Power shifts? The political economy of socio-technical transitions in South Africa's electricity sector

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Thesis Abstract

South Africa's electricity sector is subject to significant change. Its historical dependence on cheap coal for approximately 90 per cent of its electricity generation is challenged by rising coal costs, national supply shortages, climate change mitigation requirements and the introduction of renewable energy generation. The generation of cheap electricity for minerals-based export-oriented industry forms the essence of the country's 'minerals-energy complex' (MEC) (Fine and Rustomjee 1996) which is founded on intrinsic links between state corporations and private capital and the country's complex legacy of apartheid. Meanwhile as a privately-generated renewable energy industry emerges, the Medupi coal-fired power plant, the largest on the continent has been redefined as 'clean coal' following a World Bank loan of $3 billion in April 2010.

The overarching analytical framework of this thesis fuses a socio-technical transitions framework (Smith et al 2005, Geels and Schot 2007) with political economy perspectives (Fine and Rustomjee 1996, Büscher 2009). This generates insights into governance and policy-making in South Africa's electricity sector and constructs a framework for a problem that is at once political, economic, social, environmental and technological. Firstly it allows for an analysis of structural change, conflicts between state entities, and the underlying interests of dominant actors and beneficiaries of the country's electricity sector. Secondly it permits an exploration of shifting capital interests between the country's entrenched coal-based 'regime' and its emerging renewable energy 'niche'. The thesis investigates the extent to which low carbon developments taking place in South Africa's electricity generation sector constitute a socio-technical transition in the country's MEC. It concludes that recent changes in South Africa's electricity sector are indicative of the MEC's evolution rather than its decline. Despite considerable diversification in the electricity mix, for the time-being coal-based vested interests are set to dominate at the level of supply and demand.

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List of Abbreviations

AAC	Anglo American Corporation
AFD	Agence Française de Développement
AfDB	African Development Bank
ANC	African National Congress
BEE	Black Economic Empowerment
BBBEE	Broad Based Black Economic Empowerment
CaBEERE	Capacity Building Project in Energy Efficiency and Renewable Energy
CAPEX	Capital Expenditure Programme (of Eskom)
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CDP	Carbon Disclosure Project
CEF	Central Energy Fund
CER	Carbon Emission Reductions
COSATU	Congress of South African Trade Unions
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
CSR	Corporate Social Responsibility
CSIR	Council for Scientific and Industrial Research
CTF	Clean Technology Fund
DA	Democratic Alliance
DCCSF	Development and Climate Change, a Strategic Framework for the World Bank Group
DANIDA	Denmark's development cooperation (under Denmark's Ministry of Foreign Affairs)
DANCED	Danish Cooperation for Environment and Development
DARLIPP	Darling Independent Power Producer
DBSA	Development Bank of South Africa
DEA	Department of Environmental Affairs
DFI	Development Finance Institution
DME	Department of Minerals and Energy
DNA	Designated National Authority (of the CDM)
DoE	Department of Energy
DPE	Department of Public Enterprises
DRC	Democratic Republic of Congo
DSM	Demand Side Managment
DTI	Department for Trade and Industry
ECA	Export Credit Agency
ECCWEDA	Eastern Cape Community Wind Energy Development Association
ED	Executive Director (of World Bank or African Development Bank)
EDD	Economic Development Department
EDI	Electricity Distribution Industry
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIUG	Energy Intensive Users Group

EPCM	Engineering, Procurement and Construction
EPRI	Electric Power Research Institute
ERC	Energy Research Centre (of the University of Cape Town)
ESI	Electricity Supply Industry
FGD	Flue Gas Desulphurisation
GEF	Global Environment Facility
GDP	Gross Domestic Product
GHG	Green House Gas
GIZ	Deutsche Gesellescshaft fuer Internationale Zusammenarbeit
GPE	Generation Primary Energy Division (of Eskom)
GTZ	Deutsche Gesellscahft für Technische Zusammenarbeit (German Technical Cooperation)
GWH	Giga watt Hour
IBRD	International Bank for Reconstruction and Development
IDASA	Institute for Democracy in Africa
IDC	Industrial Development Corporation
IEA	International Energy Agency
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPAP	Industrial Policy Action Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan
ISMO	the Independent Systems and Market Operator
ISS	Institute for Security Studies
JSE	Johannesburg Stock Exchange
LDC	Least Developed Country
LMIC	Low and Middle Income Country
LTMS	Long-Term Mitigation Scenarios
MEC	Minerals-Energy Complex
MIC	Middle Income Country
MLP	Multi-Level Perspective
MPRD	Mineral and Petroleum Resources Development
MTPPP	Medium Term Power Purchase Programme
MW	Megawatt
MYPD	Multi-Year Price Determination
NEPAD	New Partnership for Africa's Development
NERSA	National Energy Regulator of South Africa
ODA	Overseas Development Assistance
O&M	Operation and Maintenance
OECD	Organisation of Economic Cooperation and Development
OPEC	Organisation of Petroleum Exporting Countries
PAFO	Powering Africa: the Financial Options (conference in Cape Town, Nov 2010)
PGM	Platinum Group Metals
PPA	Power Purchase Agreement
PPIAF	Public Private Infrastructure Advisory Facility
PPP	Public Private Partnership
PV	Photo voltaics
RBCT	Richards Bay Coal Terminal
RED	Regional Electricity Distributor

RE IPPPP	Renewable Energy Independent Power Producer's Procurement Programme
REFIT	Renewable Energy Feed-in Tariff
REMT	Renewable Energy Market Transformation Project
RFP	Request for Proposals
SAAEA	South African Alternative Energy Association
SACU	South Africa Customs Union
SADC	Southern Africa Development Community
SAFCEI	South African Faith Communities Environment Initiative
SAIPPA	South African Independent Power Producers Association
SANEA	South African National Energy Association
SANERI	South African National Energy Research Institute
SAPP	Southern Africa Power Pool
SAR	South African Railways
SAREC	South Africa Renewable Energy Council
SAWEA	South Africa Wind Energy Association
SAWEP	South African Wind Energy Programme
SSA	Sub-Saharan Africa
TCOA	Transvaal Coal Owners Association
TIPS	Trade and Industrial Policy Strategies
TM	Transition Management
TWh	Terra Watt Hours
UCT	University of Cape Town
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
VFTPC	Victoria Falls and Transvaal Power Company
WASA	Wind Atlas for South Africa

1 Chapter 1: Introduction

1.1 Background, research questions and rationale

South Africa's electricity sector is subject to significant change. Its historical dependence on cheap coal for approximately 90 per cent of its electricity generation is challenged by rising coal costs, national supply shortages, climate change mitigation requirements and the introduction of renewable energy generation. As an embryonic renewable energy industry emerges, the Medupi coal-fired power plant, the largest on the continent has been redefined as 'clean coal' following a World Bank loan of $3 billion in April 2010. While South Africa's electricity sector has to date been controlled by the monopoly utility Eskom, 44 per cent of its generation is consumed by its Energy intensive User's Group whose 36 members include some of the world's largest resource and mining conglomerates. These companies, of which five simultaneously hold a monopoly over the country's coal production, are its largest emitters of greenhouse gases.

The overarching analytical framework of this thesis fuses a socio-technical transitions framework (Rip and Kemp 1998, Smith et al 2005, Meadowcroft 2011) with political economy perspectives (Fine and Rustomjee 1996, Büscher 2009). This generates insights into governance and policy-making in South Africa's electricity sector and constructs a framework for a problem that is at once political, economic, social, environmental and technological. This allows for an analysis of structural change, conflicts between state entities, and the underlying interests of dominant actors and beneficiaries of the country's electricity sector as well as shifting capital interests between the country's entrenched coal-based 'regime' and its emerging renewable energy 'niche'.

In this thesis I examine how South Africa's electricity sector is inextricably bound up with its dependence on abundant coal resources and cheap labour for the generation of cheap electricity for minerals-based export-oriented industry. This forms the essence of the country's 'minerals-energy complex' (henceforth MEC) (Fine and Rustomjee 1996) which is founded on intrinsic links between state corporations and private capital and the country's complex legacy of apartheid. I investigate the extent to which low carbon developments taking place in South Africa's electricity generation sector constitute a socio-technical transition in the country's MEC. The starting consideration is that low carbon initiatives in South Africa's electricity sector are being slotted into an existing industrial infrastructure based on a high carbon paradigm, which has limited benefits for the energy poor, high inequality of access and a highly uneven infrastructure development (Hallowes and Munnik 2007).

1.1.1 Research gap

This thesis contributes firstly to a research gap that responds to calls to consider power and politics in the socio-technical transitions literature (Meadowcroft 2011, Smith et al 2005) and Goldthau and Sovacool's (2012:238) finding that the "political economy of energy transitions is a vastly understudied area". Secondly while the literature on sustainability transitions has examined energy systems change at length, it has focused mainly on OECD countries, particularly Europe. Its consideration of low and middle income countries (LMICs) whose economic growth is predicated on natural resource extraction and heavy manufacturing within the context of a globalised and financially interdependent world is therefore limited (Lawhon and Murphy 2011:10). Though work on India and China has emerged in recent years (Pachauri and Jiang 2008, Wang and Watson 2010, and Watson et al 2010) and Asia more generally (Berkhout et al 2009, 2010), work on sub-Saharan Africa appears to be non-existent. Responding to such a gap is one of my key contributions. Thirdly I address the relative absence of political economy perspectives of South Africa's power sector in the post-apartheid era (Büscher 2009). Added to which, while the MEC is widely cited in literature on South Africa's energy policy and climate change strategies (Winkler 2009, IDASA 2010, Edkins et al 2010), conceptually it has not been explored in-depth in relation to the introduction of renewable energy given the latter's recent emergence (Burton 2011).

I am also cognisant of the profoundly inter-disciplinary origins of political economy (Tabb 1999 Milonakis and Fine 2009) and therefore it can be argued, integrating this with socio-technical transitions is appropriate to the notion of "economics as a social science" (Milonakis and Fine 2009:1) and as an illustration of the fluid boundaries of both disciplines. In essence, I attempt to speak to audiences from two broad camps: those concerned with the impacts of climate change and environmental degradation and who see low carbon transitions as a way to analyse and bring about socio-technical change in the energy sector; and those concerned with political economy as a framework of analysis and a method for the realisation of economic and political structural transformation, with social well being as the ultimate end. While these two broad camps are not mutually exclusive, there has been limited cross-fertilisation between them to date. In attempting to address this and while accepting inevitable limitations, I hope to enrich both perspectives whilst doing justice to both sides.

1.1.2 Research questions

The overarching research questions that this thesis addresses are:

- *To what extent do recent developments in South Africa's electricity generation sector constitute a low carbon transition in its minerals-energy complex?*
- *How can political economy perspectives contribute to a socio-technical transitions framework in order to generate insights into governance and policy-making in South Africa's electricity sector?*

These are assisted by the following more empirically focused sub-questions:

- *How is electricity policy negotiated in South Africa?*
- *How are environmental, social, economic, political and technical priorities reflected in electricity decision-making in South Africa?*
- *How has the introduction of renewable energy in South Africa been negotiated and implemented, and who and what have been the key drivers and forces of influence?*
- *How is the historically entrenched coal industry resisting and adapting to an evolving energy landscape?*

1.1.3 Case studies

The research questions are addressed in relation to the following case studies:

i. Key policy developments in the electricity sector, specifically: the renewable energy independent power producer's procurement programme (RE IPPPP) and the integrated resource plan for electricity (IRP). These are examined within the context of significant, yet at times conflicting national policy developments taking place simultaneously (chapter 5).

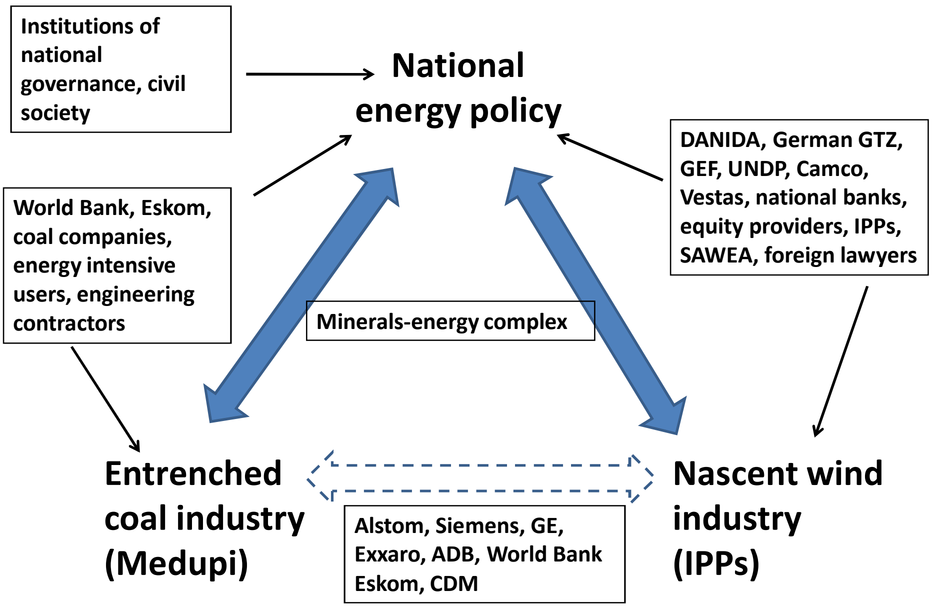
ii. The nascent wind energy industry: this is being developed largely by independent power producers backed by private finance who aim to benefit from the country's recently approved RE IPPPP (chapter 6).

iii. The Medupi coal-fired power plant in Limpopo province. Referred to by the government as "Africa's first clean coal 'supercritical' power station", when complete it will emit approximately 30 million tonnes of CO_2 per year. In April 2010, in the midst of intense environmental, economic and social debate, the World Bank approved funding for $3 billion (chapters 7 and 8).

These case studies help to explore and illuminate key tensions between economic, political, industrial, environmental and social priorities in the electricity sector. This thesis looks exclusively at electricity, the country's largest energy sub-sector which supplies 29 per cent of its energy demand. The research is focussed within the context of the national grid to which 70 per cent of the population has access, the proposed wind projects and the Medupi coal-fired power plant will connect and the national policy in question applies. Other energy developments beyond the national grid infrastructure such as South Africa's solar water heating programme go beyond the remit of this thesis.

As a study of the policy process, the research employs a qualitative methodology and embedded case study approach (Yin 2009) in order to obtain rich insights into multiple dimensions of the political economy of South Africa's electricity sector. It constitutes a deep and critical enquiry into how changes in national policy are being negotiated and evaluates the role of national and international stakeholders and beneficiaries in the public and private spheres. These include government departments; industrial conglomerates; private banks, bilateral and multi-lateral donors; civil society and grass roots organisations; unions; and academics. Figure 1.1 illustrates the interdependent relationships between these three case studies and some of the key stakeholders that influence and/or benefit from them.

Figure 1.1: The relationship between the case studies



1.1.4 Rationale

Motivated by a concern for poverty reduction and social, economic and environmental justice, this research should be read in the context of other studies which assert that a fundamental transformation to a low carbon future and industrial structure is needed (Weischer et al 2011). This thesis takes as a starting point that the world's natural resources are limited (Meadows et al 1972, Rockström et al 2009) despite the innovative role that can be played by technological developments. It sees global economic dependence on fossil fuels as one of the fundamental obstacles to global environmental change (Adger et al 2010). While the need for an equitable low carbon transition is an underlying motivation for this research, I do not ignore the urgent need for rich countries to face up to their own green house gas responsibilities, or the role that their demands have played in driving and perpetuating South Africa's high carbon export-based growth. Concepts of ecological debt (Simms 2005) are similarly relevant. Neither does this thesis naively assume that all of South Africa's energy needs, however defined, can currently be met with renewable energy, acknowledging the significant technological uncertainties that exist on this point. This research recognises the immense challenges of the entrenched and highly inequitable and racist legacy in the energy sector inherited by the post-apartheid government in 1994 and pays all due respect to the struggle and dedication of the numerous individuals and institutions that have fought to overcome this.

I examine a multiplicity of processes and activities within a constantly evolving national scenario in order to expose and illuminate a complex and at times obscure reality of the political economy of South Africa's electricity sector. Empirical findings at the national level are related to the global context, including trends in the renewable energy industry, international coal markets, the role of energy subsidies and climate finance. I seek to identify factors which explain emerging policy changes in South Africa's electricity sector rather than designing a deterministic vision of low carbon energy development for the country which would go beyond my legitimacy as a foreign post-graduate researcher. Hence the overall objective is analytical rather than prescriptive, is in keeping with the difference identified by Ham and Hill (1993:4) between analysis *for* policy and analysis *of* policy.

