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Post-apartheid electricity policy and the emergence of South Africa's renewable energy sector

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Abstract: This paper situates South Africa's new renewable energy sector within the context of the country's electricity system and in turn its unique political economy. I chart major developments in the country's energy policy and governance since the end of apartheid and show how electricity policy is determined by economic, political, and technological factors. I examine the contested negotiation of key policies, which have been fundamental to the introduction of a renewable energy sector. I consider how the new renewable energy sector has evolved thus far and raise key challenges and concerns for its future development.

Keywords: South Africa, electricity, renewable energy, political economy, policy
JEL classification: O38, Q28, Q48

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1 Introduction

Recent developments in coal-dependent, carbon-intensive South Africa's electricity sector present something of a paradox. On the one hand, the country is now a leading destination for investment in renewable energy, scoring twelfth in Ernst and Young's latest Renewable Energy Country Attractiveness Index (RECAI 2015). Since the country's Renewable Energy Independent Power Producers' Programme (RE IPPPP) was launched in 2011, nearly 6,327 MW and 92 projects have been approved, of which almost one-third were connected to the grid by October 2015, constituting approximately two per cent of overall capacity (CSIR 2015). RE IPPPP is held up as an international model for the procurement of utility-scale renewable energy (Eberhard et al. 2014). In reflection of global trends, since mid-2015 solar photovoltaic (PV) and wind technologies have become cost competitive with South Africa's new build coal-fired power plants.

On the other hand, large-scale renewable electricity generated by independent power producers (IPPs) is feeding into a grid otherwise controlled by the state-owned monopoly utility, Eskom, which has depended almost entirely on abundant sources of historically low cost coal and generated 90 per cent of the country's electricity to date. This carbon-intensive electricity sector accounts for 45 per cent of national carbon emissions (237 Mt CO_2-equivalent in 2010). While Eskom continues to build more coal-fired power plants, it is also experiencing a financial and supply-side crisis, the culmination of events over decades. The most recent symptoms of this crisis include load shedding in 2006 and 2008, and regularly since late 2014. Described as a 'monster of apartheid',[1] Eskom is now subject to growing indebtedness and received a negative outlook for its credit rating in November 2015. Meanwhile, a highly controversial 9.6 GW nuclear fleet is being pushed by the Presidency and explorations are under way for the extraction of shale gas.

In light of these competing parallel narratives, this paper asks how, why, and when South Africa's renewable electricity sector has emerged, and considers potential challenges for its future development. Focusing on shifts that have taken place in the country's electricity governance and policy-making from a period of generation surplus[2] in 1980s to the supply-side constraints of the present, the paper builds on earlier studies of South Africa's electricity policy (Pegels 2010; Baker et al. 2014; and Eberhard et al. 2014,) and provides an up to date analysis of complex and constantly evolving developments. The paper includes an examination of two key developments, the Renewable Energy Independent Power Producers' Procurement Programme (RE IPPPP) and the Integrated Resource Plan for Electricity (IRP), both launched in 2011. In addition to enabling the emergence of a renewable electricity sector, these two mechanisms were carried out under relatively transparent and participatory planning and procurement processes when compared to the secretive nature of decision-making in electricity and other sectors during the apartheid-era.

In theoretical terms, this paper develops the notion of a political economy of electricity policy, in order to understand how political and economic power and networks operating over and within South Africa's electricity sector are enforced by and enmeshed with technological factors. This in

[1] By government member, in interview, May 2010, anonymous.

[2] Note that 'surplus capacity' is a technical term that fails to account for the social reality that until 1993, only one-third of the population was connected to the grid.

turn has implications for the nature of the policy process as non-linear, complex, and inherently political (Keeley and Scoones 2003). The framework builds on previous contributions that link political economy with socio-technical transitions[3] in relation to South Africa's electricity sector (Baker 2014, 2016). In doing so, critical overlaps are identified between approaches from socio-technical transitions and political economy. The framework is informed by the concept of the minerals-energy complex (Fine and Rustomjee 1996), which offers both a theoretical perspective on South Africa's political economy, as well as a description of its unique system of accumulation.

The paper is based on long-standing and extensive original field research on the political economy of South Africa's electricity sector. This includes primary data gathered in approximately 50 semi-structured interviews between 2010 and 2015 conducted with: members of the energy industry (electricity, coal, and renewables); energy intensive users; government departments involved in electricity policy; the National Energy Regulator of South Africa (NERSA); the utility Eskom; banks and financial institutions; research institutes; and civil society. The research is also informed by an in depth content analysis of grey literature, such as national policies and publications by government and industry, and a long-term and systematic consultation of media sources on energy in South Africa and globally, including: *Engineering News*, *Mining Weekly,* and *ESI Africa*. Given the breadth, complexity, and fast moving nature of the subject matter, the research inevitably contains some empirical gaps.

The structure of this paper is as follows. Section 2 puts forward an analytical framework for the political economy of electricity policy. Section 3 explores the key features of the MEC and recent shifts within it, particularly in the electricity sector and the current crisis. Section 4 provides a longer-term perspective on the governance and structure of Eskom. Section 5 explores the nature of post-apartheid policy-making and significant changes that have taken place since 1980s, particularly as regards the role of the Department of Energy (DoE) and other entities that undertake activities in its name. Section 6 examines the negotiation of the Integrated Resource Plan (IRP) for electricity, the country's first process for electricity planning and how its latest revision has since stalled over the controversial issue of nuclear power. Section 7 explores the emergence of the renewable energy independent power producers' procurement programme (RE IPPPP), which is followed in Section 8 with an examination of key challenges for the new renewable energy industry. Section 9 concludes.

2 Towards a political economy of electricity policy

As this paper demonstrates, technology and economics are insufficient for an analysis of electricity policy, and therefore, 'politics- or the political economy, with its focus on actors and decision-makers, on institutions and regulations, and on past and present interactions-must be included' (Moe 2010: 1731). Here, the notion of a political economy of electricity policy incorporates concepts from socio-technical transitions, a wide-ranging literature, which draws originally from evolutionary economics (Dosi 1982), the sociology of technology (Hughes 1983; Rip and Kemp 1998), and more recently political science and theories of governance (Meadowcroft 2011). Specifically, this paper's approach follows Smith and Stirling (2007), who see technologies within a socio-technical system as embedded within complex socio-political and economic networks.

[3] Specifically the multi-level perspective (MLP) (Geels and Schot 2007).

While political economy provides valuable tools with which to analyse networks and institutions of economic and political power, socio-technical transitions conceptualizes technological change as unpredictable, long-term, and involving complex interactions between different actors (Elzen et al. 2004). The literature therefore overlaps in their understanding that for any transition—political, economic, or technological—to take place, changes must take place at the level of supply and demand. Specifically, the term 'transitions' is central to both socio-technical transitions and political economy. For the latter it refers to South Africa's post-apartheid socio-economic and political transition and the on-going struggle to uphold principles of justice and democracy (Michie and Padayachee 1997). For the former it refers to low carbon technological and societal shifts in response to the challenges of climate change mitigation and environmental sustainability. A number of other parallels can be identified between these two approaches: both place emphasis on linkages between developments, institutions, and actors at multiple levels; both talk about the need to revise and reconfigure structural changes and relationships, be that in technology, infrastructure, politics, economics, or institutions for any transition to take place (Rip and Kemp 1998); and both underline the importance of a historical understanding e.g. Hughes (1983: 2); Freeman and Louçã (2001: 48); Elzen et al. (2004); and Milonakis and Fine (2009).

A political economy of electricity policy is therefore necessarily context specific, understood via a localized exploration that includes political, economic, technological, and social complexities, institutional architecture, infrastructural and industrial development, comparative technological advantage, and geophysical factors (Rip and Kemp 1998). It allows for the consideration of historical power relations, the role of vested interests and key networks, and complex relationships between political and economic institutions and state and non-state actors involved in electricity governance. Given the path dependent nature of electricity, there are substantial challenges to any potential reorientation (Unruh 2002) and therefore any socio-technical transition will require fundamental shifts in technological development, policies, and infrastructure (Freeman and Perez 1988).

With such factors in mind, this framework challenges conceptions of the policy process and policy-making as objective and linear. Rather, as Ham and Hill (1993: 21) assert, 'the effectiveness of policies and policy-making processes cannot be assessed independently of analysis of the distribution of economic and political power within political systems'. The policy process therefore involves a multitude of actors in the public and private spheres as well as changes, incremental adjustments, or changes of direction. As Keeley and Scoones (2003: 22) elaborate, '…in practice, policies generally consist of a broad course of action (or inaction for that matter; see Smith 1976) or a web of interrelated decisions that evolve over time during the process of implementation'. As this paper seeks to demonstrate, following Wildavsky (1979: 387), policy is as much a process of decision-making as is a 'product of that process' for which reason, policy analysis 'should be shown not just defined'.

