Governing power in South Africa: the political economy of socio-technical transitions

1. Introduction
The governance of South Africa’s electricity sector is inextricably bound up with its historical dependence on its abundant coal resources and cheap labour for the generation of cheap electricity for export-oriented industry. This forms the essence of the country’s ‘minerals-energy complex’ (Fine and Rustomjee 1996) and complex political and economic legacy of apartheid which sits at the heart of this research.

The country’s dependence on cheap coal for approximately 90 per cent of its electricity generation which generates 50 per cent of its carbon emissions is now challenged by rising coal costs, national electricity supply shortages, climate change mitigation requirements and the emergence of renewable energy independent power producers (IPPs). Despite the absence of national expertise the country has a huge potential for a number of different renewable energy technologies still largely untapped. Meanwhile as an embryonic renewable energy industry emerges, amidst great controversy the 4,800 MW Medupi coal-fired power plant- the largest on the continent- has been redefined as a ‘clean coal’ power plant following a highly controversial World Bank loan of $3 billion in April 2010.

This paper examines examples of two recent developments in South Africa’s electricity sector: the National Integrated Resource Plan for electricity and the Medupi coal-fired power plant. It examines the extent to which they constitute structural transitions in the country’s minerals-energy complex, or rather form an ‘add-on’ to incumbent interests which remain fundamentally unchallenged. The paper takes a critical political economy approach (Büscher 2009, Söderbaum 2004) which fuses South Africa’s minerals-energy complex with a socio-technical transitions framework (Rip and Kemp 1998, Smith et al 2005) in order to generate key insights into governance and policy-making in the electricity sector. In doing so it contributes to a comprehensive analytical framework for a problem that is at once
political, economic, social and technological. This allows for the analysis of historical power
relations, structural change and the underlying interests of dominant actors and
beneficiaries of governance mechanisms. It also avoids reducing a complex debate to a
technocratic perspective on governance and policy (Torgerson 2003), referred to by

This contributes to a research gap that firstly responds to calls to consider issues of politics
in the socio-technical transitions literature (Meadowcroft 2011, Smith et al 2005) and
Goldthau and Sovacool’s (2011:238) finding that the “political economy of energy transitions
is a vastly understudied area”. Secondly the transitions literature has mainly focused on
OECD countries, particularly Europe and so its consideration of low and middle income
countries within the context of a globalised and financially interdependent world is
therefore limited (Lawhon and Murphy 2011:10) with exceptions including the work by
Sussex Energy Group on India and China (Wang and Watson 2010, Watson et al). Work on
sub-Saharan Africa appears to be non-existent and is a key contribution of this research.
Thirdly this research addresses the relative absence of critical political economy perspectives
of the country’s power sector in the post-apartheid era (Büscher 2009). Added to which,
while the minerals-energy complex is widely cited in literature on South Africa’s energy
policy and climate change strategies (Winkler 2009, IDASA 2010), conceptually it has not
been explored in depth in relation to the introduction of renewable energy given the latter’s
recent emergence.

This paper asks:

- **How can insights from political economy contribute to a socio-technical transitions
framework in order to generate insights into governance and policy making in South
Africa’s electricity sector?**

- **To what extent do recent developments in South Africa’s electricity sector represent
a genuine shift in its minerals-energy complex?**

### 2. Minerals-energy complex

A concept initially coined and expanded by Ben Fine and Zavareh Rustomjee in 1996, the
minerals-energy complex (MEC) lies at the “core of the South African economy, not only by
virtue of its weight in economic activity but also through its determining role throughout the
rest of the economy” (Fine and Rustomjee 1996:5). The authors identified an intrinsic link
between the state and private capital and between “a core set of activities around mining
and energy, straddling the public/private divide”. Key activities of the MEC include coal, gold, diamond and other mining activities; non-metallic mineral products; iron and steel basic industries; and fertilisers, pesticides, plastics, basic chemicals and petroleum. It is “uniquely dependent on electricity and uniquely electricity-intensive” (Fine and Rustomjee 1996:8). Cheap labour has also been essential to this process (Makgetla and Seidman 1980).

