a). For renewables, this assessment takes required natural gas peaking power requirements to compensate for intermittency into account.

While the uptake of small-scale PV was quietly ignored by national government, media reports from 31 March and 4 April 2016 disclosed proof of covert Cabinet-level negotiations to buy a fleet of six Russian nuclear reactors. This deal allegedly falls outside of conventional procurement processes and in possible contravention of Constitutional due process (Paton, 2016; Thamm, 2016). Further evidencing the insularity of decision-making for the energy sector, it was revealed in March 2016, that Minister Joemat-Pettersson deliberately ignored legal advice that the nuclear deal in question required tabling under Section 231.2 of the Constitution, which prescribed public participation and parliamentary approval because of its long-term fiscal implications (Thamm,

[16] David van Rooyen, a public servant with a reputation for bad performance was briefly installed by Zuma, but this was widely opposed (Gosam, 2017).
[17] Processes are also underway to procure independent power from other sources, including coal, cogeneration and gas, as well an embedded generation programme for rooftop solar photovoltaics (PV) (Lucy Baker et al., 2015).

2016). The nuclear procurement deal was challenged by two civil society organisations, EarthLife Africa and Southern African Faith Communities Environment Institute, in the Western Cape High Court. The respondents include the Minister of Energy, the President, NERSA, and representatives from Parliament.

4.5.5 Eskom undermines REIPPPP

While a nuclear deal was being designed out of sight, both REIPPPP and localised renewable energy were allowed to continue. This apparent support or at least tolerance for the programme shifted when Eskom caused major controversy in 2016. Brian Molefe's (then Chief Executive), correspondence was leaked, communicating the SOC's refusal to connect more (already planned and approved) renewable IPPs to the transmission grid (Creamer, 2016). Since this revelation in July 2016, Eskom's pro-nuclear stance has been vehemently reinforced, with the utility being one of the Minister's few vocal supporters of nuclear expansion. By October 2016, not the DoE, nor the Minister, nor Eskom had provided any concrete information to explain why South Africa needs nuclear energy.

In December, it was announced that Eskom would be the official procurement agent for nuclear power, which it would own, operate, and finance through further significant international borrowing. This was despite its already dire financial situation[18] (Eskom Media Desk, 2016). What this meant was that the original determination, which was the subject of the High Court challenge, had changed. The Minister had delivered this new evidence minutes before the case was set to commence. The High Court ordered that the Minister pay punitive costs and the case was postponed to February 2017 (Groundup, 2016).

4.5.6 A story of state capture

As the set of relationships around the nuclear deal have become clearer, so its promotion of private interests that deviate from public objectives have too (Rennkamp & Bhuyan, 2016). The nuclear procurement programme, conservatively estimated to cost USD50 billion, with the unlikely caveat that the build runs on schedule and nothing goes wrong, has been linked back to issues of state capture along two channels. The Public Protector's recent report on state capture, titled "State of Capture" connects Eskom's pro-nuclear ex-CEO Molefe with President Zuma and a

[18] In addition to its debt of approximately $300 billion, in 2015, a funding gap of R225 billion for planned work over the following five years, was identified (OECD, 2015a). In the same year, Standard & Poor's downgraded Eskom's credit rating to junk, citing poor management, rising costs, and inadequate support from the government (Lucy Baker et al., 2015).

network of actors, allegedly using public funds to pursue private benefit. These actors are linked to coal mining interests belonging to the Gupta family, now synonymous with the phrase ‘state capture' in South Africa (Public Protector of South Africa, 2016). Since Molefe’s resignation, further allegations of links between the nuclear deal, and networks of patronage emerging around Zuma, and connected to the Gupta family again (through uranium interests) have been reported in the media (Gosam, 2017).