Taking such factors into consideration, the political economy of South Africa's electricity policy is characterized by the country's minerals-energy complex (MEC) (Fine and Rustomjee 1996). In descriptive terms this refers to a highly electricity and carbon-intensive economy based on the country's abundant and historically cheap sources of coal. Analytically, it offers a framework that can be used to address the economic legacy of apartheid, driven by the questions, what does the MEC 'tell us about power relations and "politics" in contemporary South Africa' and 'what does it imply for policy'? (Padayachee 2010: 2). On this point, Marquard (2006: 71) describes 'a number of overlapping policy networks… coordinated by what can be termed an "industrial

policy elite" concentrated in agencies such as the Industrial Development Corporation and the state's economic planning machinery, with close connections to the political elite'. This relates to Freund's (2010) concept of an architecture that explores links and networks between the financial and private sectors, state-owned companies, and different sections of government. Such questions and perspectives inform the nature of this study. With this in mind, section 2 now situates South Africa's electricity sector within the MEC and explores some of the complex historic reasons that have led to the current electricity crisis.

3 The minerals-energy complex and electricity crisis

The MEC describes an evolving system of production and consumption originally based on the country's historical dependence on cheap and abundant coal, cheap labour based on racial divisions, to produce cheap electricity for an export-oriented industry based on raw and semi-processed mineral products such as coal, platinum, iron ore, steel, and aluminium. South Africa's natural resource wealth however has not been evenly distributed (Harvey 2015). The MEC is accompanied by huge socio-economic development challenges in one of the most unequal countries in the world. These include a history of racial oppression and inequality, high levels of violence, an unemployment rate of 40 per cent[4], and poor access to economic and social services such as health and education. Approximately 25 per cent of the population or 12.3 million people lack access to electricity (IEA 2011) despite a significant electrification programme after apartheid (Bekker et al. 2008).

As a vertically integrated monopoly, Eskom has been a key player in and beneficiary of the MEC and under apartheid, 'fulfilled a particularly important function in lubricating both the growth of MEC core sectors and the ascendance of large-scale private capital' (Fine and Rustomjee 1996: 97). To date Eskom has controlled the country's high-voltage transmission grid, 90 per cent of coal-fired generation plants, and 60 per cent of distribution, which is consumed by one-third of South Africa's customers.[5] The MEC's carbon and electricity intensity is illustrated by the fact that the country's 31 energy intensive users consume 44 per cent of the country's electricity. This group includes five major mining companies who also supply 80 per cent of the coal used by Eskom (Eberhard 2011): Glencore, Anglo-American, South 32 (demerged from BHP Billiton in 2015), Exxaro, and Sasol. A number of these energy intensive users were granted preferential tariffs, or 'special purchasing agreements' by Eskom during the early 1990s when the utility had substantial overcapacity.

However, in recent decades a number of the MEC's core features have been subject to change. Firstly, this can be identified in the evolving set of relationships and linkages between the country's state-owned companies, corporate capital, and a growing financial sector. As McDonald (2009: 20) surmises, the former MEC model of 'big state negotiating with big capital' has been replaced by a 'fragmented and rescaled state negotiating with more globally dispersed capital, in many different sectors with new technical demands'. Secondly, shifts in the MEC

[4] This includes formal job seekers as well as those who have given up finding work.

[5] Municipal distributors purchase electricity from Eskom Distribution and in turn supply about two-thirds of the country's customers. Municipal distributors account for 40 per cent of total electricity sales and are dominated by large metropolitan distributors such as City Power. Given that they depend on the revenue from their on-selling of electricity in order to provide other municipal services, this system has created perverse incentives to limit embedded generation within cities despite rising costs of electricity and shortages.

include an increased contribution by financial and business services to the economy, which now constitutes 24 per cent of GDP (Bhorat et al. 2014), the creation of black industrial and financial elite under post-apartheid black economic empowerment legislation (Cargill 2010), and a declining contribution that mining makes to the national and international economy.

Notably, until 25 years ago South Africa accounted for 40 per cent of the world's mining industry but now only accounts for four per cent (Seccombe 2015).[6] The country's long-term weak economic growth rate and large budget deficit further poses a threat to its national credit rating. The complex and long-term reasons for the decline of the country's core industries include path-dependent inefficiencies and the inability to compete with the growth and expansion of China's manufacturing and control of the value chain. South Africa's industries have been further affected by rising national electricity prices. The country's coal supply chain has also changed: Eskom is no longer able to rely on ready supplies of cheap national coal resources, reasons for which include growing export demands, and the end of long-term coal contracts between tied coal mines and Eskom (Burton and Winkler 2014).

The country's on-going electricity crisis represents a further shift in the MEC. Since mid-1980s, South Africa has gone from a period of electricity surplus with some of the lowest electricity prices in the world as a result of over-planning and the construction of excess generation capacity (Dubash 2002), to capacity restraints, a supply side crisis, and imminent deficit. The country has seen a 250 per cent cumulative increase in electricity prices since 2008 (Pombo-van Zyl 2015), with further tariff increases predicted in the future. By October 2015, Eskom was facing a funding gap of R280-billion (Creamer 2015a). The crisis has contributed to lowering growth rates, discouraged private investment, exacerbated the country's large current account deficit, and pushed the cost of electricity way beyond the reach of the poorest households who are connected to the grid.

Reasons for South Africa's electricity sector crisis are deep seated and long-term,[7] and represent the culmination of complex events over decades (Pickering 2010). They include a legacy of mismanagement and disorganization by the utility; a failure by Eskom to enforce contracts with its coal suppliers (Olsen 2007); inadequate maintenance of the utility's older power stations, and of the coal silo for the Majuba Power Station, which collapsed in November 2014; the end of cheap coal supplies, discussed above; climate change mitigation commitments pledged in 2009;[8] and a failure by government to approve the construction of new generation capacity in the early 1990s as the following sections discuss.

Eskom faces a capital crisis and a cash flow crisis and since 2005, has failed to meet its target for an additional 17000 MW of generation capacity by 2018. Its ability to do so has been hampered by the fact that the construction of the Medupi and Kusile coal-fired power plants of approximately 4,800 MW each, is severely behind schedule. Both plants have experienced significant cost overruns and labour unrest (Yelland 2014). In addition to a loan from the African

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[6] For instance, Glencore has experienced a 70 per cent share fall in the past four years and the country's steel industry formerly a state-owned monopoly and now dominated by Arcelor Mittal has been struggling to compete both globally and in domestic markets.

[7] For more in depth discussions see: Eberhard (2005, 2007); Trollip and Marquard (2014); and Baker et al. (2015).

[8] When President Jacob Zuma committed to reduce emissions by 34 per cent below current emissions baseline by 2020 and 42 per cent by 2025. This has since been formalized in the country's National Climate Change Response White Paper and South Africa's Intended Nationally Determined Contribution (INDC).

Development Bank in 2009, in 2010 the utility received a US$3 billion loan from the World Bank as a 'lender of last resort' of which the majority was for the Medupi (IBRD 2010: 1). To make up further shortfall in its supply, Eskom has been relying heavily on expensive diesel peaking plants but having long exhausted its budget to do this, and is now seeking further tariff increases. Electricity prices have tripled in real terms since 2005 (IEA 2014: 147). In addition to a commitment of R23 billion from National Treasury in 2015, the utility has also discussed the sale of its assets in order to raise the capital to fill an estimated funding gap of R200 billion (US$17 billion) by 2018 (Reuters 2015). In January 2016, Eskom submitted a 16.6 per cent tariff increase request to NERSA in an attempt to recoup R22 billion worth of expenditure on diesel generated turbines in financial year 2013/2015 (Creamer 2016).

The crisis arguably presents a challenge to the dominance of Eskom as a monopoly utility. Eskom's monopoly is further challenged by embryonic processes for the procurement of independently produced power from renewable energy under RE IPPPP in addition to gas, coal and cogeneration, and small-scale rooftop solar PV (Baker et al. 2015). With this in mind, the following section now provides a longer-term perspective on Eskom's governance.