The MEC’s activities were first established in the north east of the country following the discovery of gold, which resulted in the concentration of economic power and wealth in the hands of a small number of large state-owned corporations, including the electricity utility Eskom (Hallowes and Munnik 2007). Eskom generates 96 per cent of national electricity and is the sole transmitter of electricity via the country’s high-voltage transmission grid. However its strategic monopoly position within the MEC is now threatened by electricity supply shortages, rising coal costs from private coal suppliers, a funding crisis and legislative changes that allow for the introduction of private producers of renewable energy. Industry, of which mining and manufacturing form the bulk, consumes over 50 per cent of the country’s electricity with residential consumers accounting for less than 20 per cent (see figure 1). The Energy Intensive User’s Group whose 36 members include conglomerates such as BHP Billiton, Anglo-American and Xtrata, consumes around 44 per cent of the electricity sold in South Africa.
The MEC has been used as framework of analysis by a number of scholars writing about the country’s political economy. For example, Freund (2010) finds that it offers “a way of understanding power and key networks in South Africa’s political economy” between the financial sector, parastatals, government and the private sector. Similarly, Padayachee (2010) asks what does the MEC “tell us about power relations and ‘politics’ in contemporary South Africa” and “what does it imply for policy”? Such perspectives contribute to the analytical approach of this research.

### 3. Socio-technical transitions

The term ‘socio-technical transitions’ refers to “deep structural changes” in systems such as energy and transport, which involve long-term and complex reconfigurations of technology, policy, infrastructure, scientific knowledge, and social and cultural practises to sustainable ends (Geels 2011:24). Its wide-ranging literature draws originally from institutional theory, evolutionary economics and the sociology of technology (Rip and Kemp 1998, Geels and Schot 2007) and more recently political science and theories of governance (Scrase and Smith 2009, Meadowcroft 2011). Contemporary work on socio-technical transitions exists...
under a variety of permutations, of which the most relevant for this research is the multi-level perspective (MLP) (Geels 2011). This analyses systems change from the level of: ‘landscapes’, ‘regimes’, and ‘niches’ as illustrated in figure 2. As a framework it is concerned with the way in which incumbent regimes lose stability and thereby undergo transitions as a result of coordinated selection pressures from the niche and landscape levels. It offers a valuable heuristic device for the narrative exploration (Smith, Voß and Grin 2010) of developments taking place in South Africa’s electricity sector that will in turn provide valuable insights into governance and policy making.

A regime refers to patterns of technologically determined behaviour which is shaped by “cognitive routines” shared by engineers and influenced by policy makers, scientists, energy users, vested interests and other professional groups (Geels and Schot 2007:400). Though gradually evolving, events and structures and within the regime are stable and fairly predictable, and protected by ‘lock-in’ mechanisms (Unruh 2010). A niche refers to a protected space at the micro-level, where “radical innovations” (Geels 2011:27) and learning such as new technologies, markets, ideas, practices and policies emerge which deviate from the dominant regime (Lehtonen and Kern 2009). These are carried out by “small networks of dedicated actors, often outsiders” and are unstable in nature (Geels and Schot 2007:400). A ‘landscape’ refers to the external environment or influences at the macro-level. Geels (2011:28) adds that it includes “demographical trends, political ideologies, societal values and macro-economic patterns” and influences dynamics at the levels of the regime and the niche.
Such a framing permits an inquiry into the extent to which electricity governance in South Africa currently constitutes a simple confrontation between entrenched coal-fired interests at the regime level and emerging niches in renewable electricity generation. While the former broadly consists of a state-run, coal-generated, publicly-funded electricity sector, the latter involves an emerging entrepreneurial cluster of renewable energy independent power producers backed by bi-lateral donors, private equity and investment. Both of these levels interact with and are backed by stakeholders and events at the ‘landscape’ level, which include: trends and costs in international renewable energy development; global research into ‘clean coal’ technologies; the role of international development finance institutions such as the World Bank; and carbon trading mechanisms such as the Clean Development
Mechanism (CDM). Alternatively it must be asked whether a more complex reality is emerging and if in fact the incumbent regime may not actually be threatened by low carbon initiatives which thus far are taking place in parallel to additional coal developments. As Goldthau and Sovacool (2011:235) state, “new technologies may succeed only if they can ‘add on’ to the incumbent system i.e if they are compatible with the system’s dominating features. By definition, this prevents radical change”.