4.5.7 Erasing the map, redefining the territory: IRP 2016

The gradual lack of support for renewable energy underpins an attempt to create some vaguely credible energy demand and affordability case for nuclear procurement. The IRP that sanctioned renewable energy generation at all scales has finally been updated. Following Cabinet's approval on 2 November 2016, the "Integrated Resource Plan Update" (hereafter Draft IRP 2016) and updated IEP were both released for public comment (Joemat-Petersson, 2016; Republic of South Africa Department of Energy, 2016). The Draft IRP 2016 rolls back its support for SSEG, places technology constraints on possible energy generated from renewable sources, and applies highly contested technology costs in its assessment (Republic of South Africa Department of and Energy, 2016; Yelland, 2016b). The cost of nuclear energy, in particular, is derived using a wildly out of date Rand to Dollar exchange rate of $1,00 = R11,55 (EPRI, 2015).

Initially, the Draft IRP 2016 included references to several appended schedules providing detail on the assumptions and data for the assessment of an energy "base case" from which several possible scenarios and policy recommendations are to be developed. These schedules were never provided. Instead, upon discovery of this oversight, a revised document with all references to detailed information removed, was published. A series of opportunities for input has commenced, which, according to this document, will culminate in the new official energy outlook and policy being released in March 2017.

4.6 Concluding comments

While nuclear procurement and renewables were part of the same coherent energy policy for South Africa in 2010, the country's economic growth, energy pricing, and technology options shifted so much between then and 2016, that this is no longer the case. This was already apparent in 2013. The economic case for renewable energy in South Africa has been growing stronger, in part because of the success of REIPPPP, which introduced successful, centrally managed renewable energy through an internationally lauded procurement programme. This programme has not seriously challenged the structure of the energy sector, however. While it has introduced some new private investment and ownership, planning and procurement (the programme's viability) lie with the Ministry. It is clear that the Minister's and Eskom's support for nuclear are part of a covert procurement process that goes back to 2013, with links to 'state capture' networks. While rent-seeking is certainly possible with any energy procurement, whether renewable or nuclear, this deal's scale of economic impact on South Africa's economy is cause for urgent action.

REIPPPP presents an alternative to nuclear, but because it is centrally managed, it remains vulnerable to a direct conflict with nuclear, as demonstrated by Eskom's announcements of 2016. As municipalities grow their legitimacy in the energy sector, expanding their mandate and power, REIPPPP can build its resilience by diversifying energy procurement points. The City of Cape Town (CCT) Mayor Patricia de Lille announced in January 2017 that the City was prepared to take the Minister to court over the right to purchase energy directly from IPPs, without having to go through Eskom (Evans, 2016). The announcement was made at the opening of a new waste to energy plant. Direct procurement from IPPs is one step further than NMBM working through PowerX, and it presents a new strategy to drive renewables, illustrated below.

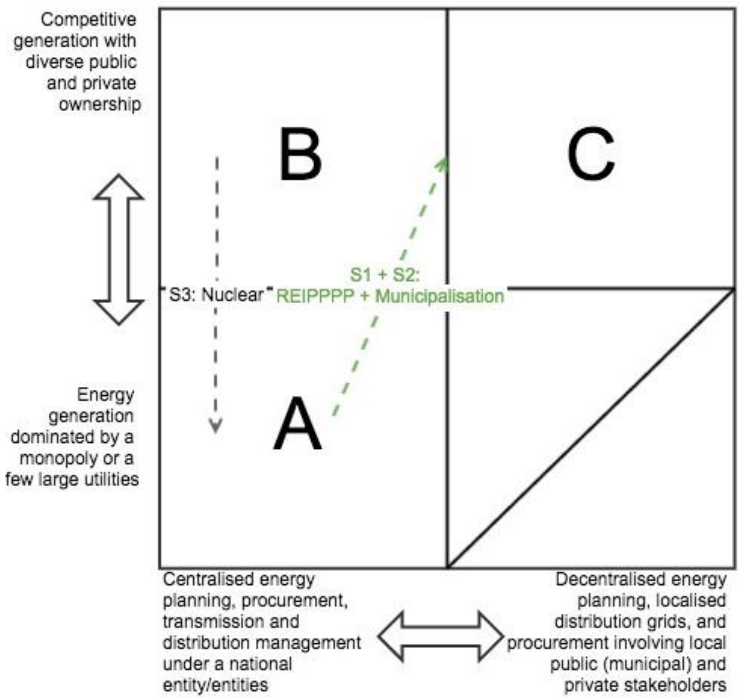

Figure 7: Contested pathways for South Africa's Energy Future

While individual municipal challenges to the Minister's control presents an opportunity to break through the pro-nuclear logjam at a national level, it still does not solve the issue of sustainable, affordable and equitable management of decentralised renewables, raised in the previous two chapters. The challenges for decentralisation require focused attention, as well as adequate policy and investment.