4 Governing Eskom

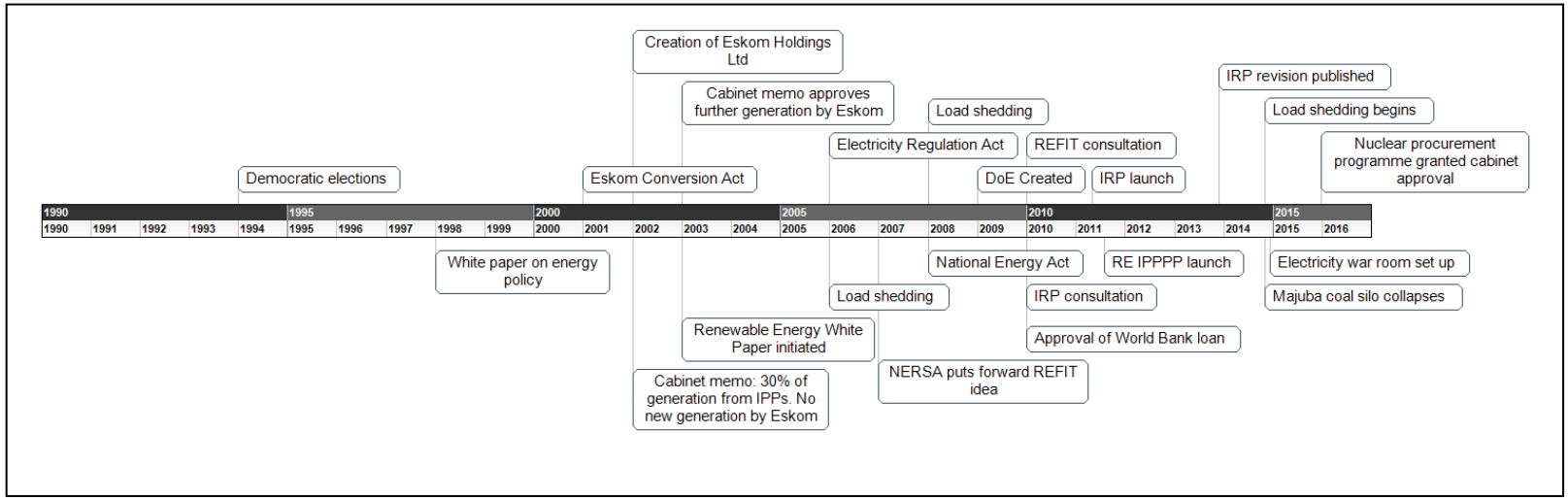
Eskom retained its monopoly status and side-stepped global trends of power sector liberalization in the 1980s and 1990s. This was due firstly to South Africa's political and economic isolation under apartheid and the absence of a heavy national debt burden, which meant that the country was not beholden to the loan conditionalities of structural adjustment; and secondly to the country's cheap and abundant supplies of indigenous coal and a well-developed transmission network. The 'standard model' of power sector liberalization, as endorsed by the World Bank (Gratwick and Eberhard 2008) was based on the notion that public ownership was hampered by poor technical and financial performance and high investment requirements. The standard model thus advocated a move away from a publicly-owned utility to one based on privatization, competition, and the unbundling of the utility into separate transmission, generation, and distribution companies (Dubash 2002). However in light of repeated failings, the model is now in demise (Williams and Ghanadan 2006; Yi-chong 2006), serving 'neither a descriptive nor a prescriptive role' (Gratwick and Eberhard 2008: 3958).

Nonetheless, in the mid-1990s attempts were initiated to unbundle South Africa's electricity sector when the Department for Public Enterprises (DPE) of the new democratic government announced plans to restructure Eskom alongside the country's four largest state-owned enterprises (Eberhard 2005). As a member of the energy intensive users' group explained [in interview, October 2010], this development 'was informed and motivated by the global privatization drive of the time and the strong belief that privatization was better than government following examples such as British Rail in UK', even though there was fierce resistance to this within the utility. Subsequently the 1998 White Paper on Energy Policy (DME 1998) set out a gradual liberalization of the power sector in line with the standard model, which would see the corporatization and outsourcing of various functions of Eskom. Notably, the White Paper anticipated the creation of a separate transmission utility and system operator, which would be owned by the state in the first instance but with a view to a possible future sale. The 1998 White Paper was followed by a cabinet memo in 2001 announcing that 30 per cent of electricity generation, including renewable energy, would come from IPPs, in turn followed by a cabinet ruling that Eskom no longer be allowed to build new electricity generation. Such a move

was described by Eberhard (2007: 231) as South Africa's 'self-imposed' structural adjustment programme as part of broader attempts to improve efficiencies in government-owned entities.

The subsequent Eskom Conversion Act of 2001 required a corporate governance structure for the utility, which converted it from a statutory body to a public company and required that it pay tax and dividends for the first time. This would mean the formation of separate transmission and distribution bodies and the creation of different generating companies to create internal competition. Eskom's stakeholder-based electricity council was replaced by a board of directors with government represented by the Minister of Public Enterprises as Eskom's sole shareholder. The utility was formally converted to Eskom Holdings Ltd in 2002 (Gaunt 2008).

Figure 1: Time line of South Africa's electricity policy: 1994–2015



Source: Author.

However, key aspects of the 1998 White Paper were not implemented and some are still outstanding. For instance, a separate transmission utility has never been established and the Independent Systems and Market Operator bill that would do this has been continually postponed. Significantly, between 1998 and 2003, no new generation was built. The various reasons attributed to this include: union resistance, inadequate political buy-in, and resistance from within Eskom (Eberhard 2007); tensions within the Department of Minerals and Energy (DME); the loss of construction and management expertise as white staff members left the country after apartheid; and surplus generation capacity from 1980s, which reduced incentives for any new construction. One energy-intensive user stated [in interview, November 2010], 'the then DME did not put in an appropriate policy, the regulator was not sufficiently empowered to make things happen, the ministry did not fully understand and the Department of Public Enterprises failed to step up. There were also drivers within Eskom not to cooperate with the introduction of private generators'. A member of the mining industry added [in interview, December 2010], 'Eskom's problems are organic. It completed its last power station, Majuba, in 1996 for which construction of this was delayed due to overcapacity. In 1994, there was the election and at the time no new power was required so most expertise was paid off, retired or left the country as part of the post-apartheid reforms'.

Furthermore, despite the approval for the entry of IPPs under the White Paper, there was no adequate institutional framework for private sector investment including a lack of clarity over who the buyer of power would be. Furthermore, no IPP would be able to compete with Eskom tariffs, which at the time were well below cost. As such, matters became increasingly apparent; by 2003, government had begun to rethink its strategy. Faced with falling reserve margins and an imminent electricity crisis, a cabinet memorandum approved that Eskom should be re-allowed to construct more power plants but that 30 per cent of new generation should be built by IPPs. However, in the absence of a regulatory framework, it was not until the introduction of RE IPPPP that this actually took place as discussed in the following section. In 2005, Eskom was permitted to re-invest in new generation capacity with the result that the construction of two coal-fired power plants, Medupi and Kusile, each 4,800 MW, and the Ingula pumped storage scheme was approved. However due to severe delays, Medupi and Kusile are still under construction (Paton 2015c).

According to (Marais 2011: 348), such a move reflects a slowing down in the privatization drive in all sectors in the 2000s due to 'the demise of the Washington consensus globally in the late 1990s'. This, in addition to trade union resistance at the national level. Eberhard (2005: 5309) has described this sequence of events as a move 'from state to market and back again', relating to the constant national tension between the interests of public and private capital, and the broad and diverse political spectrum that falls under the umbrella of the ruling ANC, from the developmental state at one end to market liberalization at the other (as discussed in Gumede (2007) and Edigheji (2010)).

The following section now discusses the contested and conflicted nature of electricity policy and planning in South Africa, including the shifting roles of various different departments and institutions involved, and the relative weakness of the DoE, despite its formal mandate.

5 Electricity policy

Apartheid era policy-making on energy has been described as excessively secretive, which 'made rational and public debate on energy policy nigh impossible' (DME 1998: 24). Since then, electricity policy-making has been influenced by weak institutional capacity (Newbery and Eberhard 2008) and 'a systemic lack of clarity concerning roles and responsibilities in the electricity sector, with an associated extended period of policy opaqueness and uncertainty' (IDASA et al. 2010: 4).

Under apartheid, Eskom was responsible for all planning and new build decisions in electricity. There was no department dedicated solely to energy and no public process. Since then, responsibility for policy-making on electricity has moved across various different departments. In March 1980, the energy function of the then Department of Environmental Planning and Energy was moved into the newly formed Department of Mineral and Energy Affairs (DMEA) (Fine and Rustomjee 1996: 97). It was not until 2009, following President Jacob Zuma's inauguration that the functions of what had by then become the Department of Minerals and Energy (DME) were separated into two departments: the Department of Minerals (DMR) and the DoE. Meanwhile, it was not until the Electricity Regulation Act of 2006 that responsibility was formally allocated to the energy minister to approve the construction of new generation capacity and what the source of that capacity should be.

Various different departments are involved in South Africa's electricity governance. The Department of Public Enterprises (DPE) is Eskom's principle shareholder and is responsible for the operability of the entity in accordance with the 2001 Eskom Conversion Act. National Treasury is responsible for Eskom's financial exposure. The National Energy Regulator of South Africa (NERSA), established in 2004,[9] has a mandate to determine electricity tariffs; approve generation, distribution, and transmission licences; and oversee the import, export, and trading of electricity within the Southern Africa Power Pool (SAPP). Both the DoE and NERSA report to the energy minister. Other institutions of national governance that are involved in energy policy include the Department of Environmental Affairs, and metropolitan and municipal governments.