1.2 Why South Africa?

Even since the start of 2010 when my fieldwork commenced, South Africa's energy policy has undergone a bewildering sequence of events, preceded in December 2009 under the Copenhagen climate change accord when President Jacob Zuma pledged to reduce his country's greenhouse gas emissions by 34 per cent by 2020 and 44 per cent by 2025, contingent on financial support and technological transfer (RSA 2010b). This was based on the 'Peak, Plateau and Decline' trajectory of the country's Long-term Mitigation Scenarios (LTMS) endorsed by Cabinet in 2008 (CDP 2011:6) which sets the country's emissions to peak by around 2020 to 2025, plateau for a decade and decline in absolute terms from around 2035. Meanwhile South Africa faces a crisis of generation which resulted in rolling blackouts and mine closures across the country in 2008 and threats of further load shedding in 2012 and beyond. Since 2005 the country's monopolistic utility Eskom, which currently generates 95 per cent of its electricity has been struggling to build an additional 17000 MW of generation capacity by 2018 whilst facing a funding crisis (Eskom 2011:61).

On 24 February 2010 the energy regulator approved a cumulative increase in electricity tariffs of approximately 25 per cent per year for the next three years starting on 1 April 2010. In 2011 Canada replaced South Africa as the world's cheapest electricity producing country which is now in 11th place globally with an average cost of electricity at 8.55 US cents per kWh (Njobeni 2012:*28 June*). Further price rises are predicted. While the era of cheap electricity, of particular benefit to the country's large energy intensive users may be over, there has been public outcry over cheaper electricity tariffs, or 'special purchasing agreements' for users such as BHP Billiton, Anglo American and Xstrata (Carnie 2010, Earthlife 2010b) some of which had been agreed during the apartheid era (Creamer 2010:*12 March*). Amidst great national and international controversy on 8 April 2010 the World Bank's board approved a $3 billion loan for Eskom's Medupi coal-fired power plant (chapter 8), alongside $260 million for the Sere Wind Farm and Upington Solar Power Plant (section 6.10).

The structure of South Africa's electricity sector is characterised by its social, political and economic legacy that was developed under apartheid to meet the needs of industry and the white minority (Ziramba 2009). The world's fifth largest mining country after China, the US, Australia and Brazil, its dependence on historically abundant sources of low cost coal for 96 per cent of its electricity has resulted in an incredibly energy-intensive economy. Electricity is South Africa's largest energy sub-sector supplying 29 per cent of its energy demand and generating approximately 50 per cent of its carbon emissions[1] compared to 26 per cent globally (CDP 2011). Its emissions are higher than UK's on a per capita basis, while its GDP per capita is only a sixth as much. In financial year 2009/2010 Eskom burned 123 million tonnes of coal (Creamer Media 2011:5). Its remaining emissions come from synthetic fuel production, energy intensive industries (mining, iron and steel, cement), and the transport sector.

It is responsible for about 40 percent of Africa's CO_2 emissions. It ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1997 and acceded to the Kyoto Protocol in July 2002. As a non-Annex 1 signatory it has no legally binding emission reduction targets under the Kyoto protocol and is one of the few countries in sub-Saharan-Africa to have projects registered under the Kyoto Protocol's Clean Development Mechanism (CDM). Given that South Africa's electricity expertise is based on burning low grade coal, renewable energy and all that entails in terms of generation, transmission and distribution is something in which the country has very limited experience. However, the country has enormous potential for renewable energy generation (Holm et al 2008), particularly on-shore wind and solar (Winkler and Marquand 2009), still largely untapped.

South Africa's electricity sector is characterised by its monopoly parastatal Eskom which has largely defied the "standard model" of power sector reform which became universally accepted during 1980s and 1990s (Gratwick and Eberhard 2008). This model, which involved the unbundling of the electricity sector into separate transmission, distribution and generation companies and the

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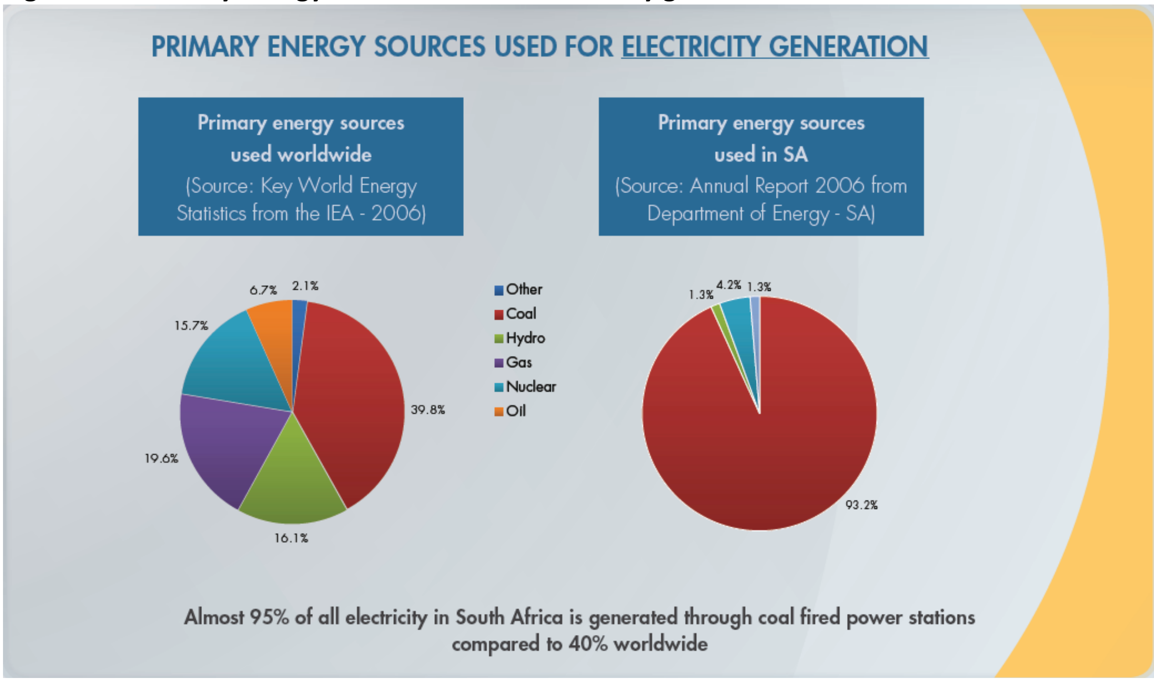
[1] Eskom (2010: 54) reports that SA's carbon emissions from electricity were 224.7 million metric tonnes. According to the Carbon Disclosure Project, SA's total emissions for 2010 were 500 million metric tonnes of CO2-e (CDP 2011:4)

introduction of private competition, was unsuccessfully imposed upon other countries in sub-Saharan Africa as part of World Bank-lead structural adjustment programmes (Tellam 2003).

South Africa is one of the most socially unequal countries in the world with 70 per cent of its income going to approximately 20 per cent of its population and 1.6 per cent of its income going to the poorest 20 per cent (The Presidency 2009:23). Unemployment stands at 25 per cent though this figure rises to 31 per cent if "discouraged work seekers", those of working age who have given up seeking employment are included (Statistics South Africa 2012). Infrastructure provision is influenced by a history of racially determined differentiation (Bekker et al 2008) and a third of its households lack access to electricity. This has also resulted in a highly fragmented local governance system with poorly performing service delivery departments and the existence of separate local black municipalities (Eberhard 2007:231). Before the end of apartheid in 1993 only 36 per cent of the population were connected to the electric grid, with inequality of access being defined along divisions of racial origin (CURES 2009). While Eskom's unprecedented expansion programme between 1994 and 2000 saw 2.4 million houses connected to the grid and many more connected by local government municipal utilities (McDonald 2009:15) one third of the country's population are still without access to electricity, particularly in rural areas. Electricity disconnections which affect millions of low income households annually have led to service delivery protests (Bond 2011:4). Households make up 15 per cent of electricity consumption nationally (McDonald 2009:15), which has remained at this percentage since 1982, though residential demand has risen by more than 50 per cent since the 1980s and constitutes the third-largest market for electricity consumption after mining and manufacturing. Millions of low-income households, who account for no more than five per cent of national electricity consumption cannot afford to buy electricity, even if they are grid connected (Ibid p16) and prioritise paraffin, coal, wood fuel and other sources. Middle to high-income urban households consume an average of 96 000 kilowatt hours per annum (Ibid p15), just below that of the US at 112, 000 KWh per year. Figure 1.2 illustrates the coal-heavy dependence of South Africa in relation to other energy sources.

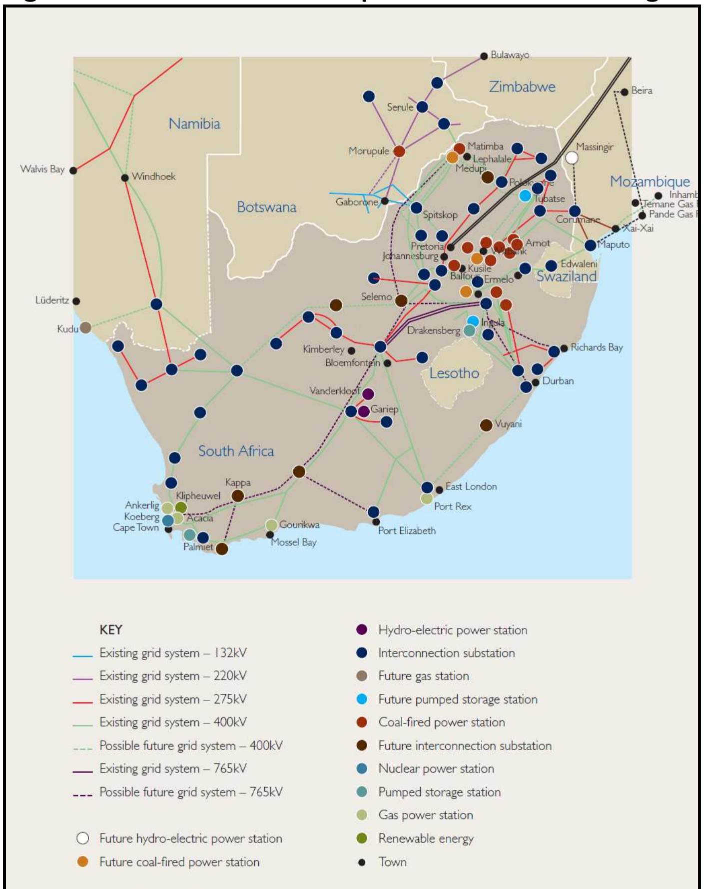
As a regional sub centre (Makgetla and Seidman 1980), South Africa's ability to develop a renewable electricity industry will be a key determinant of the ability of its neighbours to do the same. Energy stakeholder (1) argued "South Africa cannot afford to get this wrong as the rest of the region is also riding on it. They will copy our model". The Southern Africa Power Pool (SAPP), a region wide transmission system shared by twelve countries is heavily dependent on Eskom which accounts for nearly 85 per cent of SAPP's energy generation. However Eskom now imports more than it exports, as national power shortages limit its future involvement in foreign markets “to those projects that have a direct impact on ensuring security of supply for South Africa” (Eskom 2008).

Figure 1.2: Primary energy sources used for electricity generation



Source: NERSA (2006:11)

Figure 1.3: The South African power network and neighbouring connection



The map indicates the South African power network and some interconnections with neighbouring countries.

Source: Eskom integrated report (2010:5)

1.3 Minerals-energy complex

The minerals-energy complex (MEC) a term coined and conceptualised by Ben Fine and Zavareh Rustomjee in 1996 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). In theoretical terms it provides a framework for analysing power relations and key networks in the country's political economy while in descriptive terms it encapsulates a set of national activities organised in and around the energy and mining sectors and associated sub-sectors of manufacturing. These include the evolving relationship between the state and corporate capital. It is central to the country's historical dependence on cheap coal and cheap labour for electricity which in turn serves the interests of export-oriented industry. This system of accumulation, which applies largely to the interwar period onwards, has "a character and dynamic of its own that was far from pre-determined", and whose "corporate control and influence" goes far beyond its core sectors and its national boundaries (Fine 2009:27).

The historical influence of a small number of large resource-based conglomerates over policy, now internationalised with privileged access to cheap energy, tax breaks and infrastructure is central to the MEC (Roberts 2007:20). They have acute levels of control and concentrated ownership over the country's industrial and economic sectors (Fine and Rustomjee 1996) and are part of growing financialisation trends in the country's economy (Fine 2009). These sectors continue to be extremely influential over the state and direction of the economy but with "new features coming to the fore" (Ibid p2). This research justifies the role of IPPs and renewable energy as one of those features. Using a political economy approach informed by the MEC, I examine the nature of governance and policy making in South Africa's electricity sector. As part of this I also analyse the extent to which some MEC incumbents are reconfiguring themselves in the face of recent low carbon developments. The case studies in this research focus on developments in the last five years in the electricity generation sector as an integral component of the MEC, rather than undertaking an overarching exploration of relations between South Africa's mining, manufacturing and energy industries. This thesis complements studies that have explored the mining and minerals beneficiation sectors which are the majority users of the electricity in question, including Mohamed (2010), Freund (2010), Walker and Jourdan (2003).

1.4 Why electricity?

"Electric power systems demanded of their designers, operators, and managers a feel for the purposeful manipulation of things, intellect for the rational analysis of their nature and dynamics, and an ability to deal with the messy economic, political, and social vitality of the production systems that embody the complex objectives of modern men and women" (Hughes 1983:1)

A determining factor in the realisation or impediment of sustainable development and climate change mitigation, energy is not a common subject within development studies. Energy, like water is a global good but has billions of people without access or with access only to poor quality; is under rapidly growing global demand; constrained by natural resources; varies in regional availability; and operates in heavily regulated markets (Bazilian et al 2011:7897). It is as much a part of a country's development policy (Ljung 2007:37) as policy on industry, the environment, foreign relations, trade, climate change and social development. The conflict for policy-making that results from such a complexity of competing and fragmented interests is central to this investigation. Electricity is defined here as a subset of energy.

Electricity is a critical feature of infrastructural development and a large technological system embedded in broader political, economic and social forces (Hughes 1983, Rip and Kemp 1998).

Goldthau and Sovacool (2012:233) describe electricity as “perhaps one of the most obvious large-scale socio-technical systems involved in converting energy fuels into services”, which goes far wider than the arenas of science and engineering (Hughes 1983). As a technology, electricity is ‘site-specific’ (Ibid p47) determined by natural geography, in South Africa’s case its large coal endowment, and human geography, in South Africa’s case racially differentiated access and a high demand from industrial users. For all these reasons, electricity is not easily governed or manipulated and is compounded by path-dependency, the role of vested interests and uncertainty in the adoption of new technologies.