4. Power struggles: increased coal and emerging renewables

South Africa’s Integrated Resource Plan (IRP 2010) for electricity, approved in May 2011 aims to double national generation capacity from approximately 41,000 MW to 89,532 MW by 2030 (see figures 3, 4). This has been celebrated in some arenas for diversifying the country’s energy mix away from coal and allowing for the introduction of 23,559 MW of grid-connected renewable energy (of which 9,200 MW wind, 8,400 MW solar photovoltaic (PV) and 1,200 MW concentrated solar power (CSP) ) (DoE 2011:14). Although the mix has incorporated renewables, of which the majority will come from independent power producers, the doubling in overall capacity will still lead to increased national greenhouse gas emissions. This is because in absolute terms, coal increases by 6,000 MW to a total of 50,771 MW even though proportionally it decreases from 85 to 46 per cent (DoE 2011:14). An ambitious nuclear fleet is also planned whose cost has yet to be determined. A project must be in line with the technological limits set by IRP 2010 in order for it to be granted a generation license by the national energy regulator.
Winkler (2011) explains that the IRP would result in “GHG emissions from electricity generation increasing from 237 million tons of CO2 in 2010 to 272 million tons in 2030”. It will also increase electricity prices, “by at least 250 per cent in real terms from their current level by 2020 and by a much higher rate with inflation factored in” (Winkler 2011). This doubling in electricity capacity serves to fuel a demand forecast which anticipates a double
fold increase in mining and minerals beneficiation and coal-to-liquids technology as shown in figure 5, something which was referred to by a representative of the City of Cape Town’s climate and energy branch in December 2010 as “business as usual on steroids” (in Donnelly 2010).

**Figure 5: IRP 2010 demand forecast for industrial sector**

![Graph 1](image1)

**Graph 2**

![Graph 2](image2)

*Source: Eskom Systems Operation and Planning Department (2010)*

The way in which this plan was negotiated is also notable. While the participatory nature of its public consultation process was welcomed, a ‘technical advisory group’ which provided inputs into the modelling process was heavily criticised for consisting largely of representatives from coal miners, the energy intensive users group, the utility and government. Described as a “Who’s Who of the coal-mining and energy-intensive users in South Africa” (Greyling 2010), it failed to include representatives from the renewable energy industry, civil society or experts from the fields of social impacts and environmental quality. The committee’s meetings and its minutes were not made accessible to the public and all of
its members signed confidentiality agreements with the Department of Energy. Civil society
groups expressed concern that the modelling process on which the committee was advising
was likely to reflect the industrial bias of the interests of its members (McDaid et al 2010:6).

Not only does this process illustrate that an apparently technical exercise, such as electricity
modelling can be inherently political but also reveals the privileged access that traditional
MEC stakeholders have to decision makers, and the influential role that regime incumbents
continue to play in electricity policy making in South Africa. This is in spite of the incremental
steps made by emerging renewable energy players and indeed the nuclear industry. Finally
despite its transformative potential the plan may merely perpetuate high-carbon
technological lock-in. In May 2011, journalist Troye Lund explained, “Government has been
insistent the IRP is a “living document” and not cast in stone: it will and can be changed as
and when new technologies develop. However, the reality is that once an energy plan such
as the IRP is approved – and once the State is locked into huge fleet contracts for the
relevant new coal or nuclear power stations – it will be difficult, if not impossible, to get out
of them. Furthermore, if funding is committed to those power stations, that spending will
hinder any potential for investment in renewable or cleaner energy technologies as and
when they come on line” (Lund 2011).

5. ‘Clean’ Coal: Protecting the regime?
The 4,800 MW Medupi coal-fired power plant in Limpopo Province will be the largest coal-
-fired power plant on the continent and the first to use ‘supercritical’ coal technology. It is
estimated that on completion, the plant will emit 29.9 million tonnes of CO2 per year.

The $3.75 billion loan from the World Bank to Eskom, approved in April 2010 is its largest
ever investment in the country and consists of three components: $3,040 million for
Medupi; $260 million for the Sere Wind Farm and Upington CSP plant; and $440 million for
“low carbon energy efficiency components” (World Bank 2010). As part of Bank conditions
for the loan, Eskom must have a programme in place to install flue-gas desulphurisation
(FGD) equipment in each of the six units which must be retrofitted as it was not included in
the project’s original design.