Six years after it was established, the DoE is still developing capacity and expertise. Its ability to govern electricity has been challenged by a lack of knowledge and understanding of new technologies, particularly renewable. One of the reasons attributed to this lack of capacity was because energy policy, in addition to many other policy imperatives, such as safety conditions in mining and the growth of mining employment, was marginalized when under the remit of the DME, which was heavily focussed on the distribution of mining rents to the country's recently established group of black capitalists (Baker 2012).[10] Therefore, informal and formal influence over many decisions and activities made in the DoE's name is carried out by various departments and institutions under varying degrees of secrecy as the following examples illustrate.

[9] Under the National Energy Regulator Act.

[10] For a more in depth discussion of how mining and minerals rents have benefitted politically connected insiders at the expense of pro-poor growth and other public goods see Harvey (2015).

Firstly, and as discussed in the following section, Eskom still carries out electricity planning in name of the DoE. Secondly, the policy capacity for the procurement of privately generated power from renewable energy under RE IPPPP and future IPP programmes is housed within the Independent Power Producers' (IPP) unit. While the IPP unit acts on behalf of the DoE, the unit was set up by National Treasury's Public Private Partnership unit together with foreign technical consultants for the specific purpose of managing RE IPPPP. The IPP unit functions outside of formal departmental governmental structures but since it was set up in 2011, has maintained credibility as a high quality, transparent, and secure professional body. Perhaps because it 'did not start out with the level of mistrust of private business that sometimes characterises other government agencies in South Africa' (Eberhard et al. 2014: 9).

Thirdly, a 'War Room' was set up in late 2014 by the Presidency in response to the electricity crisis, and in order to ensure greater coordination between all departments that hold a stake in the sector and between which there are evident tensions (Baker et al. 2015). In addition to those departments discussed above, these include Cooperative Governance and Traditional Affairs, Economic Development, Mineral Resources, and Trade and Industry. The War Room is chaired by Deputy President Cyril Ramaphosa, in turn advised by a panel of high-level academics, finance, and business, and co-chaired by Energy Minister Tina Joemat-Pettersson, and Public Enterprises Minister Lynne Brown. Despite its potential influence, limited information is available with regards to the activities of the War Room and how it makes decisions.

Fourthly, the highly controversial, highly secretive nuclear procurement programme being pushed by the Presidency and a minority within the DoE, was granted cabinet approval at the end of 2015. Should the programme go ahead it is possible that it will be managed by the Energy Security Cabinet Subcommittee (ESCS). As discussed in Baker et al. (2015: 42), while the ESCS reports to cabinet, 'its proceedings and documents are classified under the Minimum Informational Security Standard Act as TOP SECRET (sic)'. The issue of nuclear power is a key sticking point for the latest revision of the Integrated Resource Plan, now discussed in the following section.

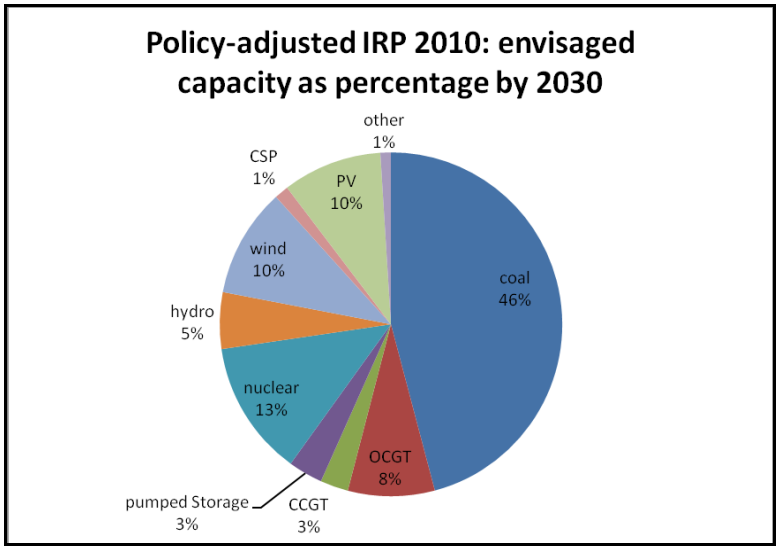
6 The Integrated Resource Plan for electricity

First promulgated in 2011, South Africa's Integrated Resource Plan (IRP) for electricity is a master plan covering total generation requirements for electricity from 2010 to 2030. The plan anticipates a doubling of national capacity from approximately 41,000 MW to 89,532 MW by 2030. Significantly, IRP represents the first time that electricity planning has taken place in South Africa in accordance with the 2006 Electricity Regulation Act, which established the necessary powers for the DoE to conduct an open planning process for electricity. While the IRP's negotiation process was heavily contested, it is still considered a breakthrough in terms of electricity planning. However, as this section explores, this breakthrough is now threatened by the scrapping of the revised IRP released in late 2013, which questioned the need for a national nuclear programme. The scrapping of this revision is seen as a deliberate attempt by government attempt to push through nuclear power (Baker et al. 2015).

Before an electricity generation project can be approved, it must align with the technological allocations set by the IRP in order for NERSA to be able to grant the project a licence (Pienaar and Nakhooda 2010). However according to the Electricity Regulations on New Generation Capacity updated in 2011, the minister holds the discretion to approve additional generation capacity of a certain technology if they consider it appropriate. The plan allows for

approximately 20 per cent (17.8 GW) of installed generation capacity to come from renewable energy (including projects approved under RE IPPPP) which will deliver nine per cent of supply. The plan claimed to be consistent with a carbon emissions constraint of 275 million tonnes of carbon dioxide annually after 2024 (DoE 2011: 6). Despite this constraint and the positive gains for renewable energy, the overall generation mix will still be dominated by coal (see Figure 2). It has therefore been argued that the IRP has created the conditions for a low carbon transition to take place in parallel to an already existing high carbon trajectory (Baker 2016).

Figure 2: Policy-adjusted IRP 2010



Source: Adapted from DoE (2011: 14).

The IRP is a subset of the Integrated Energy Plan (IEP) required under the National Energy Act 2008, which is to cover all energy sources. However, while the IEP was to have been completed by 2012, it has yet to be approved by cabinet. Nonetheless, according to the Minister of Energy's budget speech in May 2015, 'Our government's urgent response to load shedding has accelerated the finalisation of the much awaited Integrated Energy Plan. Once approved by Cabinet, the Integrated Energy Plan will be published as a policy document. This Plan will inform our future energy mix and prioritize policy interventions for future programmes within the energy sector'.

The IRP 'stakeholder engagement process', which took place throughout 2010 and early 2011 was protracted and not without controversy. Inputs were received from representatives of the country's coal, renewable, and nuclear industries; energy-intensive users; financial stakeholders; civil society and academics. In light of the DoE's lack of capacity, discussed above, the IRP was put together by Eskom's Systems Operator with inputs from a technical task team that consisted largely of members from government, Eskom, coal companies, and energy intensive users. This team was heavily criticized for consisting largely of vested interests from the mining and energy spheres and related government institutions, and for excluding the renewable energy industry and civil society (Baker et al. 2014). IRP was subject to numerous other criticisms, including the methodology and input parameters on which the plan was based; a lack of transparency over critical assumptions; technology costs; and the plan's potential impacts on the poor. Notably, the IRP's assumption that national electricity demand would double by 2030, led to one member of the City of Cape Town to refer to it as 'business as usual on steroids'.

Despite this, IRP was still considered a significant advance on previous electricity planning processes, or lack thereof (Hughes 2010; Mainstream Renewable Power 2010). For instance, an earlier draft in late 2009 that covered the period from 2010 to 2013, was only three pages long and scarce on detail. While the IRP process was dominated by relatively specialized stakeholders able to engage with the inevitable technical complexity of electricity planning, opening it up to public participation still set an important national precedent Nakhooda (2011).

In 2013, a revised IRP was put out for public comment following the requirement that the plan be updated on a biennial basis (DoE 2011: 7). Given the decline in South Africa's economic growth since the release of the first IRP in 2010 and declining electricity consumption by the mining and minerals sector, the revised draft made a downward adjustment to the demand forecast by 6,600 MW. The draft also proposed to reduce allocations for new coal (from 6,250 MW to 2,450 MW) and wind (from 9,200 MW to 4,360 MW) while increasing contributions from solar PV (from 8,400 MW to 9,770 MW) and CSP (from 1,200 to 3,000 MW). The wind industry was particularly critical of the assumptions contained within the revised draft, arguing the technology costs do not reflect price decreases that have taken place since the start of RE IPPPP (Baker et al. 2015: 24).