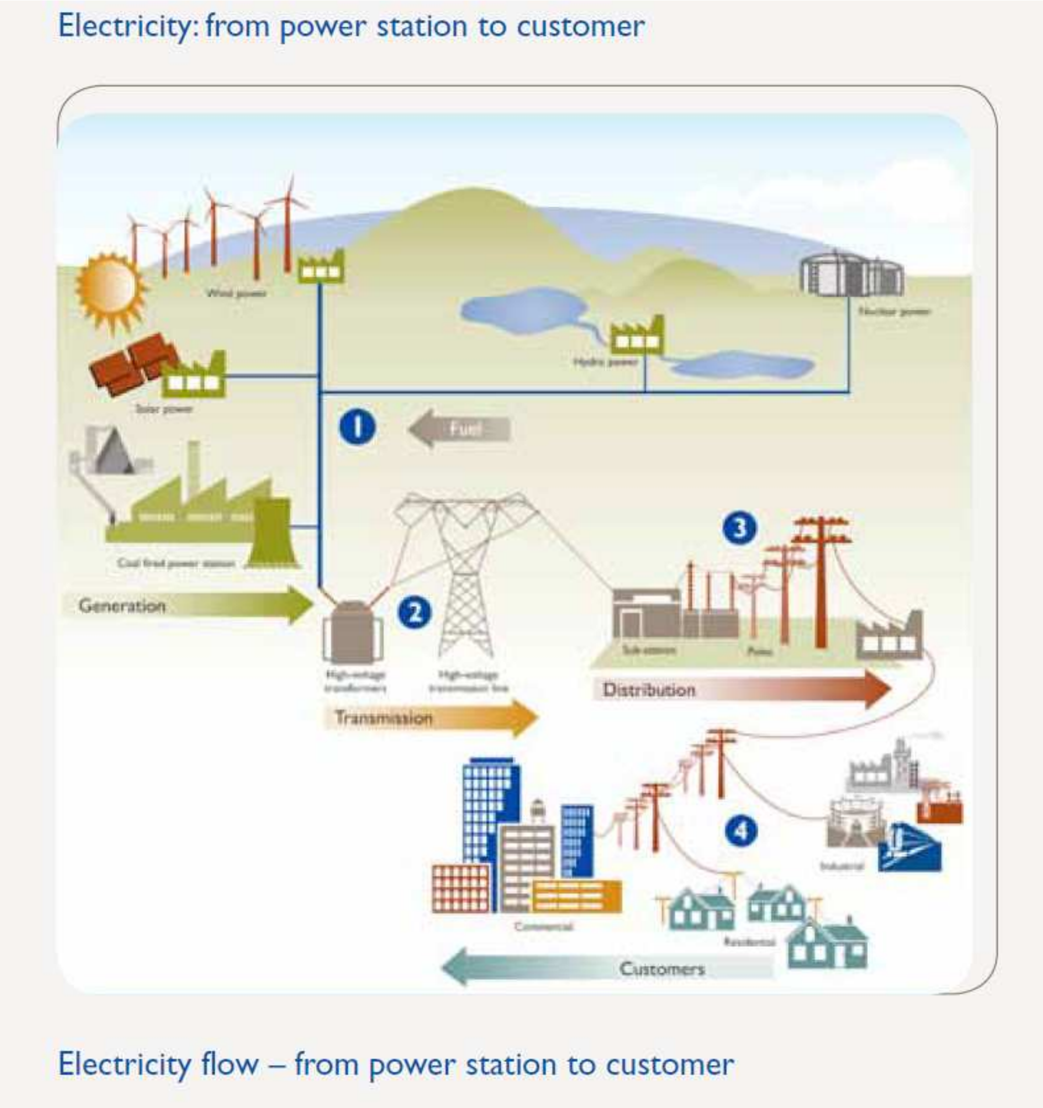
Electricity as an infrastructural and network technology (Rip and Kemp 1998) and natural monopoly is difficult to separate from the concept of its governance in that it lends itself towards economies of scale. According to Victor and Heller (2007:1) the treatment of electricity as a commodity like any other, and its separation into generation, transmission, distribution and supply for sale along market principles is highly flawed. It has proven one of the hardest network industries to reform and has been difficult to “replace the state with private enterprise because infrastructures usually display strong economies of scale, which arise through network interactions that are prone to natural monopoly”. Freeman and Louça (2001:229) discuss how electric power in industrialised countries was developed to benefit large utilities, to the disadvantage of local decentralised ‘in house’ generators of electric power. In essence, the technological system was socially constructed by the “Edison mafia”.

Yi-chong (2006:803) classifies electricity is a process rather than a commodity, formed from the conversion of different forms of energy which are then consumed shortly after production. The simultaneous production and consumption process is achieved through “a complex ‘coordination’ system that integrates a large number of generating facilities dispersed over wide geographic areas to provide a reliable flow of electricity to dispersed demand nodes while adhering to tight physical requirements to maintain network frequency, voltage and stability” (Ibid p804, see figure 1.4).

There are two different framings of the electrification problem competing for institutional and policy dominance in South Africa (Bekker et al 2008). The first one, pioneered by the socially oriented policy analysts such as the University of Cape Town’s Energy and Development Research Centre in the late 1980s and 1990s was based on an analysis of low-income household energy use which saw electrification as a key intervention to address energy poverty. The second framing, inherent in the approach of the national utility perceives electrification as a development to be integrated with other service-oriented infrastructure development processes. This aligns with the energy commons approach (cf Wamukonya 2003:1284) which puts forward the notion that energy is a public good rather than the commodity it is often treated as. Such an approach asserts that concerns of equity and efficiency should be included in energy policy making and points out that the natural availability of renewable energy resources "make them potential energy commons". Meanwhile the treatment of energy as a commodity underpins a profit-oriented urban bias in national electrification policy which results in the marginalisation of rural communities, overlooks goals of universal access and leans towards fossil fuel based technologies, in disregard for environmental concerns (Ibid).

Box 1.1: Power, a note on terminology
In scientific terms 'energy', refers to "the capacity to do work" and 'power' as "the rate of doing work", or "the rate at which energy is converted from one form to another, or transmitted from one place to another" (Boyle et al 2003:6). In daily usage and in policy debates on electricity, the word 'power' is used loosely as a synonym for 'electricity'. This thesis applies these terms accordingly. Electricity is used here to refer to the power sector at the national level, encompassing the electric grid and its sub components of transmission, distribution and generation and specific projects such as coal mines, wind farms and solar power plants. Christie (1984) describes how the word 'power' refers to an electrical force but also serves as an indicator of the relationship between electricity and social control.

Figure 1.4: Electricity flow from power station to customer



Source: Eskom (2010d:4)

1.4.1 Clean energy

In these times of climate consciousness, 'clean energy' is an oft-used platitude. Closely related to the term 'clean coal' (chapter 8) there is no internationally agreed standard or accepted definition of what it means. Related terms such as 'renewable', 'low carbon', and 'energy efficiency' are equally ambiguous[2]. Extending the concept of 'clean energy' to include a social as well as an environmental dimension must bring in issues such as energy poverty and access, which is particularly relevant in

[2] Examples of this can be found in the significant disparities identified between the literatures of multi-lateral institutions (World Bank 2007) and civil society (WWF 2008). There are also serious questions as to whether large hydro power, nuclear and carbon capture and storage should be defined as 'clean' or 'renewable' energy. Timmons Roberts et al (2008) explain that there is a dramatic difference in aid for climate mitigation i.e 'clean energy', depending on whether or not large hydropower is included.

light of the failure of grid expansion plans and large infrastructure projects that meet the needs of economic and industrial centres but often neglect the needs of the rural and urban poor (Prasad 2008, CURES 2009). It also relates to ethical debates over how the pressure to decarbonise should be balanced against the need to provide pro-poor energy and/or economic growth on equity and justice principles (Timmons Roberts and Parks 2007, Okereke and Schroeder 2009)[3], possible conflicts that may exist between these two objectives and potential accusations of being 'anti-development' or 'anti-technology'. A further question is to what requirements LMICs should be subjected, in light of their minimal historical carbon emissions when compared to developed countries and lack of access of the majority of their populations, and what the obligation of high income countries to provide financial and technological assistance should be (Ockwell et al 2009:12). This relates closely to demands for 'climate justice' from South African and international NGOs, such as the *Climate Justice Now!* network (see also Bond 2011).

Box 1.2: Climate finance and ODA
Climate finance and ODA is a key theme in the political economy of socio-technical transitions in South Africa's electricity sector. That the country's 2009 commitment to reduce its carbon emissions is conditional on financial, technological and capacity-building assistance under a multi-lateral agreement (RSA 2010b) means that international finance from public and private sources and technical assistance is central to the case studies in question. As Weischer et al (2011:10) explain, given the limits to international public financing for climate change mitigation, questions of climate finance must be considered in the context of the drivers of policy. The case studies of Medupi, the emerging wind energy industry and national level policy processes link the themes of assistance for energy and infrastructure to broader international debates on climate and renewable energy finance (Zadek 2010, UNEP-FI 2012), the governance of energy finance (Newell 2011) and finance for public services (Lipschutz and Romano 2012). In doing so it explores how a variety of different multi-lateral and bilateral institutions and processes, foreign investment trends and norms of international project finance interact with national level electricity policy making and renewable energy development.

[3] For a framework that tackles this issue see *The Greenhouse Development Rights Framework* (Baer et al 2008).

1.5 Why wind?

While the renewable energy focus of this thesis is on the wind industry, this is not to disregard the contribution that other renewable energies such as solar concentrated solar power (CSP) and solar photovoltaic (PV) will make to the country's electricity mix as well as other measures such as demand-side management, and energy efficiency. Wind is the lowest cost renewable energy available at scale and currently makes the second largest contribution to renewable electricity after hydro (IEA 2010:130) and the largest contributor to new installed power generation capacity globally (Szewczuk et al 2010). During the period of field work in 2010, wind energy producers were more advanced as an industry than solar power producers who have since gained ground and are now just a few steps behind wind.

1.6 Why 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). Contemporary work on socio-technical transitions exists under a variety of permutations (cf Geels and Schot 2007), of which the most relevant for this research is the multi-level perspective (MLP) (Geels 2011). The MLP analyses systems change from the level of: 'landscapes', 'regimes', and 'niches' and as a framework it is concerned with the way in which incumbent regimes lose stability. It offers a valuable heuristic device for the narrative exploration (Smith et al 2010) of developments taking place in South Africa's electricity sector.

Such a framing permits an inquiry into the relationship between entrenched coal-fired interests at the regime level and emerging niches in renewable electricity generation. While the former is broadly defined here as a state-run, coal-generated, publicly-funded electricity sector, the latter involves an emerging entrepreneurial cluster of renewable energy independent power producers backed by bilateral donors, and private finance. Both of these levels interact with and are backed by stakeholders and events at the 'landscape' level, which for the purposes of this thesis includes: trends and costs in international renewable energy development; global research into 'clean coal' technologies; and the role of international development finance institutions such as the World Bank. This thesis asks whether the incumbent regime is in fact threatened by low carbon initiatives which as I will uncover are thus far taking place in parallel to additional coal developments.

1.7 On governance and policy

Fusing a socio-technical transitions and political economy approach brings insights into governance and policy-making in South Africa's electricity sector. This allows for an analysis of the links between state and non-state actors within the framework of globalisation and neo-liberal economic development and is based on the notion of continuous evolution in response to changing structures, systems and orders (Chhotray and Stoker 2008). The political nature of policy processes are treated here as a critical aspect of governance (Meadowcroft 2011, Mosse 2004, Keeley and Scoones 2003).

An analysis of electricity policy must be context specific (Newell 2009), understood via a localised exploration that includes political, economic and social complexities, institutional architecture, infrastructural and industrial development, comparative technological advantage, historical legacies and geophysical factors (Rip and Kemp 1998, Ockwell et al 2009:10). In the case of South Africa this includes its MEC, the legacy of apartheid, cheap labour based on racial divisions and inward industrialisation (Makgetla and Seidman 1980), and its influence and interdependence within the Southern Africa region and internationally. The thesis is cautious of 'one-size fits all' approach to policy which would assume that a European or North American model for low carbon energy development can be transposed into the South African context.

This localised exploration is in turn situated within a global perspective given the integration of energy with numerous multi-lateral, regional, national and sub-national institutions (McGowan 2009:33). Arrangements for the global governance of energy are fragmented and uncomfortably spilt across a variety of international agencies including the World Bank, the International Energy Agency, the World Energy Council, industry bodies, trade and investment agencies and various UN institutions. In addition private actors, energy conglomerates and related rules and institutions such as long-term contracts and 'host government agreements' can and often do have greater influence over energy governance than do national governments. Florini and Dubash (2011:3) summarise that "the multiplicity of energy subsectors and the linkages to other important issue areas (including everything from economic growth to agriculture to national security environment) suggests the likelihood of a complex decision-making architecture. This complexity, in turn, poses challenges to understanding the linkages between national and global energy governance processes, and in particular the ability of global processes to shape national decision making".

1.8 Structure of the thesis

Chapter 2 discusses the methodology used to carry out this research. Chapter 3 develops the analytical framework on which it is based and explores the key concepts of socio-technical transitions, political economy, policy and governance. Chapter 4 provides a historical exploration of the key characteristics of South Africa's electricity sector as a central component of its MEC, which begins in earnest with the creation of the electricity parastatal ESCOM, now Eskom in 1922. The chapter also introduces the role of key beneficiaries and stakeholders in the MEC such as energy-intensive users and mining and finance houses. Chapter 5 undertakes a rich description and analysis of two key policy processes negotiated in 2010, the renewable energy independent power producer's procurement programme (RE IPPPP) and the integrated resource plan for electricity (IRP 2010). Chapter 6 analyses the emergence and development of South Africa's nascent wind industry and considers its development to date, including how 'traditional' actors in the wind energy such as Vestas are competing with emerging market technology suppliers such as India's Suzlon. Chapter 7 looks at the role of coal in South Africa's economy and considers the bargaining power that the country's large coal miners have over the electricity utility Eskom. This sets the context for an analysis of the Medupi coal-fired power plant in Chapter 8 which analyses how multi-lateral development lending was justified by 'clean' discourse. Chapter 9 draws the thesis to a close, with one conclusion being that low carbon initiatives and a significantly diversified electricity generation mix have been accompanied by a concomitant increase in coal-fired electricity.

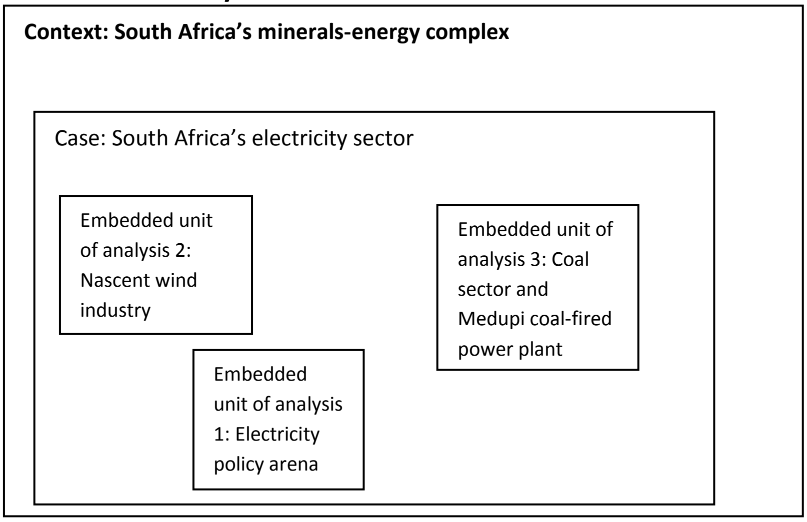
2 Chapter 2: Methodology

*A case study is an empirical inquiry that: investigates a contemporary phenomenon in-depth and within its real-life context especially when the boundaries between phenomenon and context are not clearly evident (*Yin 2009).

In this investigation I have strived to generate a comprehensive analysis of current policy and governance arrangements in South Africa's electricity sector, considering relevant instruments, plans, departments, ministries and regulatory arrangements. This has involved the identification of actors, agendas and stakeholders and the tensions and dynamics present. It illuminates issues relating to the political culture of decision-making on energy policy at the national level, and how this interacts with international influences such as the World Bank, private international investment and bilateral interests. It has sought to understand who is setting the agenda, the policy formulation and the implementation and monitoring of specific political decisions. As outlined in chapter 1, this research employs a case study approach relying largely on semi-structured and key informant qualitative interviews, informal off-record discussions and participant observation as data collection techniques. It also involved content analysis of sources such as: policy documents, legal papers, public meeting minutes, media articles, speeches by government and other energy stakeholders and parliamentary transcripts relating to South African energy policy. The consultation and analysis of key documents has been central to analysis of South Africa's official policy and practice and the extent to which there has been a discursive shift over time with regards to the incorporation of renewable energy. The process of the research was both inductive and iterative, employing a constant back and forth between data and the theory.

Such an approach was adopted in order to generate an in-depth understanding of complex political and economic phenomena and the significant contextual conditions in which they are sited. The case studies are not comparative, but instead provide a rich description of three different but interlinked sites of South Africa's electricity sector, with the intent of the thesis being to develop explanations rather than to test a hypothesis. Figure 2 (following Yin 2009:46) illustrates how South Africa's MEC forms the context, with the country's electricity sector as the overarching case study. The three embedded units of analysis are: developments in electricity policy-making (chapter 5), the nascent wind industry (chapter 6) and the Medupi coal-fired power plant and the national coal industry (chapter 7-8).

Figure 2.1: Embedded units of analysis



The fieldwork was carried out in the Western Cape, Johannesburg and Pretoria. Two visits of four months were undertaken, the first between February and May 2010, and the second between September and December 2010. The first phase of fieldwork consisted of an exploratory level of analysis. The aim of the interviews and participant observation undertaken during that time was deliberately broad based in order to tease out key themes, identify the level of access I would be able to get and gauge how receptive people would be to discussing certain issues. It also assessed the feasibility of the case studies in answering the research questions. The second round of field work was more focused in its approach and included an intense six week visit to Johannesburg and Pretoria. Throughout both periods of field work, I was hosted as an academic fellow with the Institute for Security Studies (ISS) a respected national think tank on governance issues, in Cape Town and its head office in Pretoria while in Gauteng.

In total I carried out 79 semi-structured and informal interviews with representatives of government, industry, academia, civil society, Eskom, the legal profession, trade unions, journalists, banks, development finance institutions and bilateral donors. A list will be provided for examiners but will not be made public. Snowballing techniques played a key role in identifying interviewees as many participants were able to suggest other contacts, sources of evidence or facilitate further introductions. I also undertook participant observation within a diversity of different forums including: industry specific conferences on renewable energy, parliamentary meetings, public hearings for the country's Integrated Resource Plan; and meetings of civil society and trade unions.