5 Conclusion: The Contest for a Secure, Low-Carbon, Energy Future

When the research for this paper commenced in January 2016, two critical events had just occurred. The first was that NERSA's much-awaited regulations, *Small-Scale Embedded Energy Regulatory Rules for energy systems up to 1MVA*, providing a potential coherent national regulatory framework for the local management of decentralised renewable energy, were suspended. The suspension was put in place, pending the release of new generation licensing conditions by the DoE (NERSA, 2015a). By February 2017, the DoE's licensing framework has still not materialised. The second event was the announcement of a ministerial determination for 9,600 MW of new nuclear energy generation, officially starting an infrastructure procurement process (Republic of South Africa Department of Minerals and Energy, 2015).

While this research was undertaken, over the course of 2016, the relationship between these events became clearer. Both were signals, gesturing to the respective directions in which the South African energy sector was being driven. The nuclear procurement programme that is still unfolding is a commitment to a centralised configuration of infrastructure ownership and energy planning, procurement and management. At the same time, however, municipal governments are responding to global and local trends, new technology and existing policy, to develop energy planning, policies, investments and regulations that would lead the sector towards greater decentralisation. Understood together, the two framing events suggest that the evolution of South Africa's energy sector has reached a critical point, a kind of aporia from which it is not clear which way it will go. It was this aporia that gave rise to the hypothesis:

H1: Municipal policy, regulations, investments and facilitation are creating a bottom-up alternative to South Africa's highly centralised energy sector, in which energy planning, procurement, generation, transmission, and a proportion of the distribution, are all determined through centralised institutional configurations.

After contextualising South African municipalities' efforts within a broader global context of decentralisation of energy sectors through the uptake of renewable energy technologies in Chapter 2, this hypothesis was tested by applying a process tracing methodology to municipal activities and related outcomes between 2008 and 2016 in Chapter 3. Attention was directed at two case studies, the City of Cape Town (CCT) and Drakenstein Municipality, respectively, in the Western Cape. It was shown how entrepreneurial civil servants, within CCT in particular, and other municipalities, slowly carved out technical, financial and policy responses to enable direct investment in, and facilitation of, localised renewable energy generation and management. Despite a national regulatory grey area, an initial cohort of municipalities, two in 2008, growing to 13 by 2012, have worked independently and in partnership, to redefine their role in the energy sector, from the bottom up.

On its own, Chapter 3 affirms the hypothesis, H1, as correct. Cumulatively, over eight years and across a growing number of local governments, municipal governments have implemented a small but significant amount of legal decentralised renewable energy generation and consumption. NERSA's ad hoc input, approvals and licensing have been critical to the success of these efforts, leading to an expanding legally mandated role for municipal governments in the energy sector by 2016.

Returning to the original two events that sparked this inquiry, it was necessary to probe more carefully, to question to the viability of this bottom-up disruption of the increasingly insular national, determination of the country's energy sector. For this purpose, a second hypothesis was formulated, as a supplement to the first:

H2: The development of a top-down nuclear procurement programme is crowding out any space for the development of decentralised renewable energy.