However, the draft has yet to be approved by cabinet and it looks increasingly unlikely that it will be. The main reason for this is that it challenges the necessity of a 9.6 GW nuclear fleet currently being pushed by the Presidency and members of the DoE (Baker et al. 2015). Significantly, the draft questions the high associated costs of nuclear technology, stating that 'the revised demand projections suggest that no new nuclear baseload capacity is required until after 2025 (and for lower demand not until at earliest 2035)' (DoE 2013: 8). In light of the high costs and implications for technological lock in of a large nuclear fleet, the draft asserts that rather than the 'fixed capacity plan' espoused by the IRP 2010, 'flexibility in decisions should be the priority to favour decisions of least regret' (DoE 2013: 9) and therefore 'commitments to long range large-scale investment decisions should be avoided' (DoE 2013: 9). Instead, the draft points to a potential increased role for gas, including resources from the region and shale gas. Details regarding how much the nuclear programme will cost, how it will be paid for, and who might build own and operate it have been entirely lacking in transparency (Paton 2015d). Current but as yet unconfirmed capital cost estimates are at R1 trillion. National Treasury, which has largely been excluded from the process, has questioned the programme's affordability (Mantshantsha and Marrian 2015).[11] Given the uncertain status of this draft, it has now been suggested that instead a new draft will be published in 2016 that will contain a higher allocation for nuclear energy than the 9.6 GW currently included (Paton 2015b).

The IRP represents a poignant example of the inherently political nature of policy-making in electricity. Despite the 2006 Electricity Regulation Act, discretionary powers held by the DoE may still undermine the plan's apparent neutrality. Furthermore, control over the plan and its implications seems to be as much about a contest over which technologies get prioritized, as a contest over which models should be used to procure and manage them. As one South African project developer clarified [personal communication, November 2014] '…the competitive bid model around RE IPPPP is through private generation, while nuclear is a bi-lateral negotiation led by the head of state'. The nature of RE IPPPP as the introduction of the first successful

[11] Serious questions over the affordability of any potential programme have been linked to the firing of the finance minister Nene in December who stated that nuclear power would not be procured if the country could not afford it (Paton 2015a).

framework to procure renewable energy and privately generated power is now discussed in Section 7.

7 Renewable energy procurement

RE IPPPP is a competitive tender system under which IPPs bid to construct and connect their renewable electricity projects to the country's monopoly controlled transmission grid. The programme's initial allocation in August 2011 was for 3,725 MW to be allocated fewer than five bidding rounds. This was augmented by an additional 3,200 MW of capacity declared by the Minister of Energy in December 2012, a further 6,300 MW in 18 August 2015, and an 'expedited' round to absorb 1,800 MW of projects that failed marginally in previous rounds in November 2015. It is anticipated that a new tender framework for round five and beyond will be introduced in 2016.

Internationally RE IPPPP is held up as example for its high quality regulatory framework, tough qualification criteria, and strong economic development and community ownership requirements, all of which it is argued, provided the demanded positive policy signal to investors and developers (Eberhard 2013). The programme has further been celebrated for the savings it has created for the South African economy. According to the Council for Scientific and Industrial Research (CSIR 2015), solar and wind projects collectively generated a R8.3 billion benefit in the first six months of 2015. This is firstly through savings in diesel and coal fuel costs, to a total of R3.6 billion and secondly through savings to the economy by avoiding load shedding or 'unserved energy' (Creamer 2015b).

The initial concept for RE IPPPP began in the form of a renewable energy feed-in tariff (REFIT), for which the idea was put forward in 2006–07 by individuals within NERSA's Electricity Regulatory Division. This move was supported by bilateral donors and some individuals within Treasury, the DPE, and the Department of Environmental Affairs, who had been inspired by study tours to Germany and Denmark (Baker et al 2014). Both Germany and Denmark, as first movers in the global renewable energy industry had successfully implemented a feed-in tariff. The main aim of REFIT was to create a market mechanism that would 'kick start and stimulate the renewable energy industry in South Africa' in order to meet the target of 10,000 GWh of renewable energy by 2013 as set out in the 2003 Renewable Energy White Paper (NERSA 2008: 4) discussed in Box 1.

Box 1: Renewable energy white paper

In the midst of failed attempts to introduce privately generated power and renewable energy discussed above, the 2003 Renewable Energy White Paper was the first national document that referred to the procurement of renewable energy from IPPs. Described by one Eskom employee as 'a visionary blip on the horizon', it was published by the then DME in 2003 with support from the Danish foreign aid agency DANIDA, just missing the World Summit on Sustainable Development hosted by South Africa in 2002. The paper set a minimal target of four per cent of the estimated electricity demand by 2013 (DME 2003), to be achieved through a mixture of biomass, landfill gas, hydro-electricity, and solar water heaters with only one per cent for wind (DME 2004, in Edkins et al. 2010). Funded under the World Bank's Renewable Energy Market Transformation Project and managed by the Development Bank of South Africa, the paper should have been revised in 2008. When this stalled it was given a new completion date of March 2011, to be carried out by the Cape Town based renewable consulting firm AGAMA energy. Still unpublished by May 2012, it therefore had no influence on the content of the IRP, discussed above. Reasons for the delay are attributed by one energy analyst to a resistance within the Department of Energy (DoE): 'the World Bank paid for the research to be carried out on the renewable energy white paper as part of REMT. This was resisted by the DoE. The irony is that the DoE should be making this policy. Instead it ended up being an activist process funded by the World Bank' [in interview September 2010].

Initially there was opposition to the notion of a feed-in tariff and renewable energy from within the regulator, the DoE and Eskom. However, in pushing for REFIT, NERSA's director succeeded in galvanizing the global renewable energy industry, whose market opportunities in Europe and the United States had been undermined by the 2008 global financial crisis. Once the idea had been put forward, REFIT was subject to intense interest from South African renewable energy IPPs, in turn backed by international renewable energy developers and private finance, who were awaiting the policy certainty that would allow them to build their projects and feed into the grid (Baker et al. 2014).

During the negotiation process for what is now RE IPPPP there were protracted disagreements over: how the tariff levels should be set; who the buyer of power would be; mistrust of renewable energy from various factions of government and business; and how political and financial risks should be allocated between government and the private sector. The process involved different government departments, NERSA, Eskom, South Africa's commercial banks, international investors, project developers, and civil society.

There was also significant conflict over whether a tender system, which was eventually selected, or a feed-in tariff system should be implemented. Notably, at the Renewable Energy Summit in March 2009, the DME proposed a tender system as the preferred model, while private sector representatives, the South African Wind Energy Programme, NERSA, and the Danish Embassy argued in favour of a feed-in tariff system (Renewable Energy Summit 2009). While a feed-in tariff pays generators a fixed price for each unit of renewable energy sold to the grid, which is set at a higher rate than the retail price of electricity generated from conventional resources, under a competitive bidding system potential project developers bid for a renewable energy contract below a certain cap. The latter system is therefore more competitive and for the time being at least, is currently seen as the preferred model (EY 2014).

When REFIT had become so high profile as to be irreversible, in late 2010 the DoE backed by National Treasury's Public Private Partnership Unit and various international technical advisors made changes to the Electricity Regulations on New Generation Capacity, which effectively transferred powers over the procurement process away from NERSA to the DoE and National

Treasury. This move also facilitated the shift from a feed-in tariff to a competitive bidding system, which saw the proposed REFIT replaced by RE IPPPP in August 2011 (Baker 2012: 109–13). This move followed a declaration by National Treasury that REFIT was illegal, justified by an assessment carried out by Johannesburg law firm Webber Wentzel, which found that 'the predetermined tariff would fall foul of South Africa's procurement rules' (Creamer 2011). In addition to the legal challenge, the DoE and National Treasury also argued that NERSA had neither the budget nor the expertise to run REFIT and that the high tariffs set by the regulator may generate corruption in the bidding process (Baker 2012: 116–7).

Significantly RE IPPPP's negotiation demonstrates a turf battle between NERSA as the initiator of the process and the DoE backed by National Treasury, who in altering legislation ultimately seized control of the programme. In trying to establish a procurement process for renewable energy NERSA was undoubtedly 'acting beyond its mandate' (Baker 2012: 105) given that under the 2006 Electricity Regulation Act, it is the DoE's role to make policy and NERSA's to implement it through licensing and regulation. Yet NERSA's lead in pushing for the system was clearly instrumental in its emergence. Shortly after RE IPPPP's launch in August 2011, the IPP-Unit, discussed above was set up to manage the process, and is now responsible for other emerging IPP programmes in South Africa including co-generation, baseload coal, and gas.