I negotiated access to three industry specific conferences organised by the company Energy Net[4] (*Powering Africa: Captive Power, IPP & Cogeneration Options*, Cape Town, 6/7 May; *Africa Energy Forum*, Basel Switzerland, 29 June-1 July; and *Powering Africa: the Financial Options* (PAFO), Cape Town, 25/26 November). This was on the agreement that I would take notes and author a 'conference report' in exchange for the conference organisers waiving the prohibitive conference fee. In this way I gained access into crucial spaces which it would have been hard to enter otherwise. While I had agreed that the notes I took would not be cited, I gained a direct insight into debates, conflict and networks within and between South Africa's aspiring renewable and co-generation electricity industry, government departments, Eskom, investors, lawyers, engineers, project developers, technology suppliers and development finance institutions. Even being able to observe body language between participants and apparent spats during plenary discussions was very revealing of implicit tensions and dynamics that I could then pursue further in subsequent interviews. These debates included: what constitutes a 'bankable' power purchase agreement, the importance of a credible off-take agreement, shared costs and responsibilities with regards to integration into the electric grid, land tenure agreements for wind farm developers, definitions of investment 'risk' and demands by investors for a government backed guarantee. Attendance at such events also facilitated access to key individuals who I may have struggled to get hold of otherwise.

The periods of field work coincided with numerous interrelated and landmark events in South Africa's electricity sector. These included: the announcement of the creation of an Independent Systems and Marketing Office, electricity tariff hikes, the release of the feed-in tariff criteria, consultations on the Integrated Resource Plan for electricity (chapter 5), the approval of the World Bank loan for Medupi (chapter 8) and various technical reports relating to the wind industry (chapter 6). Given the diversity of issues under development, it was important to keep the focus of the research and the case studies clear at all times in order to avoid getting side-tracked.

Obtaining access to certain decision makers who were able to provide meaningful input into the research for instance in the Department of Energy, Eskom, Department of Public Enterprises and National Treasury was at times problematic and made it harder to observe and record directly divisions both between and within departments. For this reason the review of evidence such as government speeches in the press and minutes of parliamentary committee meetings was important.

[4] http://www.energynet.co.uk/

Formal institutional affiliation with ISS helped to overcome some of these obstacles in providing me with a national institutional identity. As a nationally respected think tank, ISS works quite closely with government on various issues of governance though has a low profile with regard to its work on climate change and energy. This served me well in view of the bad feeling that developed between some government departments and a number of the more 'radical' environmental NGOs such as Earthlife Africa following protests over World Bank funding for the Medupi coal-fired power plant in April (chapter 8). Due to my position within ISS I also had good contact with a number of civil society organisations some of whom I already knew from my previous occupation with the UK-based NGO, Bretton Woods Project. I was able to use these contacts prudently for advice on, and access to, certain interviewees. Being based with ISS was also helpful in terms of logistical support such as access to a telephone, computer, printer; professional support and advice from colleagues and introduction to some of the civil society networks.

It was relatively easy to gain access to a number of potential wind energy Independent Power Producers (IPPs) many of whom are based in Cape Town. I sensed that given their apparent frustration with stalled developments at the level of renewable energy policy they were keen to talk freely to 'outsiders', though without compromising too much information on their project developments. While they were relatively forthcoming in interviews with regards to matters such as policy, technical issues and general features of project development, they were unable to reveal a great deal of detail about their potential projects.

Due to the sensitive nature of South Africa's coal industry and the Medupi coal-fired power plant as well as confidentiality agreements between government and the World Bank regarding the institution's loan to the project, access to stakeholders involved in these fields was much more limited than those involved in the nascent wind industry. This in itself is very revealing about the way energy policy is being negotiated. As mining industry expert (1) explained "with regards to Medupi there is a great deal of secrecy surrounding it and people are unwilling or fearful of talking about it. It is a black box". For this reason, chapter 8 on Medupi has relied more on grey literature including media and publications by development finance institutions, industry, civil society, and government speeches. Academic literature on Medupi is also limited given that the controversy surrounding its construction and the World Bank loan has emerged relatively recently. Analysis of the coal industry and its formation in chapter 7 which sets the scene for Medupi adopts a historical approach and also draws from a significant leaked document regarding the negotiation of Eskom's coal contracts.

I undertook a continuous review of relevant newspaper articles and industry specific publications such as *Africa Energy Online* and Creamer Media's *Engineering News* and *Mining Weekly* received via daily email feeds. These were highly informative and helped me to maintain a firm grasp of rapidly evolving events. Throughout the fieldwork I undertook extensive consultation and analysis of key documents as they emerged, such as the latest drafts of the Integrated Resource Plan for electricity, the draft Power Purchase Agreement (PPA), and the report by the South African Wind Energy Association (see chapter 5). This allowed for an in-depth exploration of specific policy processes and events, the strategic targeting of appropriate interviewees and the design of strategic and insightful questions before each interview rather than the use of generic questions. I also drew on country-specific second hand quantitative data from sources such as: South Africa's Department of Energy; Statistics South Africa; UNDP Energy for Sustainable Development; the International Energy Agency; WRI Earth Trends database; WRI database of policy and measures; and the US government's Energy Information Administration.

The interviews were guided conversations rather than a structured list of questions. Following Yin (2009:69-71), in order to carry this out successfully, the ability to be a good listener was fundamental, as well as to pose questions in a neutral and non-threatening manner; adapt questions according to my knowledge of the expertise and opinions of the interviewee, and their responses, behaviour and body language; exercise high levels of discretion and be able to seize opportunities for interviews as and when they arose. In many cases, questions were carefully worded in order to conceal my level of knowledge of an issue in order to ensure that the interviewee provide a "fresh commentary" (Ibid p107) on the topic. Lastly, it was important to interpret the information as it was being collected in order to triangulate the facts and identify further opportunities for interview.

As a rule interviewees were informed in writing via email about the nature of the research, its aims and objectives, the key working questions being addressed and the specific issues relevant to them about which I intended to ask. It was agreed in advance that notes of the meeting would be typed up and shared with the interviewee who would have the opportunity to comment on the accuracy of the content and agree the extent to which the data could be cited in the thesis or related peer-reviewed publications. Due to the socially and politically sensitive nature of certain aspects of the investigation a cautious approach was adopted at all times, particularly with regards to the integrity of interviewees and the researcher. In the interest of encouraging participants to speak freely, the majority of the interviews that were carried out were not recorded. Exceptions to this included a few cases of where the interviewee requested that the meeting be recorded, or where the interviewee was relating ‘factual’ information for which other sources were freely available in the public domain. In the absence of a recording device I hand wrote detailed notes during the interview and typed up a full version within 24 hours. Notes were then emailed to the interviewee with an agreement that they would alert me to any inaccuracies or if they felt that some of the material should remain unattributed or further still not be mentioned at all. Due to the sensitive content of some of the material being discussed in the interviews and the need to protect participants, some of the material collected was classified as ‘off record’ which has posed some difficulty for the use of such evidence. Hill (2009:10) is relevant here where he states that analysts of policy processes often “find themselves in situations in which -like journalists- they cannot validate their findings by revealing their sources”. Despite this, such information still guided the investigation and informed the search for other interviewees and sources some of whom were willing to be more forthcoming. Interviewees cited in this thesis have been anonymised and referred to only by their departmental representation e.g Eskom, Department of Energy. In cases where the person in question may be easy to identify, interviewees have been attributed only by broad subject area, e.g energy analyst. To further disguise identities, a small number of interviewees have been assigned more than one attribution.

2.1 Policy mapping and textual analysis

As introduced in chapter 1 this thesis explores the notion of different sites of electricity governance and policy making, primarily in terms of the entrenched coal-based ‘regime’ which broadly consists of a state-run, coal-generated, publicly-funded electricity sector, and an emerging ‘niche’ consisting of a growing entrepreneurial cluster of renewable energy independent power producers backed by bilateral donors, private equity and investment. It considers the way and extent to which these sites are simultaneously in conflict and cooperation with each other, as the country’s electricity sector rapidly moves towards the integration of privately generated renewable energy. In order to do this, an examination of government stakeholders and institutions, parastatals, civil society and the private sector has been carried out in order to consider the extent to which they constitute a new formation or a reordering of traditional actors.

As this thesis will explore the role of vested interests in influencing the policy making process is highly significant. Therefore Lukes (2004:7) methodological question of how to investigate the role of ‘influencing’ or ‘non-decision making’ in the policy process, must be borne in mind here, particularly if it goes beyond “behind-the-scenes agenda-setting, incorporation or co-optation of potential adversaries and the like and could be ‘unconscious’ and include the influencing of ’values’ and the effects of 'rituals'". I recognise the methodological limitations of my research as to quote Dryzek (2005:11) "I cannot always say exactly who said what and why behind which closed doors to whom about a particular point, and how the other responded". However I felt that I was able to overcome many of these limitations by an extensive representation of interviewees, access to a number of leaked sources or sources not available in the public domain, and my ability to permeate spaces where conflicts over key issues were more overtly expressed.

As the research involves an in-depth analysis of the policy process it is important to be aware of possible biases. As Hill (2009:10) explains, given the nature of this, analysts of policy processes "are thrown back on methods which must involve inference from the data they can secure" and are therefore particularly vulnerable to accusations that "their theories and ideologies predispose them to particular interpretations of their data". In response to such a statement this research acknowledges the assertion of Rein (1976 and 1983 in Ham and Hill 1993:19) that analysis cannot be entirely value free as it will inevitably have been influenced by "the beliefs and assumptions of the researcher" (Ham and Hill 1993:18). As someone who has worked as a campaigner and advocate on issues of environmental, social and economic justice, I therefore declare my interests.

The approach employed by Keeley and Scoones (2003) in going beyond the "conventional categories that often guide policy analysis" was influential over my field research. They talk about the need to unpack terms such as "the state", "local", "international", "national" and "civil society" in order to understand the interaction of networks and relationships and the different sites of policy making that cross boundaries. They analyse "specific policy stories" and map different networks and coalitions as well as carrying out an evaluation of their impacts. In analysing certain policy processes, they "traced connections upwards, downwards, sideways and outwards", considering the "institutional location" of experts and the political context within which scientific decisions are made. Otherwise known as an "archaeological approach", following Foucault (Keeley and Scoones 2003:17), this allows for an identification of the power relations and links between different networks of people, documents and ideas in order to understand how the policy debate had emerged. Related to this is Lewis and Mosse's (2006) "order and disjuncture" of development studies. They identify the need for a "critical ethnography of development policy and practice" or of what Ferguson (1994) referred to as the dominant "interpretive" grid of development discourse. This asserts that the "order" of development does not come from the "prior logic of policy" but rather the interactions of networks or actors (Lewis and Mosse 2006). This is now further discussed in chapter 3 in relation to the analytical framework.

3 Chapter 3: Analytical framework: the political economy of socio-technical transitions

This chapter responds most directly to the question: *How can perspectives 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?* In doing so it constructs a framework that integrates a diverse range of conceptual approaches in order to generate a comprehensive understanding of the political economy of socio-technical transitions in South Africa's electricity generation sector and capture the networks and power dynamics at play in various sites of governance and policy making. While a mix of multiple approaches aims for a comprehensive understanding of the cases in question, this may come with inevitable contradictions and shortcomings. This chapter firstly explores the socio-technical transitions literatures in-depth, and focuses on the multi-level perspective (MLP) on which the framework of analysis of this thesis is based. It then enriches this approach by integrating concepts from technological lock-in. Subsequently, the chapter introduces key features of a political economy approach most relevant to this research in particular a historical perspective and the role of vested interests. This is followed by a section on the MEC as a theoretical tool for understanding South Africa's electricity sector, following Freund's (2010:3) assertion that it offers "a way of understanding power and key networks in South Africa's political economy". The final section of this chapter considers definitions of governance and policy into which the fusion of socio-technical transitions and political economy generates key insights.

3.1 Socio-technical transitions

The term socio-technical transitions is used to mean deep structural changes in systems such as energy, transport and water to sustainable ends. These involve long-term and complex reconfigurations of technology, policy, infrastructure, scientific knowledge, and social and cultural practices (Geels 2011:24) and, as this thesis will explore, the relationship between political and economic power. A socio-technical system refers to a configuration whereby technologies are embedded within complex socio-political and economic networks (Smith and Stirling 2007:353), geophysical factors, institutions and infrastructures (Rip and Kemp 1998:338). The change from one socio-technical system to another can also be referred to as "system innovation" (Geels et al 2004). The wide-ranging literature on socio-technical transitions draws originally from evolutionary economics (Dosi 1982, Dosi et al 1988) the sociology of technology (Hughes 1983, Rip and Kemp 1998) and more recently political science and theories of governance (Meadowcroft 2011, 2009). Focussing on electrification in Western society, Hughes (1983:7) underscores the need to examine a broad range of factors, events, institutions and people intertwined in complex networks of power, via a technical, economic, political and social perspective. In this sense, a socio-technical transition therefore requires fundamental shifts in the structures of a technological regime or paradigm (Freeman and Perez 1988), which implies considerable changes on the supply and demand sides and in technological development, policies, infrastructure and demand.

As a relatively new discipline contemporary work on socio-technical transitions and systems change has developed significantly over the last decade and exists under a variety of terms and permutations (cf. Markard et al 2012). These are: the multi-level perspective (Geels and Schot 2007), transition management (Kern and Smith 2008), and technological innovation systems (Elzen et al 2004). The most relevant strand for this research upon which the analytical framework is based is that of the multi-level perspective (MLP), discussed below. This is further developed by integrating contributions from technological lock-in (Unruh 2000).

While a number of transitions writers assert that politics is important in the transitions approach (Lehtonen and Kern 2009, Meadowcroft 2009, 2011) they find that the approach has largely failed to apply this in practice. Meadowcroft (2011:73) states that “behind policy there is always politics” and issues a call to political scientists “to develop a politically oriented literature on sustainability transitions equivalent in sophistication to that produced by our innovation-oriented colleagues” (Ibid 2011:70). This thesis responds to this call. Lawhon and Murphy (2011:18) find that power relations are inadequately accounted for in the transitions literature and that there is too much of a focus on elite actors such as technical experts and entrepreneurs in the decision-making process. They advocate for the inclusion of key insights from political ecology, as a way to address this. Acknowledging the valuable contribution made by political ecology in the consideration of power and knowledge in the management of natural resources (Peet and Watts 2004, Blaikie 1985), I find political economy more appropriate for an analysis of electricity policy-making given the largely centralised nature of its governance within the context of a large national electric grid, and the fact that though far from ideal it remains very much the domain of elite actors.

Referring to the transitions approach as a way of understanding “the stabilisation and overthrow of dominant socio-technical practices”, Meadowcroft (2011:71) summarises three key perspectives in the thinking: i) a political and policy framework with which to look at “societal movement towards sustainability”; ii) a “useful theoretical idiom to explore change processes (Geels and Schot 2007) and an impressive set of historical studies of system transitions” (Geels 2005); and iii) “a practical toolbox of techniques to encourage collaboration among innovators" offered by the 'transition management' approach such as by Kemp et al (2007), which focuses on policy-making for low carbon transitions in response to climate change (Smith et al 2005). Perspectives i) and ii) align directly with the objectives of this research which offers a unique contribution to case studies on electricity transitions and incorporates political economy approaches into the socio-technical transitions framework. Perspective iii) which is reflective of the transition management (TM) approach and prescriptive in nature is less relevant to the objectives of this thesis.