To test this hypothesis, it was useful to juxtapose nuclear with not only small-scale renewable energy but also with REIPPPP, as examples of distinct but not mutually exclusive strategies to secure an increasing share of renewables as the primary driver of decarbonisation of the energy sector. Many municipalities in the Western Cape, as well as Nelson Mandela Bay and others, have been vocal in their enthusiasm for REIPPPP. By tracing the top-down (national) and bottom-up (municipal) processes leading up to and surrounding the establishment of a nuclear procurement programme, it became clear that stakeholders driving this deal were increasingly positioned in tension with REIPPPP. The tension was most blatantly demonstrated by Eskom's leadership in 2016. While ardently promoting nuclear as a long-term affordable investment (without evidence), Eskom's Chairperson and ex-CEO both questioned and actively delayed REIPPPP's processes (Creamer, 2016). In 2010, Nuclear and renewable energy had made sense as part of the same national strategy to achieve decarbonisation and energy security. In 2016, however, as pointed out by critics of the nuclear deal, pro-nuclear actors, and the IRP 2013 and Draft IRP 2016, this was no longer the case (Eberhard, 2016; Republic of South Africa Department of and Energy, 2016;

Yelland, 2016a, 2016b). The advancement of a nuclear procurement programme was indeed set to undermine further implementation of REIPPPP, and bottom-up municipally driven renewable energy proliferation.

The story does not end there, however, because nuclear procurement is by no means, a done deal. Municipalities' plans for localised renewable energy are not limited to only small-scale commercial, residential or municipal embedded energy. Already, a growing area of energy procurement and facilitation is bringing the REIPPPP programme and its small and utility scale projects closer to the municipal push for expanding local agency in energy matters. Chapter 3 outlines those relationships that are both possible and being pursued, most notably, the NERSA-approved licencing of PowerX as an energy trader, allowed to operate by Nelson Mandela Bay, within its boundaries. This kind of relationship means that REIPPPP is less vulnerable to any challenges from Eskom because IPPs can engage directly with consumers that demand its greener, cheaper electricity. It also means that municipalities have a wider range of options at larger scales to shape local energy security, without having to establish complex procurement deals and vet suppliers themselves.

The potential for REIPPPP and municipalisation to work together as a coherent strategy to ensure the continuation of renewable energy investment as the main lever for energy security and decarbonisation was given another boost early in 2017. Although it falls outside of the scope of the initial period of investigation (2008-2016), it is extremely relevant. This fortification came in the form of an announcement by the Mayor of the City of Cape Town, stating that the City would be challenging the Ministry of Energy in court, over the right to procure energy directly from REIPPPP IPPs, circumventing Eskom as well as PowerX (Evans, 2016).

The scope of municipal efforts documented in Chapter 3 affirms that, while nuclear is a countervailing force to the proliferation of renewable energy driven from national and municipal levels, it is not entirely crowding out these investments and opportunities. Even within the broader context of contestation explored in Chapter 4, the first hypothesis seems to hold. The current configuration remains precarious, still unsanctioned by national level NERSA regulations. The process of public participation to finalise the Draft IRP 2016 may work to undermine renewables in favour of nuclear. However, it could also quite feasibly open the nuclear process to yet more opposition, rendering it unable to maintain its thin veneer of pro-economic development discourse.

It is clear that traditional national institutions (the Ministry, DoE, Cabinet, Eskom), as well as municipalities, have and are using their power to shape South Africa's energy system in different and conflicting ways. If the country implements these strategies concurrently, it risks (as pointed out in the 2013 IRP Update) the burden of an unaffordable, overcapitalised, inefficient infrastructure network (Republic of South Africa Department of Energy, 2013). As pointed out in Chapter 2 and Chapter 3, an optimal implementation of any degree of decentralised energy requires a coordinated response with adequate bottom-up and top-down policy and investment to mitigate the risks associated with this process. If municipalities proceed without coordination and appropriate national-level engagement with the risks and trade-offs that will emerge, the system as a whole will suffer. The most vulnerable households, neighbourhoods, towns and cities will suffer first and most. The pursuit of nuclear energy comes with its particular risks, as noted in the DoE's planning. It also presents governance and corruption risks that continue to surface as the "State of Capture" report is reinforced with a growing body of evidence of widespread corruption implicating Eskom and others. Credible research published by the CSIR and others, as covered in Chapters 2, 3 and 4, suggests that this a coherent, national decarbonisation and energy security strategy, premised on a transition to a mix of renewable energy investments, both centrally and municipally managed, could feasibly be pursued. As things stand, however, it is not possible to predict either the duration or the outcome of the uncertainty that now characterises South Africa's energy sector.

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