8 Challenges for a new industry

South Africa's renewable energy development potentially offers a window of opportunity for the country to achieve a clean energy transition. However, will it be able to adopt a pathway that avoids high-carbon technological lock-in at the same time as overcoming energy poverty and other socio-economic challenges? Despite RE IPPPP's apparent and rapid success, there are concerns over the way in which it is evolving, including the fact that ownership of the renewable energy sector is dominated by foreign investors and utilities, and the ability of some project developers to uphold their commitments to the programme's economic development and community ownership criteria (Baker and Wlokas 2015). The ability to manage such concerns effectively will determine the extent to which the industry will result in sustainable social, economic, and environmental benefits beyond the generation of renewable electricity.

As discussed in Baker and Wlokas (2015: 3–4), the majority of capacity allocated under RE IPPPP is for wind, solar photovoltaics (PV) and concentrated solar power (CSP). Projects approved under rounds one to three collectively represent combined foreign and domestic investment commitments of approximately US$14 billion (Eberhard et al. 2014: 14). Under RE IPPPP, projects are assessed 70 per cent on price below a tariff certain cap, which decreases with each round and 30 per cent on economic development requirements. A project must meet the economic development requirements before the price submission can be considered. Project assessment takes place under a comparative rating system, which means that competing projects are measured against each other. RE IPPPP's economic development requirements are potentially very progressive, and include factors such as participation of historically disadvantaged individuals, job creation, local content, rural development, community ownership, and skills development. Each project company must have a minimum South African ownership share of 40 per cent, of which a minimum of 12 per cent black ownership, and a minimum of 2.5 per cent local community ownership. Successful projects sell their power to Eskom under a 20-year power purchase agreement (PPA) which is, government-backed and local currency denominated.

However, due to the risk adverse nature of project finance and the low costs offered by international technology providers, engineering procurement, construction companies, and project developers, early findings demonstrate that many national firms have been prohibited from entering and/or retaining a share in the market. Consequently, ownership of the industry is dominated by large international companies. Such a scenario raises questions as to who the winners and losers might be in the creation of a new renewable energy sector in a process that has to date favoured international actors over local companies. A further development is that project developers have now started to sell their equity to larger international players in keeping with global trends in project finance, but as explored in Baker (2015) and Eberhard et al. (2014), this may be in tension with requirements for community and black ownership.

The dramatic decrease in the tariffs bid by project developers under RE IPPPP means that many renewable energy projects are now cost competitive with Eskom's new build coal projects. However, these low tariffs have also been identified as a risk to the project's 'bankability'. Not least, there are questions as to how sustainable these tariffs are given that projects are now operating on very tight financial contingencies. A further concern relates to the high transaction and financial costs involved in bid preparation and the significant though undetermined amounts that will have been lost in making successful projects 'bid ready'. While this risk is carried by the private sector rather than Eskom, these costs will inevitably be structured into any successful project and therefore passed on to the country's electricity consumers.

The ability of Eskom's transmission grid to incorporate intermittent and/or variable sources of generation is a further challenge and potentially a risk to the future success of renewable energy projects. While IPPs pay for the connection of their projects, Eskom is required to strengthen the transmission network and upgrade substations in order to do so. However, Eskom has admitted that because of its funding constraints it is likely to struggle to connect IPP projects outside of areas of grid strength. Inadequate transmission capacity may challenge the integration of further renewable generation sources, and it is anticipated by industry that in some locations solar PV and wind will start to compete for access to the same line. For this reason, transmission may be viewed as an investment risk, and members of the finance industry have suggested that it may be financially prudent to force the market to bid in regions where connections are still available given the additional costs and time involved in constructing transmission and distribution infrastructure.

The ability or lack thereof of Eskom to integrate renewable energy to the grid poses obstacles to a low-carbon transition that are at once economic and technological. This evokes Mokyr (1998: 40) who explains that resistance to new technologies is not only due to social or political reasons: 'There are instances in which the technological "system" resists a novel and improved component because it does not fit the operation of the whole'.

9 Conclusion

This paper has analysed the nature of post-apartheid policy-making in South Africa's electricity sector and the emergence of a renewable energy sector by IPPs. While the limits to this study preclude a longer-term analysis, more recent factors that have shaped the nature of policy-making in South Africa's electricity sector include: surplus power capacity from mid-1980s until the early 2000s; the country's economic and political isolation under apartheid; a spectrum of political and economic ideological conflicts within government, Eskom, and the unions with regards to the privatization of the electricity sector; and the loss of skills in the utility as many

white engineers and managers left the country following the end of apartheid. Significantly, in light of the recent introduction of a regulatory framework for electricity planning and in the absence of expertise and capacity within the recently established DoE, activities carried out in the department's name have been undertaken by various other institutions. Electricity policy is therefore embedded within long-standing political and economic forces, which demonstrates the diverse and often conflicting nature of interests within the ruling party the ANC, whose tensions and conflicts play out in the sphere of energy policy.

A political economy analysis of South Africa's electricity policy has demonstrated how decision-making over the ideal electricity mix reflects deeper struggles over what gets supported by the state, who gets to build it and who gets to benefit. Policy-making for electricity therefore goes far deeper than technological choices. In this sense, the contested nature of electricity policy in South Africa relates as much to a struggle over which technology is selected as the model that should procure and manage it. While privately generated renewable electricity presents a clear challenge to Eskom's long-standing but currently crisis-ridden monopoly utility, Eskom's coal-fired power is likely to remain the primary energy source for the time being, despite the end of historically cheap prices given international demands and pressures. Meanwhile, the potential construction of a highly contested 9.6 GW nuclear generation programme appears to represent an attempt by the state to reinforce its power through Eskom, at the same time as precipitating a potential return to an era of secretive decision-making as existed under apartheid.

Returning to the link between socio-technical transitions and political economy, this paper has challenged more technocratic approaches, which fail to integrate nationally specific path dependencies and upheld the argument that 'more attention should be given to the context in which regime transformation arises' (Smith et al. 2005: 1498) in terms of the peculiarities of incumbent regimes and the specific features of its governance structure. A study of the trajectory of South Africa's electricity sector has uncovered the uncertain and unpredictable nature of technological development, which relates both to Fine's (2008: 2) assertion that the MEC as a system of accumulation has a dynamic that 'evolved and was far from pre-determined' and Elzen et al.'s (2004: 288) claim that 'transitions are the result of unpredictable interactions between different stakeholders, power games, new developments that cannot be seen and unanticipated catastrophes or opportunities'.

The nature of policy-making as non-linear and 'web of interrelated decisions' (Keeley and Scoones 2003) discussed in Section 2, has been clearly illustrated by the protracted and prolonged way in which the RE IPPPP and the IRP 2010 emerged, were negotiated by multiple actors and networks, resisted by incumbents, changed form, and eventually launched following a series of different decisions. Furthermore, as this paper has demonstrated, vested interests resisting structural change may take the form of laws and regulations restricting the entry of new technology, lobby groups, and state monopolies (Moe 2010). Similarly, vested interests may also resist change through non-decisions (Heclo 1972 in Ham and Hill 1993: 12). The strong tendency of entrenched interests to 'defer decisions' (Meadowcroft 2011: 73), has been witnessed in various instances, including: the failure to establish appropriate regulatory conditions for the construction of new generation capacity in the early 2000s; the failure to implement key aspects of the 1998 White Paper, particularly an independent systems operator as discussed in Sections 4 and 5; and the stalling of the revised draft of the IRP discussed in Section 6.

This paper also contributes to the broader debate over the ideal model of power sector governance. Significantly, my argument does not subscribe to the notion of 'private goods and public bads', which would assume that a liberalized sector is inevitably efficient, competitive, and

innovative while a state-owned utility is inherently over-subsidized, corrupt, and resistant to new technologies. Or alternatively that a state-controlled utility always works in the interests of the majority public, while a privatized electricity sector in the interest of a private rentier class. Regardless of the ownership structure, the bigger and harder question is whether the sector is transparent, financially accountable, subject to public scrutiny, technically and managerially competent, and in terms of a low-carbon transition, committed to technological innovation.[12]

On a related point, this paper raises poignant questions over the significance of transparent and democratic decision-making for a clean energy transition. Following a breakthrough as the first public negotiation process for electricity planning, the IRP as a process now appears to have been undermined. This is due to the DoE's stalling of the revised draft in light of the draft's questioning of a potentially unviable nuclear fleet whose costs are unknown. Arguments aside as to whether nuclear power should contribute to a clean energy transition, of greater concern is that it represents a backward step in terms of a transparent process for electricity planning (Baker et al. 2015). This has huge implications for how any other technology, clean or otherwise, and its related procurement model may then be pushed through in future, beyond the view of public scrutiny.