Geels (2004) explains that the treatment of technical change in mainstream economics is inadequate for its failure to consider broad political and economic changes and socio-cultural attitudes and trends, which can bring pressure to bear on the regime in question, strategic or unintended and with different levels of strength and coordination. The neglect of technical change in neoclassical economics is central to theories of evolutionary economics (Nelson and Winter 1982, Dosi et al 1988), which build on Schumpeter's study of the relationship between technological revolutions and long waves[5] of economic development. The inputs that Veblen as the founder of evolutionary economics makes to socio-technical transitions thinking are also critical, for his theory of economic development and change as based on the "dynamic interplay between human instincts, technological advance and institutional change" (in Milonakis and Fine 2009:172). His focus on the social and institutional basis of technological development and the notion of "habits of thought" (ibid p165) can be related to concepts of "cognitive routines" shared by engineers, policy-makers and scientists as discussed below. Crucially, evolutionary economics criticises neo-classical economic theories which as Rip and Kemp (1998) explore, perceive technology and technical change as an 'exogenous' factor which can be appropriated by any country regardless of national preconditions, and fail to acknowledge the significance of historical change. It is also relevant for its views on the fundamental role of technical change in shaping economic transformation; the influence that the socio-institutional framework has over processes of technical and structural change; and the significance of a historical perspective (Freeman and Louçã 2001). Evolutionary economics further emphasises how technology development and change is uncertain, unpredictable, long-term and constrained by routines (Dosi 1982), involving complex interactions between different actors. Moe (2007:14) argues that evolutionary economics are themselves theories of political economy for their recognition of the link

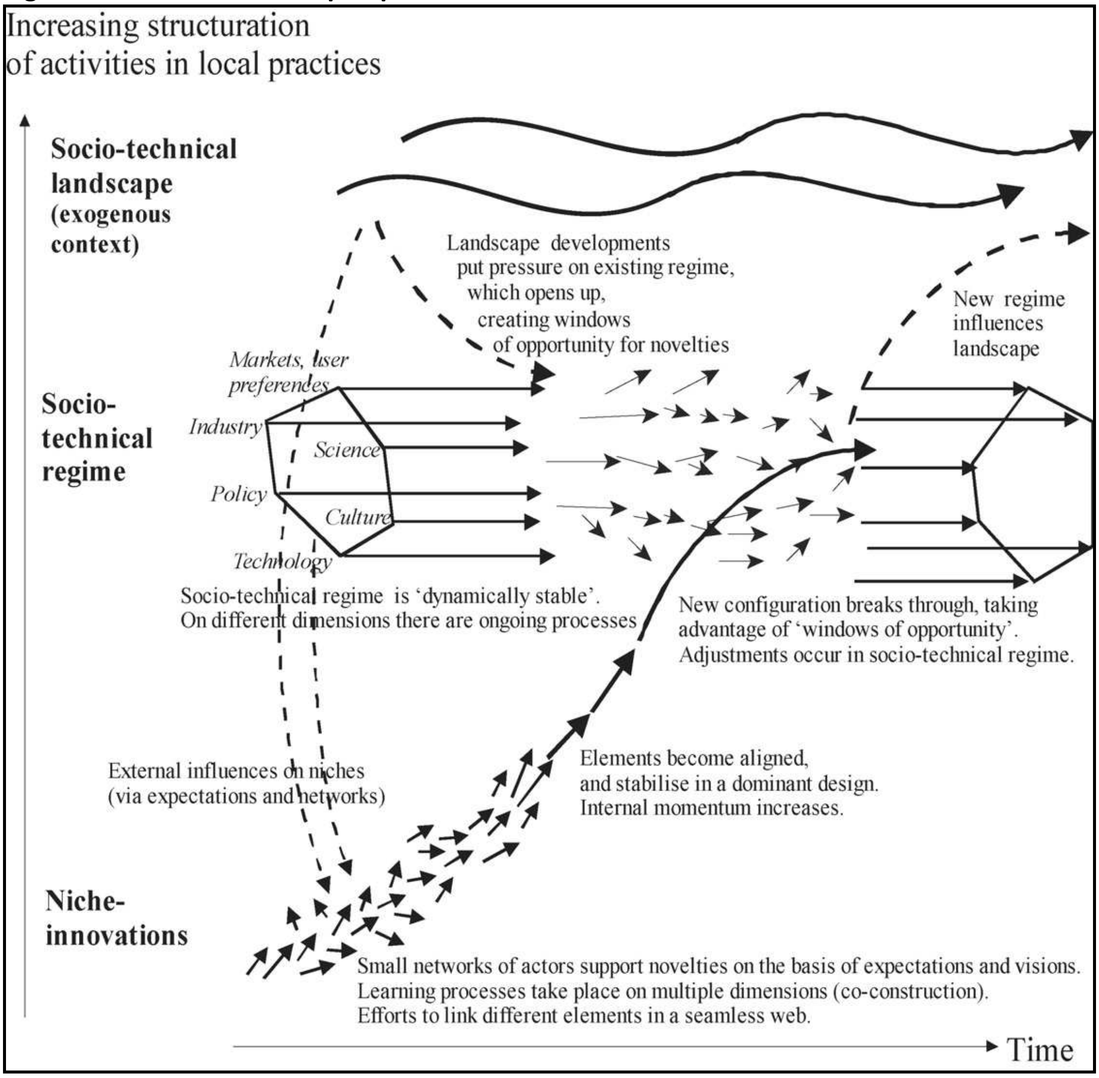
[5] Long-wave theory is one stream of evolutionary economics that aims to understand long-term technological changes that involve fundamental shifts in the techno-economic paradigm. Freeman and Perez (1998) identify 4 historical clusters: i) the industrial revolution ii) steam power and iron iii)electricity and heavy engineering iv) automobiles, oil and plastics.

between economics and the international system and the translation of economic power into overall power.

3.1.1 The multi-level perspective

This thesis constructs a "heterogeneous analytical framework" (Elzen et al 2004:195) within the framework of the MLP (Rip and Kemp 1998, Geels and Schot 2007). The MLP analyses socio-technical systems change from the level of: 'landscapes' (macro), 'regimes' (meso), and 'niche-innovations' (micro) as illustrated in figure 2.1. Such a perspective facilitates a multi-dimensional analysis of the non-linear dynamics of structural change (Geels 2011) and the complex and often competing interaction between numerous different technologies, actors, institutions, networks and processes all of which operate within the socio-technical system in some way (Lawhon and Murphy 2011) though with differing levels of access and influence. As a framework the MLP is concerned with the way in which incumbent regimes lose stability and experience transformations as a result of coordinated selection pressures from the niche and landscape levels (Byrne et al 2011:57). It therefore offers a valuable heuristic device for the detailed empirical analysis and creative interpretation (Smith et al 2010, Foxon 2010) of multi-scalar developments taking place in South Africa's electricity sector that "allows the analyst to zoom in on actors" (Geels and Schot 2007:414). As system innovations or socio-technical transitions are by their nature 'multi-actor, multi-factor and multi-level' (Geels et al 2004), the MLP offers a useful framework with which to analyse them. This is because it allows for the integration of other theories and insights, in this case political economy and the consideration of an empirical complexity involving a diversity of actors and structural context, or what Elzen et al (2004:284) refer to as a "structuralist process approach".

Figure 3.1: The multi-level perspective



Source: Geels and Schot (2007:401)

A socio-technical 'regime' refers to patterns of technologically determined behaviour which is shaped by "cognitive routines" and discourses shared by engineers and influenced by policy makers, scientists, energy users, vested interests and other professional groups (Geels and Schot 2007:400). Technology is just one aspect of a regime which is made up of complex and evolving networks of institutions, actors and artefacts (Scrase and Smith 2009:701). Though dynamic and gradually evolving, rules, structures, norms and communities within a regime are considered relatively stable, fairly predictable and protected by 'lock-in' mechanisms (Geels 2011). According to Lehtonen and Kern (2009:106) a regime evolves as "a result of interactions between technologies, institutions, markets, behaviour, policies and culture" and is not guided by any particular individual or institution.

Drawing on insights from the governance literature, Stoker (1998:23) defines the establishment of a viable regime as "the ultimate act of power in the context of an emerging system of governance".

Smith et al (2005:1493) describe how the electricity-generating regime "is dominated by rules and practices relating to centralised, large-scale (usually thermal) power technology and high voltage alternating current grid infrastructures". At a national level the authors see this "as nested within a global energy regime organised primarily around the extraction, trade and combustion of fossil fuels". The national level in turn oversees subordinate regimes, such as "the coal-fired steam turbine, the nuclear fuel cycle... or gas-fired combined cycle turbine systems" (Ibid). Here I interpret the regime concept empirically to refer to South Africa's monopoly-run electricity sector supplied by powerful privately-owned coal mines and of particular benefit to energy-intensive users as embedded within its MEC. I explore how the regime's relative 'stability' has been characterised by the political, institutional and market dominance of entrenched beneficiaries and stakeholders. This has been supported at the level of national policy and in terms of implicit and explicit subsidies such as cheap coal supply and preferential electricity tariff deals. However, as I will explore, the regime is riddled with conflicts and tensions including for instance the bargaining power that coal mining companies have over Eskom (chapter 7).

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 that deviate from if not challenge the dominant regime (Lehtonen and Kern 2009). These are carried out by "small networks of dedicated actors, often outsiders or fringe actors" and are unstable in nature (Geels and Schot 2007:400). I interpret this level empirically to include an entrepreneurial cluster of private renewable electricity generators backed by private equity and investment and supported by recent policy mechanisms, such as the renewable energy independent power producers programme (chapter 5). Chapter 6 explores the renewable niche in relation to the wind industry.

A 'landscape' refers to the external environment or macro-level influences which may create opportunities for niche-innovations, and provide support or create stress at the regime level. Geels et al (2004:34) describe it as "a set of heterogeneous, slow changing factors such as cultural and normative values, broad political coalitions, long-term economic developments, accumulating environmental problems growth, emigration. But it also contains shocks and surprises, such as wars, rapidly rising oil prices". While definitions of the landscape have lacked clarity in the socio-technical transitions literature (Geels 2011), it is interpreted here to include: trends and costs in international renewable energy development; increasing international demands for South Africa's coal exports; pressures of climate change mitigation; research into 'clean coal' technologies; carbon trading mechanisms such as the Clean Development Mechanism; the role of international development finance institutions such as the World Bank; and the increasing financialisation of resource-based conglomerates who are also embedded within the regime as coal-miners and energy users. As this thesis explores, landscape actors and developments can both reinforce and destabilise the regime, leading to Leach et al's (2010:29) assertion that "if transitions are to be successful then these higher level structures and processes must also be addressed".

This thesis challenges the notion inherent in much of the socio-technical transitions literature (e.g Scrase and Smith 2009:709) of the landscape level as exogenous to or beyond the direct influence of those operating at the niche and regime levels. Instead, as I will explore, landscape developments can be closely intertwined with regime and niche-level processes, stakeholders and technologies and hence shaped and influenced by them. One example of this is that many of South Africa's energy-intensive users are also international energy conglomerates with links to global financial markets. In addition while changes at the landscape level are said to be much slower than at other levels (Geels 2011), the extent to which this is always the case can be questioned, for instance with regards to rapid developments in costs of renewable energy technologies or cost decreases in solar technologies.

In theory transitions take place via interactions between the three levels of the MLP (Geels 2011). For example a niche, such as the wind industry, gains momentum from technological learning processes, improved performance and more competitive pricing, social approval, political support from the regime, and technical and economic support from powerful groups who are often situated at the landscape level. Meanwhile the regime is destabilised by gains made by such niche initiatives in addition to simultaneous pressure from changes at the landscape level. This creates windows of opportunity through which niche innovations break into the mainstream market and start to compete with or even support regime actors. However, without the support of sufficient landscape pressures "niche-innovations in an embryonic state do not pose a threat to the regime" (Geels and Schot 2007:406). A further argument is that "the power to affect regime change depends on regime membership" (Smith et al 2005:1492).

While selection pressures are always present in any regime, their timing from both the niche and landscape levels is a significant factor in the outcome, in that if landscape pressures take place at a time when niche innovations are not well developed and vice versa, this may pose less of a threat to the regime (Smith et al 2005:1495). The early development of South Africa's wind industry which will be explored in section 6.3 could be an example of this. Similarly, whether and to what extent selection pressures will bring about regime transformation depends on how they are "articulated". Firstly, are they "oriented coherently in a particular direction" and secondly has knowledge of these pressures been articulated in a way which will "prompt and enable a response by the regime" (Smith et al 2005:1495)? In the case of South Africa this leads to questions about the way in which the renewable energy industry, in this case wind has organised itself and the strength of its lobbying power when compared with incumbent interests and entrenched competitors such as mining and coal companies, and a potential nuclear industry which benefits from far greater political and financial support from the state than the renewable industry. This will be discussed in chapter 5.

The theory that a dominant regime will be challenged by a successful niche (Smith et al 2005:1496) raises questions over the extent to which renewable energy policy and South Africa's wind industry have become successful niches. In other words, to what extent are they genuinely destabilising the coal-based regime with an alternative pathway, or merely creating a practice that will run parallel to the status quo? As I will explore, given that influential stakeholders benefit from the continued prosperity of the entrenched regime (Valentine and Sovacool 2010), the changes they make tend to be 'incremental' and inadequate to bring about a transition to a sustainable modes of production and consumption (Markard et al 2012). The assertion that "incumbent firms are rarely the source of radical innovations" (Foster 1986, in Unruh 2000:822) but rather continue with attempts to improve existing dominant technologies relates to Scrase and Smith's (2009:710) observation that actors who benefit from the regime's status quo will undertake "incremental innovations" in order to defend it. For this reason niche innovations are often generated by outsiders (Geels and Schot 2007:400). This brings us back to the research question: *To what extent do recent developments in South Africa's electricity sector represent a low carbon transition in its minerals-energy complex?*

Though the MLP model is useful as an organising framework for developments taking place within South Africa's electricity sector as a central feature of its MEC, it must be acknowledged that defining the parameters and boundaries of the different levels is obviously an incomplete, subjective and temporary exercise given that "regime membership is neither homogenous nor clearly bounded" (Smith et al 2005:1504). In addition the boundaries of the MEC are not neatly confined within those of the nation state and can be found at the level of the regime, the landscape, and less often the niche. As this thesis will demonstrate the different levels operate within a much messier, much less linear, less predictable and more ambiguous reality than the diagram would imply. This is referred to by Leach et al (2010) as “dynamic complexities”, which are often ignored in policy interventions. The MLP could therefore be enriched by approaches which challenge the notion of layered hierarchical structures or “nested jurisdictions” implicit in its concept, as is further discussed in the conclusion. Consequently the MLP framework is employed here in a flexible sense rather than a rigid application which is appropriate for a creative interpretation and empirical analysis of the study of complex, interlinked, multi-dimensional and co-evolving dynamics (Geels 2011:34, Foxon 2010). Rather than testing the viability of this model in predicting or determining systems change or measuring the relationship between different variables in a positivist sense, this thesis uses it as a framework to analyse the different stakeholders, institutions and technologies involved in policy making processes and governance in South Africa’s electricity sector. This facilitates “narrative explanations” (Geels and Schot 2007:414) of the case studies in question and specifically allows for an examination of interactions between “technology, policy/power/politics, economics/ business/markets and culture/discourse/ public opinion” (Geels 2011:25).

3.1.1.1 Criticisms of the Multi-level Perspective

In addition to the approach’s limited consideration of politics, the unequal nature of power relations (Lawhon and Murphy 2011, Meadowcroft 2011) and an inadequate analysis of ‘agency’ (Smith et al 2005) discussed above, it is important to bear in mind the criticisms that have been levelled at this model by other transitions authors. I share many of these criticisms and acknowledge the intricate response recently provided by Geels (2011). In brief the first criticism refers to a lack of conceptual clarity in how the empirical and geographical boundaries (Smith et al 2010) of each level should be defined, for instance should an electricity regime refer to only the level of primary fuel such a coal, or encompass the entire system of generation, transmission and distribution (Berkhout et al 2004)? A second shortcoming is that the MLP places too great an expectation on the ability of technological niches to drive change (Ibid). Thirdly the model has been criticised for assuming a linearity of process and homogeneity of actors (Smith et al 2005) which for the sake of this thesis, fails to adequately account for the involvement of actors who may operate in quite different roles at different levels, and even at cross purposes. Hence there is limited scope for the role of “diversifying regime actors” (Geels and Schot 2007:408) used here to refer to regime level institutions or individuals within them who are promoting niche interests. Examples could include individuals within the National Energy Regulator and the Department of Energy involved in pushing the renewable energy feed-in tariff while their colleagues oppose it, as chapter 5 will discuss. The model fails to account for landscape actors that simultaneously support interests at the level of the regime and the niche, of which one example is the World Bank. As I will explore the World Bank has given extensive support to entrenched coal interests at the regime level by financing the Medupi coal-fired power plant while providing far smaller levels of assistance for niche-innovations in renewable energy.

I would also add that the literature's focus on environmental and 'green' concerns in defining sustainability (Geels 2011) lacks an explicit acknowledgement of the fundamental links between the environmental and the social, including issues such as the social consequences of energy exploitation, access to energy for the poor and the role of labour. Much of the literature could be accused of containing an implicit assumption that "radical green niches" (Smith et al 2010:445) will automatically result in concomitant human co-benefits and the realisation of social equity. Or in other words that a socio-technical transition will automatically result in a 'just transition'.

3.1.2 Transition Management

Another strand of the socio-technical transitions literature, Transition Management (TM) seeks to bring about gradual low carbon transitions in unsustainable regimes by "steering evolutionary dynamics towards specific visions" through a consensus-based approach (Scrase and Smith 2009:708). It promotes learning in niches in order to seed regime changes and rejects notions of techno-fixes to policy in favour of "a long-term, integrated approach addressing problems of uncertainty, complexity, and interdependence" (Ibid). To that end it considers nuclear energy and CCS as a technical fix to the issue of low carbon development.