A key rationale for the World Bank’s involvement is that it would facilitate South Africa’s
development of a low carbon strategy as enshrined in its national mitigation strategy (Peters
and Hogan 2010). The Bank’s loan document stated that without Medupi, “South Africa
would not be able to embark on the aggressive implementation of its low carbon initiatives”.
This is justified by the project’s use of FGD; the construction of the Sere wind farm and Upington CSP plant which are presented as catalysts to South Africa’s potential renewable energy sector and demonstration sites for large scale private renewable energy generation on the continent; the use of super-critical technology which will reportedly result in approximately 7 per cent less emissions per annum as compared to the use of ‘sub-critical’ technology; and the fact that Medupi and all future coal fired power projects be made ‘CCS-ready’. Eskom’s finance director said that the loan finance was “catalytic for South Africa’s commitment to renewable energy and lower carbon technologies such as large-scale solar thermal and wind power” (Eskom 2010).

The construction of the plant and the World Bank loan met with intense opposition from national and international civil society over social and environmental concerns (Hallowes 2009, Earthlife 2010). There was also internal opposition from within the World Bank demonstrated by abstentions from the board’s vote on the loan by the US, UK, Netherlands and Italy (Njobeni 2010). However in November 2011, Water and Environment Minister Edna Molewa said that because South Africa recognised its vast untapped renewable energy potential “the construction of Medupi and Kusile plants should not be seen as adding to the carbon emissions in our country... So it’s not an addition, in a way and we also know there is just no way that South Africa will do without coal, but it must be clean coal, it must be technologies that actually help us to even reduce the carbon emissions as we use coal, and I am sure that intelligent people world wide are there to help us do that” (in Naidoo 2011).

Further support from the landscape level may also be provided in the form of carbon emission reduction credits under the CDM which Eskom is considering applying for on the basis of emission reductions from Medupi’s supercritical technology and FGD (Friedman 2010).

6. Conclusion
This paper has undertaken a selective analysis of developments taking place in South Africa’s electricity sector which illustrate that while there is a potential diversification in South Africa’s electricity mix, coal is still set to play a dominant role as illustrated by the IRP 2010 and the Medupi coal-fired power plant. Emerging niche actors in private renewable energy generation supported by actors at the landscape level have clearly had some success in achieving a certain level of change. However the extent to which they can compete for resources and access to the electric grid with entrenched vested interests such as the coal industry and energy intensive users who as demonstrated by the IRP 2010 have more access
to and influence over decision makers in government is as yet unclear. Moreover in the case of both the IRP 2010 and the World Bank’s loan to Medupi, the benefits gained from the introduction of renewable energy are overwhelmed by the growth in electricity demand and end-user practices which remain fundamentally unaltered.

World Bank funding for the Medupi coal-fired power plant can be described as a “reinforcing landscape development”, following Geels and Schot (2007:406) in that it has served to stabilise the regime. What is also significant is that Medupi’s supercritical technology, FGD and the smaller renewable energy and energy efficiency projects funded alongside it are central to its national and international legitimacy. However in reality these constitute small measures compared to what is fundamentally an enormous coal-fired power plant. With this in mind it can be argued that faced with competing renewable energy development and national and international concerns over climate change, coal-generated interests are undertaking “incremental innovations” (Scraser and Smith 2009:710) in the form technological modifications and the use of discourse which presents coal as clean. Such measures seek to preserve the status quo and, it can be argued do not result in a fundamental re-adjustment to overall regime architecture. Finally, that Medupi may benefit from the CDM in this instance is a noteworthy example of a landscape pressure that should ostensibly provide support for a low carbon niche (Scraser and Smith 2009:715), that is in fact serving the interests of the incumbent regime.
7. References


Lawhon, M. And Murphy, J.T (2011). Socio-technical regimes and sustainability transitions: Insights from political ecology, Progress in Human Geography, published online 8 December 2011


Watson, J, Byrne,R, Ockwell,D and Stua, M, Mallett, A (2010). Low Carbon Technology Transfer: Lessons from India and China, Sussex Energy Group, Policy briefing, Number 9, November 2010


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