Finally, while this paper focusses on South Africa's emerging utility scale renewable energy sector, it acknowledges the other processes now emerging for the procurement and development of independent power from other sources, including embedded generation roof top solar, coal, co-generation, and gas. This, in addition to a small IPP programme of projects less than 5 MW of which ten winning bidders were announced in early October 2015 (Theron 2015). The way in which RE IPPPP may continue to develop in the medium to long term therefore has significant implications for such programmes, which are identified as areas for future research.

References

Baker, L. (2012). 'Power shifts: the political economy of socio-technical transitions in South Africa's electricity sector'. Unpublished PhD thesis, University of East Anglia. Norwich: UEA.

Baker, L. (2014). 'Renewable energy in South Africa's MEC: a "low carbon" transition?'. *Review of African Political Economy*, 42(144): 245–61.

Baker, L. (2015). 'The evolving role of finance in South Africa's renewable energy industry'. *Geoforum*, 64(0): 146–56.

Baker, L. (2016). 'Sustainability transitions and the politics of electricity planning'. In H.G. Brauch, et al. (eds), *Handbook on Sustainability Transition and Sustainable Peace (STSP)*. Hexagon series on human and environmental security and peace. London: Springer.

Baker, L., J. Burton, H. Trollip, and C. Godinho (2015). 'The political economy of decarbonisation: Exploring the dynamics of South Africa's electricity sector'. Research Report, Energy Research Centre. Cape Town: ERC, University of Cape Town.

Baker, L., P. Newell, and J. Phillips (2014). 'The political economy of energy transitions: The case of South Africa'. *New Political Economy,* 19(6): 791–818.

[12] For considerations of the role of the state and innovation, though not specifically related to electricity see Mazzucato (2013).

Baker, L., and H. Wlokas (2015). 'Renewable energy procurement in South Africa: A new frontier?'. Research report, Energy Research Centre. Cape Town: ERC, University of Cape Town.

Bekker, B., A. Eberhard, T. Gaunt, and A. Marquard (2008). 'South Africa's rapid electrification programme: Policy, institutional, planning, financing and technical innovations'. *Energy Policy*, 36: 3125–37.

Bhorat, H., A. Cassim, and A. Hirsch (2014). 'Policy co-ordination and growth traps in a middle-income country setting'. WIDER Working Paper 2014/155. Helsinki: UNU-WIDER.

Burton, J., and H. Winkler (2014). 'South Africa's planned coal infrastructure expansion: drivers, dynamics and impacts on greenhouse gas emissions'. Energy Research Centre, Research Report. Cape Town: ERC, University of Cape Town.

Cargill, J. (2010). *Trick or Treat: Rethinking Black Economic Empowerment*. Johannesburg: Jacana Media.

Creamer, T. (2011) 'Renewables bid represents "substantive progress", but raises compliance burden'. *Engineering News*. Available at: http://www.engineeringnews.co.za/article/renewables-bid-represents-substantive-progress-but-raises-compliance-burden-2011-08-23 (accessed on 8 March 2016).

Creamer, T. (2015a). 'Amid R280bn funding gap Eskom re-phases transmission capex, delays grid code compliance to 2022'. *Engineering News*. Available at: http://www.engineeringnews.co.za/article/amid-r280bn-funding-gap-eskom-re-phases-transmission-capex-delays-grid-code-compliance-to-2022-2015-10-16/rep_id:3182 (accessed on 17 October 2015).

Creamer, T. (2015b). 'South Africa's renewables ramp up impressive'. *Engineering News*. Available at: http://www.engineeringnews.co.za/article/south-africas-renewables-ramp-up-impressive-study-shows-2015-10-13 (accessed on 14 October 2015).

Creamer, T. (2016). 'NERSA seeks to get to grips with Eskom's R8 billion diesel claim'. *Engineering News*. Available at: http://www.engineeringnews.co.za/article/nersa-seeks-to-get-to-grips-with-eskoms-r8bn-diesel-claim-2016-02-04/rep_id:3182 (accessed on 15 February 2016).

CSIR (2015). 'Financial benefits of renewables in South Africa in 2015'. Available at: http://www.csir.co.za/media_releases/docs/Financial%20benefits%20of%20Wind%20and%20PV%202015.pdf (accessed on 20 October 2015).

Department of Energy (DoE) (2011). 'Electricity Regulation Act No. 4 of 2006, Electricity Regulations on the Integrated Resource Plan 2010–2030 (Policy-Adjusted IRP)'. Pretoria: Government Gazette.

Department of Energy (DoE) (2013). 'Integrated Resource Plan for electricity (IRP) 2010–2013, Update Report 2013'. Pretoria: Department of Energy.

Department of Minerals and Energy (DME) (1998). 'White paper on the energy policy of the Republic of South Africa'. Pretoria: Department of Minerals and Energy.

Department of Minerals and Energy (DME) (2003). 'White paper on renewable energy'. Pretoria: Department of Minerals and Energy.

Dosi, G. (1982). 'Technological paradigms and technological trajectories: A suggested interpretation of the determinants and directions of technical change'. *Research Policy,* 11(3): 147–62.

Dubash, N. (2002). 'Power politics: Equity and environment in electricity reform'. Washington, DC: World Resources Institute.

Eberhard, A. (2005). 'From state to market and back again: South Africa's power sector reforms'. *Economic and Political Weekly*, 40(50): 5309–17. Available at: http://www.gsb.uct.ac.za/files/FromStatetoMarketandBackAgain.pdf (accessed on 7 March 2016).

Eberhard, A. (2007). 'The political economy of power sector reform in South Africa'. In D. Victor and T.C. Heller (eds), *The Political Economy of Power Sector Reform*. Cambridge: Cambridge University Press.

Eberhard, A. (2011). 'The future of South African coal: Market, investment, and policy challenges'. Program on Energy and Sustainable Development, Stanford University, Working paper 100. Palo Alto, CA: Stanford University.

Eberhard, A. (2013). 'Feed-in tariffs or auctions? Procuring renewable energy supply in South Africa'. The World Bank Group Viewpoint, Note 338. Washington, DC: World Bank.

Eberhard, A., J. Kolker, and J. Leigland (2014). 'South Africa's renewable energy IPP procurement program: Success factors and lessons'. South Africa: PPIAF.

Edigheji, O. (ed.) (2010). *The Potentials for and Challenges of Constructing a Democratic Developmental State in South Africa.* Pretoria: HSRC Press.

Edkins, M., A. Marquard, and H. Winkler (2010). 'Assessing the effectiveness of national solar and wind energy policies in South Africa'. For the UNEP research project 'Enhancing information for renewable energy technology deployment in Brazil, China and South Africa'. Cape Town: Energy Research Centre, University of Cape Town.

Elzen, G., F.W. Geels, and K. Green (2004). *System Innovation and the Transition to Sustainability: Theory Evidence and Policy.* Cheltenham: Edward Elgar.

EY (2014). 'Renewable energy country attractiveness index (RECAI)'. *EY*, 40.

Fine, B. (2008) *The Minerals-Energy Complex is dead: Long live the MEC?* In: Amandla Colloquium unpublished).

Fine, B., and Z. Rustomjee (1996). *The Political Economy of South Africa: From Minerals-Energy-Complex to Industrialisation.* London: C. Hurst & Co. Ltd.

Freeman, C., and F. Louçã (2001). *As Time Goes By: From the Industrial Revolutions to the Information Revolution.* New York: Oxford University Press.

Freeman, C., and C. Perez (1988). 'Structural crises of adjustment, business cycles and investment behaviour'. In G. Dosi, C. Freeman, R.R. Nelson, G. Silverberg, and L. Soete (eds), *Technical Change and Economic Theory.* London: Harvester Wheatsheaf .

Freund, B. (2010). 'The significance of the MEC in the light of South African economic historiography'. *Transformation: Critical Perspectives on Southern Africa,* 71: 3–25.

Gaunt, C.T. (2008). 'Electricity distribution industry restructuring in South Africa: A case study.' *Energy Policy,* 36(9): 3448–59.

Geels, F.W., and J. Schot (2007). 'Typology of sociotechnical transition pathways,' *Research Policy,* 36(3): 399–417.

Gratwick, K.N., and A. Eberhard (2008). 'Demise of the standard model for power sector reform and the emergence of hybrid power markets,' *Energy Policy,* 36(10): 3948–60.

Gumede, W.M. (2007). *Thabo Mbeki and the Battle for the Soul of the ANC*. London/New York: Zed Books.

Ham, C., and M. Hill (1993). *The Policy Process in the Modern Capitalist State,* 2nd edition. London: Harvester Wheatsheaf.

Harvey, R. (2015). 'Mineral rights, rents and resources in South Africa's development narrative'. SAIIA Occasional Paper 224, November 2015. Johannesburg: SAIIA.