While the TM approach, in particular the latter point, contributes to the thesis, there are a number of incompatibilities that must be spelt out here. Various criticisms have been levelled at it, some of which are shared with the MLP (Berkhout et al 2004:63). One major shortcoming, with regard to TM's relevance for South Africa, is that its prescriptions for policy makers are mostly based on advice given to the Dutch government in 2001 (in Kemp et al 2007, Meadowcroft 2005). Hence key assumptions of universal access, electricity liberalisation and an economy that unlike South Africa is not defined by high levels of carbon intensive natural resource extraction do not apply. In addition the TM literature offers little guidance on how to deal with political realities over how consensus of vision can be realistically achieved (Meadowcroft 2005) and has deliberately downplayed the discourse of politics because of its applied nature in the policy making sphere and instead claims an implicit political model (Scrase and Smith 2009:719). Lawhon and Murphy (2011:6) refer to a "tendency toward techno-economic determinism" and a lack of "critical reflexivity" amongst practitioners of the approach. A further inadequacy is that its policy focus is concerned primarily with climate change, whereas this thesis is concerned with the economic, political, social and environmental dimensions of South Africa's electricity policy of which climate change is only one factor. Another criticism is that it places too much emphasis on the ability of 'bottom up' niche-led innovations to bring about change which fails to adequately consider powerful factors at the landscape level, or regime stakeholders who have broad and complex international linkages such as to global trade patterns and multinational firms, which cannot be modelled or easily manipulated, least of all by the state (Meadowcroft 2005:487-491).

The difference between the MLP and the TM approach can be related to the difference identified between Ham and Hill (1993:4) of analysis *of* policy and analysis *for* policy. While the former is concerned primarily with advanced understanding, the latter refers to applied activity "concerned mainly with contributing to the solution of social problems", or in this case environmental, social and technological ones.

3.2 Path dependence and technological lock-in

"In general the limits on technological change lie not with science and technology, which tend to evolve much faster than governing institutions, but with the organisational, social and institutional changes that allow the diffusion of new technological solutions" (Unruh 2002:318)

By its nature technology development is path dependent (Rip and Kemp 1998). This research considers how South Africa's electricity regime, characterised by the MEC within which it is embedded has been 'locked-in' to a high carbon system. Concepts of technological and carbon lock-in (Arthur 1988, Unruh 2000, 2002, and Unruh & Carillo-Hermosilla 2006) are used in this thesis to mean that increasing returns result from a dominant technology. Goldthau and Sovacool (2012:234) describe "a socio-technological path exhibiting major inefficiencies compared to alternative solutions, yet hard to leave without major costs" and which manifests strong political and/ or social resistance to the introduction of new technologies. Walker (2000:834) describes lock-in as "an essential but dangerous facet of infrastructural innovation". Technological lock-in links perspectives from socio-technical transitions and political economy when considering political, economic, industrial, social and technical factors as obstructions to structural change. Key to this concept is the reinforcing nature of increasing institutional returns to the maintenance of a certain technological path (Foxon 2010:10), which as I will explore in the case of South Africa, a coal-based electricity generation system which in turn fuels an export-oriented economy based on mining and minerals-beneficiation. As Goldthau and Sovacool (2012:235) explain, the nature of an electricity system means that it "exhibits strong path dependencies due to the large investments made into grids and plants, perpetuating a mostly fossil fuel based system of electricity production and consumption" and is therefore unable to adapt quickly to sudden changes. As is evidenced in the case of South Africa's electricity regime, lock-in mechanisms include "scale economies, sunk investments in machines, infrastructures and competencies"… and "shared beliefs and discourses, power relations, and political lobbying by incumbents" (Geels 2011:25).

Technological lock-in allows for a consideration of technical change or the lack thereof in terms of the know-how and inertia embedded in "complex technological systems" (Unruh 2002:317) and subsystems such as roads, electricity and communications networks (Scrase and MacKerron 2009:91). As technological change will inevitably undermine the gains of those involved with the incumbent regime in terms of formal skills, tacit knowledge, equipment and ownership of natural resources (Moe 2007:17), powerful interests will attempt to protect themselves via favorable treatment such as tariffs and subsidies or control over policy making. Hence "the technological, institutional and political alignments that lock nations into certain forms of electricity provision are multiple, mutually reinforcing and complex" (Scrase and Smith 2009:711).

Parallels can be drawn between what Unruh (2000, 2002) refers to as a 'techno-institutional complex' and the MEC as a system of accumulation in that both are mutually supported by a politically-entrenched institutional structure upheld by direct and indirect government subsidies, and in which is hard to bring about change. This aligns with Robert's findings (2007:17), who writing about South Africa's industrial policy, concurs that "there are strong path-dependency effects which keep a country on the same trajectory in the absence of concerted government action. The South African experience is consistent with this." He cites Hausman and Klinger (2006b) who further argue that a change in production is highly disruptive due to the very specific inputs required by any one product "such as knowledge, physical assets, intermediate inputs, labour training requirements, infrastructure needs, property rights, regulatory requirements or other public goods" (in Roberts 2007:17). The ability of market mechanisms to tackle technological lock-in and shift incumbent fossil fuel based structures are wholly inadequate and instead strong political action is necessary (Moe 2009:1732), raising fundamental questions over the role of the state and the ability of government intervention in South Africa to bring about change.

Inertia and momentum, inherent in the physical functioning of an electricity system, are fundamental to characteristics of technological lock-in (Geels et al 2004) and apply metaphorically to the associated sphere of energy policy-making. Goldthau and Sovacool (2012:234) describe how these increase "with the degree of complexity of the socio-technological system". Similarly, Walker

(2000:833) explains that “Once launched, large projects always acquire inertia. In part, this is the natural consequence of resources being committed, organisations taking up positions, and dependencies being formed”. Moreover, as evidenced in South Africa’s case, the power sector is “heavily centralised, characterised by huge converters (power plants) and end consumers largely dependent on both the network and the converters” (Goldthau and Sovacool 2012:235). Smith et al (2005) state that a regime is likely to demonstrate inertia even if its “membership is not active in its resistance to change”. Scrase and MacKerron (2009) argue that slow progress in low carbon technology is less about government obstruction and more about the way in which technological and political systems develop momentum. Once systems are locked-in to a certain trajectory or path dependency it is difficult and time-consuming to steer them onto a different path. They attribute the difficulties of transition in part to high capital intensity, longevity and fuel specificity of most capital assets in energy systems.

Investment decisions, institutional structures and policy frameworks all contribute to locking-in energy development to a certain pathway. Walker (2000) describes how technological lock-in is often characterised by commitments of capital, infrastructure, industry contracts and politics which “can create inertia causing inferior technology paths to survive long after they should have been abandoned” (Ibid p833). This is particularly the case where there are close relations between producers and states as this prevents markets and democratic processes from being able to operate effectively. While he states that technological lock-in of a particular ageing and inefficient pathway will eventually be overcome, the longer this takes to happen the greater the cost to society, “in the long run, the unfit will always lose but the costs of their survival in the interim can be grievous” (Ibid). This thesis considers the extent to which this may apply to the entrenched nature of the coal industry.

3.3 A political economy approach

A critical political economy of energy in South Africa*, “studies and challenges the political and economic power structures that influence how (global and local) actors make energy decisions, how energy debates are framed more generally and explores the deeper structures behind energy production and consumption among different actors on different scales”* (Büscher 2009:2).

South Africa’s electricity sector cannot be understood without situating it within the complexity in which is embedded. This complexity refers to a political economy and historical path dependency characterised by the MEC (section 3.4) that obstructs the realisation of change based on technocratic assumptions. A political economy approach is crucial for the analysis of relationships between political power and economic development, structural change and the underlying interests of dominant actors and beneficiaries of governance mechanisms (Söderbaum and Taylor 2003, 2004; Moe 2007, Büscher 2009). It provides a perspective that goes beyond that of the state in order to include the dynamics of global economic expansion and the role of transnational corporations and multilateral institutions in the policy process (Newell 2008). It avoids reducing a complex debate to a largely technocratic perspective on policy and governance (Torgerson 2003), referred to by Paterson (2005:277) as a 'techno fix' and Büscher (2009:5) as a 'policy fix' approach. Such a perspective, which this thesis is careful to avoid, implies a strong technical focus, is largely politics free, ignores the influence of human agency and fails to address "pressing issues of social justice on two fronts: both *within* industrialised nations and *between* highly industrialised and third world nations" (Hajer 1995:32). As Moe (2009:1731) explains, technology and economics are insufficient for an analysis of structural change and long-term growth and development. Instead, "*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). A political economy analysis of electricity governance in South Africa must therefore include the role of vested interests in resisting structural change.

Freund (2010:20) finds that "studying the political economy of South Africa was taken for granted as absolutely critical in building an intellectual foundation for the anti-apartheid movement but it has been enormously less interesting to post-apartheid intellectuals, including critical intellectuals. The issues it raises have been placed on the back burner". More specifically Büscher (2009:2) identifies a paucity of analysis of the country's power sector from a critical political economy perspective in the post-apartheid era and that many studies either "display a strong technical quantitative bias and/or lean towards rather simplistic ideas about policy processes and dynamics" with exceptions including Death (2006), Bond et al (2007) and McDonald (2009). While Büscher's (2009:7) call for more local analyses and work on the "framework of existing power relations and institutions" is highly relevant, Marquard's (2006) unpublished master's thesis is a significant omission from this list. In addition fundamental contributions on the contemporary development of South Africa's energy sector by other authors including Eberhard (2005, 2007, 2011), Steyn (2006) and Nakhooda (2011) and from the perspective of social, economic and environmental justice by civil society organisations such as Earthlife and groundWork (Hallowes 2009, Hallowes and Munnik 2007), should not be under- valued for their contribution to in-depth understandings of the political economy of South Africa's electricity sector.

3.3.1 Historically conditioned

Following Moe (2010) the historically-conditioned nature of electricity systems is fundamental to political economy. More generally a historically aware perspective is a key feature of both political economy and socio-technical transitions approaches. In the case of the former it relates to a long-standing debate identified by Milonakis and Fine (2009) over the value of specific historical content in economic method and analysis versus the extent to which abstract theory can be applied, regardless of the national context of the economy in question. Insights from the German Historical School of 1800s are relevant here, which asserted that boundaries between different social sciences are not easily defined and had as its prime aim the application of historical method to economic phenomena (Ibid 2009). In the case of socio-technical transitions a historical approach emphasises the long-term nature of changes to a socio-technical system. Building on Schumpeter and Kondratiev who challenged the dominant neoclassical economic thought of 1930s and 1940s, Freeman and Louçã (2001:48) see history as central to understanding structural transformation and economic change, stating "no explanation is legitimate without being contextualized in its proper place in the historical narration". Similarly Scrase and Smith (2005:708) assert that major transformations to socio-technical regimes "are realised over decades through (unpredictable and often disruptive) evolutionary social and technological change". In conceptualising electricity as a socio-technical system, Hughes (1983:2), in *Networks of Power: Electrification in western society, 1880-1930* explicitly adopts a historical perspective in order to "comprehend the complex, multifaceted relations of these systems and the changes that take place in them over time".

Therefore the socio-technical argument that "more attention should be given to the context in which regime transformation arises" in terms of the peculiarities of incumbent regimes and the specific features of its governance structure is essential here, as both will influence the way in which "the process of system innovation" could take place (Smith et al 2005:1498). This challenges technocratic approaches which fail to integrate nationally specific path dependencies. More crucially it allows for an exploration of the embedded nature of the electricity sector within the MEC and a diverse and constantly evolving multiplicity of networks, alliances and coalitions among mining and manufacturing industries, the utility, government and international interests who hold a stake in or benefit from the sector in some way. This in turn links to Freund's (2010) critical exploration of South Africa's MEC within the broader context of its economic history or "historiography" to which this thesis seeks to contribute along with the recent study by Rafey and Sovacool (2011). A historical perspective is also central to concepts of technological lock-in as previously explored.

3.3.2 Vested interests

The role of vested interests is a recurrent theme throughout this thesis, relating to Ham and Hill's (1993:12) assertion that much political activity "is concerned with maintaining the status quo and resisting challenges to the existing allocation of values". Powerful stakeholders most involved in the reproduction of the system and who benefit from the status quo are therefore most able to resist the introduction of new technologies (Smith and Stirling 2007:355). Mokyr (1998:50) surmises that "technological progress in a given society is by and large a temporary and vulnerable process, with many powerful enemies whose vested interests in the *status quo* or aversion to change of any kind continuously threaten it".

Drawing on Schumpeter (1983) and Olson (2000), Moe (2010) explores how vested interests resisting structural change are intrinsic to its success or failure, and may take the form of laws and regulations restricting the entry of new technology, lobby groups, state monopolies and physical resistance such as riots. Because technological change inevitably threatens the interests of those who are invested in the entrenched technology, those who stand to loose from innovation often seek to prevent it from happening (Moe 2010:1732, footnote), hence the resistance witnessed by coal-based incumbents to the introduction of renewable electricity generation in South Africa. Concrete examples of such interests for the electricity sector include utilities, regulators, consumer associations and capital goods developers and organised labour (Smith and Stirling 2007:355). This thesis will examine how investments in regime-based infrastructures such as the Medupi coal-fired power plant and institutions such as Eskom in the case of South Africa, further entrench the regime, illustrating what Smith and Stirling (2007:356) describe as "structured power". Therefore states can only implement structural change by preventing vested interests from "gaining control over economic policy-making" yet the stronger these interests are, the harder it is for the state to implement change and it may only do so "reluctantly and belatedly" (Moe 2010:1733). The extent to which the South African state has been able or willing to do this, given the influence of entrenched vested interests over policy-making, is a key theme this thesis. In addition outright resistance to new technology is a widely observed historical phenomenon. "Throughout history technological progress has run into another more powerful foe: the purposeful, self-interested resistance to new technology" (Mokyr 1998:40).

3.4 Minerals-energy complex

The MEC is the main contributor to the political economy approach of this thesis, itself informed by theoretical debates current at its conception, including Marxist value theory, the theory and practice of developmental states and the Military-Industrial Complex (Fine 2008:1)[6]. It provides both a description of the nature of production and consumption in South Africa's economy (explored in chapter 4) and a theoretical perspective on South Africa's political economy. Here it is used for understanding the evolution of power and networks operating over and within South Africa's electricity sector which combined with a socio-technical transitions approach creates a useful lens with which to analyse this complexity.

In defining the MEC, Fine and Rustomjee (1996) identified an intrinsic link between the state and private capital and national economic dependence on a core set of mining and energy-related activities. The MEC in its earlier stages consisted of the interrelationship between coal, electricity and gold mining which later expanded into "more complex relationships between mining, electricity, [minerals] beneficiation and crude oil- and coal-based petrochemicals industries" (Marquard 2006:67). Mineral commodities have been central to the South African economy since the late 1800s (Ziramba 2009) for which cheap energy has been essential (DME 1998, Winkler and Marquard 2007), coupled with cheap labour based on racial divisions (Makgetla and Seidman 1980). McDonald (2009:7) emphasises that nowhere is "the link between capitalism and electricity more relevant than in South Africa" given the economy's dependence on cheap and abundant supplies of electricity, heightened during the apartheid era when embargos forced the country to reduce its reliance on imported oil. These are "uniquely dependent on electricity and uniquely electricity-intensive" (Fine and Rustomjee 1996:8).

The MEC's activities were 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). Its activities are "vertically and horizontally integrated into a composite set of related industrial and manufacturing activities" and more recently services and finance (McDonald 2009a:8). The sectors continue to be incredibly influential over the state and direction of the economy and "have been attached institutionally to a highly concentrated structure of corporate capital, state-owned enterprises and other organisations such as the International Development Corporation (IDC) which

[6] Though unable to explore in any depth, this thesis acknowledges broad debates over theories of the relationship between apartheid and capitalist development, race and class and their relevance for the post-apartheid social and economic transformation (Heintz 2010, Nattrass 1981, Wolpe 1988)

have themselves reflected underlying structure and balance of economic and political power" (Fine 2007).

The understanding of the MEC for this thesis draws on key authors that have conceived, contributed to or critiqued it during and after apartheid, including Freund (2010), Michie and Padayachee (1997), Roberts (2007), Marais (2001), Bond (2000), Fine (2009,a,b), and Bell and Farrell (1997). Consistent with the lack of political economy analyses of the energy sector discussed above, the MEC has been disregarded in the literature and national debates as a key determinant of South Africa's economic trajectory as well as an organising concept with which to examine it and that "in the transition from apartheid to post-apartheid a historically aware analysis of 'the social forces of production' in the context of South Africa's political economy has been abandoned for "technical solutions to the economics of transition" (Fine and Rustomjee 1996:4). Freund (2010) concurs that while the influence of Fine and Rustomjee's thinking continues, their work has had limited influence over post-apartheid economic policy making.

McDonald (2009 a,b) uses the lens of 'electric capitalism' to enrich the concept of MEC. Narrowing his focus solely to the electricity sector, he explores new sectors such as urban producer services, the expansion of the grid to black areas of the country in the post-apartheid era and the impact of South Africa's neo-liberal reforms on its electricity sector (the latter discussed in chapter 4). He refers to this analytical framework as the 'MEC-plus' which also includes a focus on South Africa's strategic positioning within the electricity sector of the Southern Africa region. He finds that the mining and industry sectors as the primary beneficiaries of state electricity expenditures have now been joined by a growing urban services sector which is increasingly dominant in South Africa's economy. Also of note is his attention to "powerful European and North American interests" (McDonald 2009a:3) in the electricity sector as well as the growing presence of China and other players in the continent's resources more generally (Ayers 2012). Together with India such interests appear set to play an important role in the country's nascent wind industry, emerging nuclear fleet and continued coal development as this thesis will discuss. His conclusion that the reorganisation of South Africa's electricity sector is largely "business-as-usual" comes back to one of the objectives of this thesis, to investigate the extent to which fundamental structures of the MEC are shifting in the context of emerging low carbon developments.

Freund (2010) describes the MEC as an "architecture" which encompasses critical links and networks of power between the financial sector, parastatals, government, the private sector and the IDC and that the study of this architecture is the most significant and original contribution that can be made to the MEC. Marquard (2006:71) adds to this by describing the South African economy as an associated “industrial policy complex”, “consisting of a number of overlapping policy networks… and coordinated by what can be termed an ‘industrial policy elite’ concentrated in agencies such as the IDC and the state’s economic planning machinery, with close connections to the political elite”. This could be related to Geels et al’s (2004:7) concept of ‘organisational capital’, which consists of interdependent networks of suppliers and users and can contribute to lock-in and inertia in a socio-technical system. Padayachee (2010) uses the MEC as a policy framework to address the economic legacy of apartheid and as a way of characterising the SA system of capital accumulation. He asks what does the MEC “tell us about power relations and ‘politics’ in contemporary South Africa” and “what does it imply for policy”? (Ibid p2010:2). The approach of this research is shaped by these perspectives.

3.5 Governance and policy

By fusing a political economy and socio-technical transitions approach this thesis generates insights into governance and the policy process in South Africa’s electricity sector. This section is dedicated to establishing these latter terms. Limited attention has been paid to the relationship between socio-technical transitions and governance processes. Yet the way in which electricity is governed is determined and constrained by its nature as a socio-technical system and in relation to the “historically established commitments embodied in infrastructures, networks, institutions, practices and discourses” in which it is embedded (Smith and Stirling 2007:355). Hence following Rip and Kemp (1998:341), a restructuring of the electricity sector requires engagement with complex networks of stakeholders, institutions and infrastructures and depends on the nature and extent of its linkages within the broader socio-technical system that would need to be broken and reconfigured.

The term ‘governance’ refers to the act of steering and influence over policy-making processes by stakeholders who span the continuum of public to private and include hybrid forms that incorporate networks, hierarchies and partnerships (Leach et al 2007, 2010). While mainstream governance literature (Rhodes 1997, Stoker 1998) offers less of an insight for the long-term process of technological change and historical path dependency, it still brings a contribution for the perspective it brings to the role of the state within the broader context of market institutions. Policy processes and policy-making, and their political nature (Keeley and Scoones 2003) are treated here as a critical aspect of governance (Meadowcroft 2011).

This thesis challenges the dominant conception of the policy process as objective and linear and instead illuminates a complex political process involving a multitude of actors in the public and private spheres (Scrase and Ockwell 2009:36) as well as changes, incremental adjustments or changes of direction. Drawing on Keeley and Scoones (2003:22) "Rather than seeing policy as simply a single decision implemented in a linear fashion, many observers have noted that, 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". Such an approach responds to and builds on shortcomings identified above of the socio-technical transitions literature that has failed to account for the political circumstances that facilitate their adoption. Following Wildavsky (1979:387) in this thesis policy refers as much to a process of decision-making as it does to a "product of that process" and policy analysis "should be shown not just defined". This links to Mosse's (2004:664) assertion that "policy is part of the context of action" rather than the start of it. Ham and Hill (1993:21) assert that "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", to which this thesis would add technical systems. As I will also explore, the study of policy is often about non-decisions which is due in part to resistance of vested interests in a variety of institutions (Heclo 1972 in Ham and Hill 1993:12). Lastly while the main aim of this thesis is to undertake an analysis *of* the policy process, following Wildavsky, policy analysis is as much to do with advocacy "as with understanding", and that 'intellectual cogitation' must be linked with 'social interaction' if the analysis is to have an impact (Wildavsky 1979:17).

Smith and Stirling (2007) conceptualise two fundamentally conflicting concepts of governance in relation to the socio-technical. "Governance on the outside", is an objective, positivist and rational approach that sees the governance arena as an external intervention, separate from the discrete socio-technical object which is to be governed. Secondly "governance on the inside", with which this thesis aligns takes a reflexive approach, requires a detailed awareness of "power, authority, consent, dissent and above all, legitimacy" (Smith and Stirling 2007:364) and sees governance as co-constituting the socio-technical system, "itself conditioned by the relationships practices, problems and understandings which it seeks to steer" (Smith and Stirling 2007:367). This second concept can be related to Poulantzas' view of the state as a "complex institutional system", characterised by complex relationships within its apparatus rather than a neutral entity extraneous to the system of accumulation of which it is part (Jessop 1990:45).

Laswell (1950) describes the politics of policy making as, “who gets what, when and how”. To this one can add Söderbaum and Taylor’s (2003:7) definition of governance as “who decides what and with what means”?...For whom, for what purpose and with what consequences”. Such an inquiry can be strengthened by Fine’s (2008:12) question of asking “how much there is to get?” These perspectives relate to Lawhon and Murphy’s (2011:10) critique of the MLP which they assert focuses too much “on the rules governing regimes-and not on who creates and benefits from them”. For the sake of this research these questions can be interpreted to ask: who has control over electricity generation either in terms of whose power plant gets connected to the electric grid, and/or over the resources (i.e. coal) that supplies the power plants? Who benefits on the demand side from the electricity that is generated? Who controls the transmission grid? Who has influence in the policy-making arena? And in what way? These questions further allow us to consider the role of the state in facilitating the ability of competing fractions of capital to either reproduce their power at the level of the regime, or gain access to it. Though perhaps a simplistic analogy, in the case of South Africa’s electricity sector these fractions can be aligned with coal mining and energy-intensive interests at the level of the ‘regime’ and renewable energy interests at the level of the ‘niche’. This can be related to Fine and Rustomjee’s (1996:25) broader assertion that “…the history of the South African economy can in part be understood as the simultaneity of two processes: a shifting and complex short-term resolution of conflicts of capitalists’ interests and a longer-term integration and interpenetration of those capitals as they became increasingly large-scale and diversified. In both processes the state has played a central, mediating role”

The role of discourse and language in influencing governance and policy-making in South Africa’s electricity sector is fundamental, as chapter 8 explores in relation to the Medupi coal-fired power plant. Following Dryzek (2005) discourse offers one way to analyse the proliferation of perspectives on complex environmental problems, though in this case the subject matter goes far beyond the environmental. Discourse and politics shape and are shaped by each other (Dryzek 2005:20) and that “sometimes it is a sign of power that actors can get the discourse to which they subscribe accepted by others” (Dryzek 2005:9).

Söderbaum (2004:421) argues for an examination of the interface and interpenetration between international, regional, national and local processes and complex relationships between state, legal, market, transnational and civil society entities. This could include intergovernmental relations within states and the interaction of jurisdictional and territorial boundaries. Büscher’s (2009) argument that the treatment of global energy power politics in international relations and political science literature fails to adequately link 'geopolitics' with local energy dynamics in Africa is another consideration. He states that this leads to limited concern for what happens at a country level and consequently it is essential to ensure that a critical political economy of energy in South Africa seeks to add to the "growing body of literature on the interrelationships between "local", "national and "global" conditions, particularly in the developing countries of the global south" (Büscher 2009:7).

Finally an awareness of the regional dimension is essential to understanding policy making in South Africa's electricity sector. This is in light of its shared grid with the Southern Africa Power Pool, its increasing reliance on its neighbour's resources countries for its energy supply and efforts for regional integration more generally within SADC, accompanied by calls from former President Mbeki for an "African Renaissance" (Taylor 2002). McGowan (2009) sees the regional level as a "focal point for developing energy policy" in light of shared historical experiences between countries, and economies of scale in regional exploitation of resources and infrastructure development. Southern Africa is a clear example of this. The New Regionalism Approach (NRA) (Dunn and Hentz 2003) which focuses on understanding the changing nature of the state in the context of globalisation and regionalisation, the role of formal and informal dimensions of governance and non-state networks in regional formation contributes to this framework.

3.6 Chapter summary

Furthering Fine and Rustomjee's (1996:20) discussion on the methodological difficulties of analysing South Africa's political economy due to the complexities of its apartheid legacy, this thesis constructs a unique analytical framework that is appropriate for a subject matter that is itself unique in national and technological context, which has been understudied to date. Fusing a socio-technical transitions framework with perspectives from political economy informed by the country's MEC provides insights into in its electricity governance and policy-making. This in turn allows us to: examine relationships and tensions within a regime characterised by an entrenched coal-fired, state-run, publicly-funded electricity sector supplied by private coal mines for the disproportionate benefit of energy-intensive users; study an emerging niche consisting of renewable energy independent power producers supported by bilateral donors, private finance and emerging national level policies; examine the conflict as well as the emerging interdependence between these two loosely defined sites; and consider the role of different state agencies who are in turn riddled with their own conflicts in mediating the access of these two fractions of capital to the electric grid. This, by way of protracted and conflict-ridden policy processes. The ability of the state to support the emergence of niche innovations and facilitate structural change away from incumbents, whilst preventing the latter from obstructing the former is critical here, as is its capacity to prevent emerging niches from becoming vested interests themselves (Moe 2007). A historical perspective of the MEC followed by an exploration of the origins and development of the country's electricity sector as embedded within the MEC is now discussed in chapter 4.

4 Chapter 4: MEC and electricity history

"The mineral wealth beneath the soil, the banks and the monopoly industry shall be transferred to the ownership of the people as a whole", South Africa freedom charter endorsed by the Congress of the People 1955

This chapter introduces two key themes of this thesis. Firstly how the dominance of large-scale capital has influenced the way in which the state-owned electricity sector has developed and related policy has been negotiated. And secondly how as they did under apartheid, state-owned sectors in this case Eskom, continue to facilitate the growth of MEC core sectors and related large-scale private capital. This returns to the question introduced in chapter 1: *How is electricity policy negotiated in South Africa?*

Following the historical perspective discussed in chapter 3 this chapter firstly provides insights into the formation and development of the MEC as the key configuration within which South Africa's coal-generated electricity regime is embedded. I focus in particular on the combination of cheap coal, cheap labour and cheap electricity for export-oriented mining activities. In exploring the institutions that have been central to this process I examine the origins of the country's large state-owned corporations, a number of which have since developed into private companies. I then examine the evolution of large-scale national and international corporate capital which has been a key characteristic of MEC-related sectors during and after apartheid and in which Anglo-American Corporation has been particularly dominant. Within this, more recent trends of financialisation and black economic empowerment are also considered.

The chapter then provides a historical narrative of the evolution of the country's electricity sector since 1922, focussing on the parastatal monopoly utility, Eskom. In doing this I draw clear links between the history and structure of the electricity sector and the mining and manufacturing industry that it serves. I illustrate the central facilitating role that Eskom has played in facilitating the growth of MEC sectors. This includes an introduction to the different spheres of power and influence that operate over and within the utility and associated policy making which is further embellished in chapter 5. I then trace how the country has gone from a period of electricity surplus in 1970s to one of imminent deficit today. This poses a serious threat to Eskom's monopoly and its historical ability to supply cheap power to large mining conglomerates and has resulted in dramatic tariff hikes. I include an overview and analysis of stalled attempts since 1998 to introduce private electricity generation and renewable energy which would effectively diminish Eskom's monopoly control. Chapter 5 goes on to consider more recent developments in light of this. While South Africa's electricity industry is controlled by a public monopoly, its coal industry is controlled by five large private monopolies. These are explored in greater depth in chapter 7, including the power struggles that exist between them and Eskom, and in which national politics and the country's apartheid history are reflected.

4.1 Minerals-energy complex: cheap coal, cheap power, cheap labour

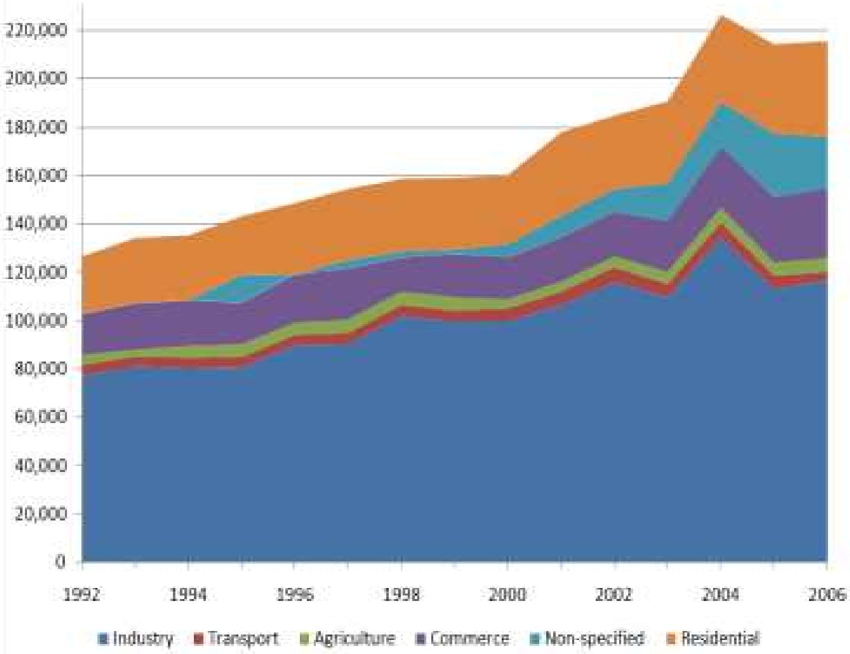
"South Africa underwrites risk for big minerals companies. The beneficiaries are private capital and the risk takers are the general public." Energy analyst (2)

"ESCOM power was cheap not only because ESCOM operated 'without profit' but also because its power-station compounds ensured cheap labour. Above all, its coal was cheap. The labour reserves, pass laws and compounds provided very cheap coal-mining labour. The coal seams were thick, shallow, horizontal and seldom faulted. These factors combined to give perhaps the cheapest coal in the world" (Christie 1984:150).