Hughes, A. (2010). 'IRP 2010 Assumptions'. Cape Town: Energy Research Centre, University of Cape Town, Energy modelling and analysis group. Available at: http://www.doe-irp.co.za/hearing1/ENERGY_RESEARCH_CENTRE.pdf (accessed on 12 September 2015).

Hughes, T.P. (1983). *Networks of Power: Electrification in Western Society 1880–1930*. Baltimore, MD: Johns Hopkins University Press.

IDASA, World Resources Institute, and Prayas Energy Group (2010). 'Electricity governance initiative of South Africa: The governance of power, shedding a light on the electricity sector in South Africa'. Pretoria: Electricity Governance Initiative. Available at: http://electricitygovernance.wri.org/files/egi/EGI-SA%20report%20-%20The%20Governance%20of%20Power%20%28Feb2010%29-cover.pdf (accessed on 7 March 2016).

International Bank for Reconstruction and Development (IBRD) and Eskom Holdings Limited (2010). 'Loan agreement (Eskom Investment Support Project) between International Bank for reconstruction and development and Eskom Holdings Limited'. Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2010/08/03/000334955_20100803023838/Rendered/PDF/560090IPR0P11610request0no10RQ10103.pdf (accessed on 7 March 2016).

International Energy Agency (IEA) (2011) 'World energy outlook'. Available at: https://www.iea.org/publications/freepublications/publication/WEO2011_WEB.pdf (accessed on 14 March 2016).

International Energy Agency (IEA) (2014). 'Africa energy outlook'. Available at: https://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf (accessed on 7 March 2016).

Keeley, J., and I. Scoones (2003). 'Knowledge, power and politics: Environmental policy processes in Africa'. In J. Keeley and I. Scoones (eds), *Understanding Environmental Policy Processes: Cases from Africa*. London: Earthscan.

Mainstream Renewable Power (2010). 'IRP 2010 comments and inputs'. Presented to Department of Energy IRP2010 Hearings, Johannesburg, 2 December 2010. Available at: http://www.doe-irp.co.za/irpJHB/MAINSTREAM_RENEWABLE_POWER.pdf (accessed on 2 September 2015).

Mantshantsha, S., and N. Marrian (2015). 'Model and cost of nuclear not yet decided'. *Business Day*. Available at: http://www.bdlive.co.za/business/energy/2015/08/31/model-and-cost-of-nuclear-not-yet-decided (accessed on 3 September 2015).

Marais, H. (2011). *South Africa Pushed to the Limit: the Political Economy of Change*. London: Zed Books.

Marquard, A. (2006). 'The origins and development of South African energy policy'. Thesis presented for the degree of Doctor of Philosophy. South Africa: Faculty of Engineering and the Built Environment, University of Cape Town.

Mazzucato, M. (2013). *The Entrepreneurial State*. London: Anthem.

McDonald, D. (2009). 'Electric capitalism: conceptualising electricity and capital accumulation in (South) Africa'. In D. McDonald (ed.), *Electric Capitalism: Re-colonising Africa on the Power Grid*. Cape Town: HSRC Press.

Meadowcroft, J. (2011). 'Engaging with the politics of sustainability transitions'. *Environmental Innovation and Societal Transitions*, 1: 70–5.

Michie, J., and V. Padayachee (eds) (1997). *The Political Economy of South Africa's Transition*. London: the Dryden Press.

Milonakis, D., and B. Fine (2009). *From Political Economy to Economics, Method, the Social and the Historical in the Evolution of Economic Theory*. London: Routledge.

Moe, E. (2010). 'Energy, industry and politics: Energy, vested interests, and long-term economic growth and development'. *Energy*, 35: 1730–40.

Mokyr, J. (1998). 'The political economy of technological change: Resistance and innovation in economic history'. In M. Bergand and K. Bruland (eds), *Technological Revolutions in Europe*. Cheltenham: Edward Elgar Publishers, pp. 39–64.

Nakhooda, S. (2011). 'Empowering a sustainability transition? Electricity planning in a carbon constrained South Africa'. MSc thesis. London: London School of Economics and Political Science.

NERSA (2008). *NERSA Consultation paper: Renewable energy feed-in tariff*. South Africa: NERSA.

Newbery, D., and A. Eberhard (2008). 'South African network infrastructure review: Electricity, 2007'. South Africa: National Treasury and DPE, Government of South Africa.

Olsen, S. (2007 19 Jul). 'Confidential memo to Jacob Maroga from Susan Olsen, Wingfield Consultancy, Warner New Hampshire, USA re: Issues for today's meeting regarding Generation Primary Energy'. Cape Town: Democratic Alliance.

Padayachee, V. (2010). 'Re-introducing the minerals-energy complex'. *Transformation: Critical Perspectives on Southern Africa*, 71: 1–2.

Paton, C. (2015a). 'Cabinet gives green light to nuclear procurement'. *Business Day*. Available at: http://www.bdlive.co.za/business/energy/2015/12/14/cabinet-gives-green-light-to-nuclear-procurement (accessed on 05 February 2016).

Paton, C. (2015b). 'Updated IRP may raise share of nuclear power'. *Business Day*. Available at: http://www.bdlive.co.za/business/energy/2015/09/02/updated-irp-may-raise-share-of-nuclear-power (accessed on 3 October 2015).

Paton, C. (2015c). 'Work drags on at key Eskom power projects'. *Business Day*. Available at: http://www.bdlive.co.za/business/energy/2015/08/13/work-drags-on-at-key-eskom-power projects (accessed on 12 October 2015).

Paton, C. (2015d). 'Key details of SA's nuclear plan kept under wraps'. *Business Day*. Available at: http://www.bdlive.co.za/business/energy/2015/06/02/key-details-of-sas-nuclear-procurement-plan-kept-under-wraps (accessed on 2 February 2016).

Pegels, A. (2010). 'Renewable energy in South Africa: Potentials, barriers and options for support'. *Energy Policy,* 38(9): 4945–54.

Pickering, M. (2010). 'Towards an independent system operator for South Africa'. Cape Town: Energy Research Centre, University of Cape Town.

Pienaar, G., and S. Nakhooda (2010). *The Great Policy Disconnect*. Cape Town: Heinrich Boell Stiftung.

Pombo-van Zyl, N. (2015). 'Eskom: Electricity tariff increase of 12.69 per cent from 1 April'. *ESI-Africa,* 23 March 2015.

RECAI (2015). 'Renewable energy country attractiveness index'. *EY*, 45.

Renewable Energy Summit (2009). 'Conference report: Towards a sustainable renewable energy sector in South Africa, 19–20 March 2009'. Pretoria.

Reuters (2015). 'NUM says would oppose Eskom asset sales'. *Engineering News*, 6 March 2015. Available at: http://www.engineeringnews.co.za/article/num-says-would-oppose-eskom-asset-sales-2015-03-06/rep_id:3182 (accessed on 1 March 2016).

Rip, A., and R. Kemp (1998). 'Technological change'. In S. Rayner, E. Malone, and L. Columbus (eds), *Human Choice and Climate Change volume 2: Resources and Technology*. Ohio: Battelle Press.

Seccombe, A. (2015). 'South Africa losing importance in global mining ranks'. *Business Day,* 16 October 2015. Available at: http://www.bdlive.co.za/business/mining/2015/10/16/sa-losing-importance-in-global-mining-ranks (accessed on 21 October 2015).

Smith, A., and A. Stirling (2007). 'Moving outside or inside? Objectification and reflexivity in the governance of socio-technical systems'. *Journal of Environmental Policy & Planning*, 9: 351–73.

Smith, A., A. Stirling, and F. Berkhout (2005). 'The governance of sustainable socio-technical transitions'. *Research Policy*, 34: 1491–510.

Theron, A. (2015). 'South Africa: Solar PV projects to grow local economy'. *ESI-Africa.* Available at: http://www.esi-africa.com/s-africa-solar-pv-projects-to-grow-local-economy/ (accessed on 28 October 2015).

Trollip, H., and A. Marquard (2014). 'Prospects for renewable energy in South Africa—climate change'. South Africa: Heinrich Boll Stiftung Available at: https://za.boell.org/2014/02/03/prospects-renewable-energy-south-africa-climate-change (accessed on 7 March 2016).

Unruh, G.C. (2002). 'Escaping carbon lock-in'. *Energy Policy*, 30: 317–25.

Wildavsky, A. (1979). *Speaking Truth to Power: The Art and Craft of Policy Analysis*. New York: Little Brown & Company.

Williams, J.H., and R. Ghanadan (2006). 'Electricity reform in developing and transition countries: A reappraisal'. *Energy* 31(6–7): 815–44.

Yelland, C. (2014). 'Medupi: Likely delay in first synchronisation of Unit 6'. *The Daily Maverick,* 25 November 2014.

Yi-chong, X. (2006). 'The myth of the single solution: Electricity reforms and the World Bank'. *Energy,* 31(6–7): 802–14.