4.1.1 From gold and beyond

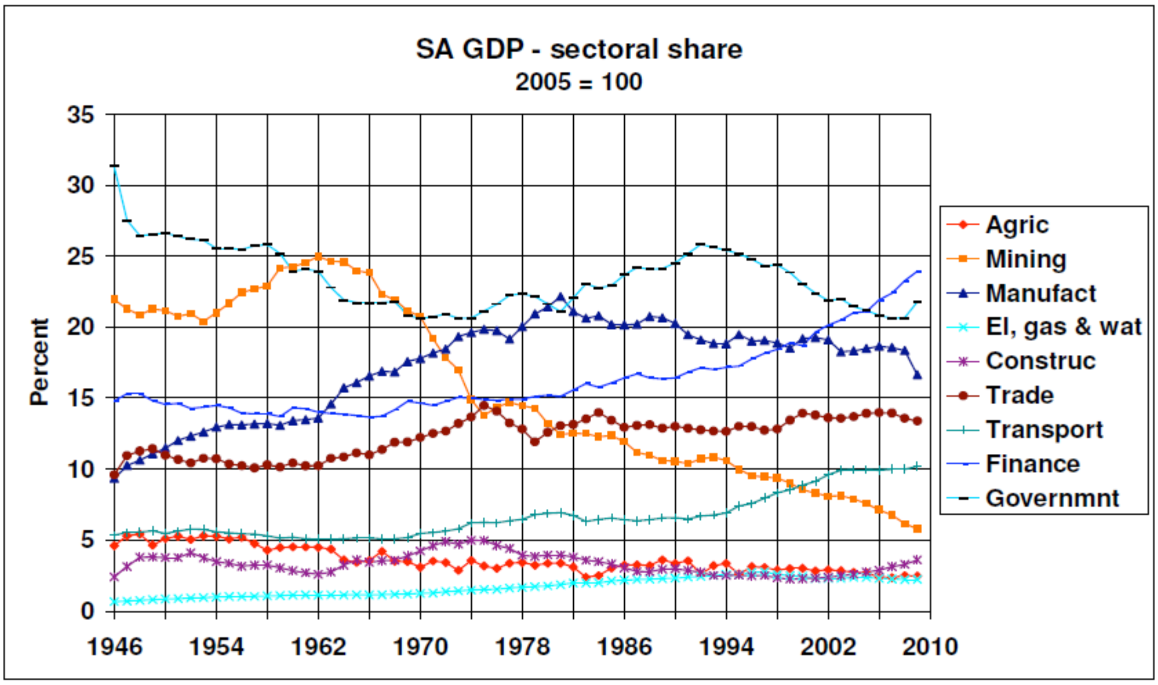
In 1984 Christie (1984:1) stated that "since 1905 South Africa has had perhaps the cheapest steam-generated electricity supplies in the world", which is attributed to abundant and easily accessible coal, the creation of a cheap black labour force for the mines and power stations, and a supply industry structured to benefit mining, transport and manufacturing with cheap power. As shown in figure 4.1, 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. In 1996 Fine and Rustomjee explored how the entire economy was dependent on the MEC, with mining playing an increasingly important role, contradicting beliefs about its declining importance (see figure 4.2). Their analysis is notable for the examination of the interdependence of mining and manufacturing activities together, disputing more orthodox economics assumptions that treat them as disconnected. Marquard (2006:67) adds that much industrial activity "involves basic beneficiation of minerals, as well as 'backward linkages' which provide commodities such as explosives and iron and steel products for mining activities".

Figure 4.1: Electricity consumption (Gwh) by sector (1992-2006)



Source: World Bank (2010a:10)

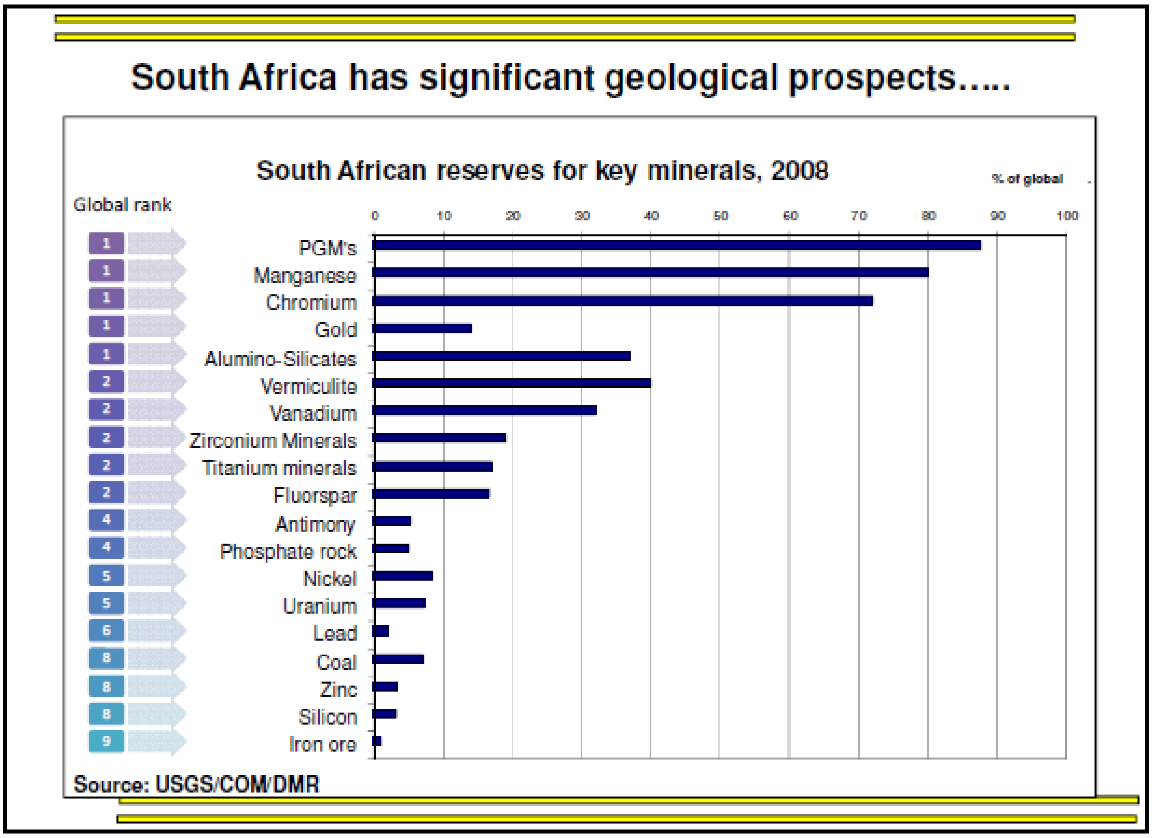
Figure 4.2: South African GDP Sectoral Share



Source: Eskom Systems Operation and Planning (2010:10)

The heart of the activity of South Africa's MEC is located in the Pretoria-Witwatersrand-Vereeniging (or Vaal) triangle in the north east of the country, established following the discovery of gold in 1886 which together with diamonds dominated the country's mining industry and economy until the mid-1900s (Fine and Rustomjee 1996:80). According to the Department of Mineral Resources (DMR) (2010:6) South Africa is the world's richest country in terms of mineral resources and the world's top producer of platinum, providing 88 per cent of global recognized resources of platinum group metals (PGMs), 80 per cent of manganese, 72 per cent of chrome, 32 per cent of vanadium, 13 per cent of gold and 7 per cent of coal (see figure 4.3, DMR 2010:6). The country is also the world's leading supplier of alloys (Ibid p16). The Vaal triangle is the country's single largest point source of carbon dioxide emissions.

Figure 4.3: South Africa's Mineral Reserves



Source: Roger Baxter (2011), Senior Executive, Chamber of Mines South Africa

Mining is 70 per cent export driven (Roberts 2007) with the country's exports being beneficiated raw materials[7] such as aluminium and ferrochrome (used in the production of stainless steel) rather than "sophisticated fabricated products". More than 60 per cent of exports are dominated by minerals and resource-intensive manufactured products, such as basic iron and steel, basic chemicals and refinery products, basic non-ferrous metals and minerals, and pulp and paper (Roberts 2007:10, see figure 4.4) In 2009 South Africa exported primary and processed minerals to 82 countries. Excluding precious metals and minerals the Pacific Rim accounted for 49.9 per cent and Europe for 33.2 per cent of the total value of exports (DMR 2010:11), reflecting changes in global demand and supply of key minerals, with increased demand coming from China and India.

While the share of South Africa's gold reserves have declined in relation to other mineral resources (see figure 4.4) particularly since 1960s, the rise and fall of the gold price has had significant impact on the country's economic development (Freund 2010, Fine 2007). By the end of 1900s, the country's 124 gold companies accounted for more than a quarter of the world's total output and were controlled by less than ten British, German and French groups (Chabane et al 2006:551). According to Makgetla and Seidman (1980:61) under British colonial rule "South African capital, accumulated from the diamond mines, combined with UK, US and German finance to monopolise the gold industry". These gold reserves financed South Africa's initial industrialisation and eventually led to the establishment of powerful mining finance houses run by whites, which "obtained initial credits from Barclays, Standard and the Deutsche Bank". Together with the state they diversified profits by developing manufacturing and the mining of base metals (Ibid p94). Clark (1994:12) describes how Afrikaners were threatened by exclusively foreign control over the mining industry led by British interests, creating tensions over natural resources that ultimately led to the 1889-1902 Boer War. This was followed by the 1910 union of South Africa which joined the British Cape and Natal provinces with the conquered Boer Republics of the Transvaal and Orange Free State.

[7] http://www.dmr.gov.za/beneficiation-economics.html

Figure 4.4: Exports of South Africa's commodities

COMMODITY	RESERVES				PRODUCTION				EXPORTS			
	Unit	Mass	%	Rank	Unit	Mass	%	Rank	Unit	Mass	%	Rank
Aluminium[+]		*	*	*	kt	1025			kt	538	3,1	7
Alumino-silicates	Mt	51	*	*	kt	265	60,2	1	kt	109		*
Antimony	kt	350	16,7	3	t	3 000	1,6	3	t	*	*	*
Chrome Ore	**Mt**	**5 500**	**72,4**	**1**	**kt**	**6 762**			**kt**	**1035**		
Coal	Mt	30 408	7,4	6	Mt	250,6	3,6	7	Mt	60,5	6,4	5
Copper	Mt	13	2,4	14	kt	89	*	*	kt	27	*	*
Ferro-chrome		*	*	*	kt	2 346	39,2	1	kt	2 621	56,5	1
Ferro-Mn/Fe-Si-Mn		*	*	*	kt	392	*	*	kt	411	*	*
Ferro-silicon		*	*	*	**kt**	**148,9**	**2,9**	**6**	**kt**	**82,0**	**2,1**	**1**
Fluorspar	Mt	80	17	2	kt	180	3,5	5	kt	*	*	*
Gold	t	6 000	12,7	1	t	197	7,8	5	t	180	*	*
Iron Ore	Mt	1 500	0,8	13	Mt	55,4	3,5	6	Mt	44,6	4,7	5
Lead	kt	3 000	2,1	6	kt	49	1,2	10	kt	47	1,9	14
Manganese Ore	Mt	4 000	80,0	1	kt	4 576	17,1	2	kt	3 978	26,6	2
Nickel	Mt	3,7	5,2	8	kt	34,6	2,4	12	kt	27,3	*	*
PGMs	t	70 000	87,7	1	t	271	58,7	1	t	251	*	*
Phosphate Rock	Mt	2 500	5,3	4	kt	2 237	1,4	11	kt	0	*	*
Silicon Metal		*	*	*	**kt**	**38,6**	**2,8**	**6**	**kt**	**38,4**	**3,5**	**6**
Silver		*	*	*	t	77,8	0,4	20	t	70	*	*
Titanium Minerals	Mt	71	9,8	2	kt	1 100	19,2	2		*	*	*
Uranium	kt	435	8	4	t	623	1,3	10		*	*	*
Vanadium	kt	12 000	32,0	2	kt	11,6	25,4	1	kt	11,9	*	*
Vermiculite	Mt	80	40,0	2	kt	194,3	35	1	kt	164,6	*	*
Zinc	Mt	15	3,3	8	kt	29	0,2	25	kt	5	0,1	24
Zirconium	Mt	14	25	2	kt	395	32	2		*	*	*

Source: DMR (2010:6)

Fine and Rustomjee (1996:147-180) describe the disjuncture during the interwar period between British capital which played a significant role in developing the mining industry and Afrikaner political power. Economic policies after the Second World War led to the integration of British capital with large-scale Afrikaner capital and the eventual consolidation of white power between the Boers and British despite on-going cultural divisions. This saw the formation of Afrikaner finance capital in 1950s after the introduction of apartheid in 1948, the integration of Afrikaner finance into mining in 1960s and the collaboration of MEC capital and the state in 1970s. Commercial banks, Barclays and Standard Bank, representative of 'English' capital dominated finance from 1930s (Christie 1984:143) but were joined by emerging 'Afrikaner' capital during 1950s. This included: the National Finance Corporation; private merchant banks; Volkskas, Nedbank and Trustbank; and life assurers (Fine and Rustomjee 1996:151).

Magketla and Seidman (1980:57) describe how after World War II, “firms from all the core capitalist countries played a complex role in transforming South Africa’s minerals-based economy into a modern, industrial, increasingly militarised state”. And that the Nationalist regime, whilst systematically intervening in the economy collaborated with mining finance houses to “build up a military-industrial complex that ensured perpetuation of the rule of white mine, farm and factory owners, buttressed by an ‘aristocracy’ of white workers. All of this ensured that the TNCs competing to operate with each other in South Africa’s manufacturing, gained high profits, particularly those who invested in the “technologically sophisticated sectors”.

4.1.2 Cheap Labour

Cheap labour based on racial divisions and the institutionalisation of black poverty has played a fundamental role in South Africa’s economy. Christie (1984:1) asserts that “South Africa’s international specialization” is as much cheap mining labour as it is cheap energy, “especially cheap electricity”. Marquard (2006:67) finds that cheap black labour, and “concomitant social and economic inequality and political repression” is as significant an input into South Africa’s MEC as cheap electricity. Legassick (1977, in Freund 2010:11) showed how dominant mining interests were in the post-Boer War reconstruction period in establishing labour and social policies for the twentieth century. Central to South African capitalism’s dependence on cheap labour was the gigantic gold mining system of labour controls, unequal land divisions and the creation of the ‘Bantustans’, territories set aside for black South Africans under the 1913 land act. Makgetla and Seidman (1980:76) add that the parastatals “held their prices down by paying their African employees particularly low wages”, and that “the state could afford to hold down corporate taxes, since it refused to provide adequate social security, health care or education for the black majority”. While net profit took off in the 1970s largely due to the global increase in the gold price, capital expenditure, salaries and wages barely rose (Ibid p100-102). Indeed by the mid 1970s, wages constituted less than a tenth of the mining companies’ total income with 85.5 per cent of all workers employed in the mines being African.

4.1.3 State corporations

The promotion of a small number of large, powerful state-owned enterprises or ‘parastatals’ which were promoted and supported by the Nationalist government under apartheid in the interests of industrialisation, employment creation and economic development (Eberhard 2007:215) has been a central feature of South Africa’s MEC. According to Makgetla and Seidman (1980:67), it was through these institutions that the apartheid regime “multiplied its investments in manufacturing, to spur industrialisation of the economy”. Of these, Eskom the electricity parastatal and Iscor the iron and steel parastatal were set up in 1920s and Sasol the coal to liquids petrochemicals parastatal in 1950s. Other parastatals include Transnet for transport infrastructure, Telkom SA for communications and South African Airways. While Sasol and Iscor have since been privatised, their sectoral dominance is still significant. According to Clark (1994) the parastatals had three main policy goals: to counterbalance the economic dominance of the gold mining industry, provide some autonomy from foreign producers and create jobs for the Afrikaner labour force. This is magnified in the Vaal where they "have largely dictated the production of space and built instant towns on the open veld to serve their needs" (Hallowes and Munnik 2007:18).

Iscor, the country's largest iron and steel company was set up in 1928 and privatised in 1989 when it was listed on the Johannesburg Stock Exchange (JSE) and later became part of the global company Arcelor Mittal which dominates the country's basic iron and steel production (Roberts 2007:9). The creation of coal mining company Exxaro, the sole supplier of coal to the Medupi coal-fired power plant (chapter 8) and one of South Africa's larger renewable energy IPPs (chapter 6) also emerged from the unbundling of Iscor (box 4.2). Through the state-owned Industrial Development Corporation (IDC) Iscor has received massive support including in the mid-1990s for the establishment of the company Saldanha Steel[8], whose R 6.8 billion development in the Western Cape was built to produce 1.2 million tonnes of hot coiled rolled carbon steel per year. Roberts (2007:20) states that this ensured a low-cost primary steel industry, despite the absence of any real attempt to ensure that the local economy would benefit.

Originally known as the pioneer of coal-to-liquids technology developed under apartheid-era sanctions that included a petroleum embargo, Sasol has received huge state financing for its synthetic fuel operations. It has since become the world's leading coal to natural gas processing company. It is the fifth largest South African company with a large captive gas market in the country, including its own petrochemical industries and is a minor multinational with interests in Europe, Middle East, Asia, Australia, Africa and the Americas. It supplies almost half of South Africa's liquid fuel requirements through coal conversions and conventional crude oil imports and refining. Sasol Gas Limited has developed a pipeline network covering more than 1500 km and delivers gas to over 600 customers, mainly in the industrial sector (World Bank 2003:9). Sasol is the country's second largest emitter of green house gases after Eskom (CDP 2011:11).

[8] http://www.arcelormittalsa.com/Operations/SaldanhaWorks/Overview.aspx

Meanwhile the IDC has been the main financing mechanism to support industrial investment and growth in heavy industry, providing loan and equity finance at low interest rates and leveraging significant amounts of private investment (Roberts 2007:26, Fine and Rustomjee 1996:151). It has had a strong decision-making role in large industrial enterprises as a shareholder and beneficiary. Since it was set up in the Smuts era in 1940 by an act of parliament, its lending patterns have had a huge influence on core MEC activities (Freund 2010:18) having provided instrumental support for many industrial mega-projects, including Sasol 1 and 2 (Fine and Rustomjee 1996:196). It has historically been oriented to the development of extremely large-scale minerals beneficiation projects, with close links to previously state-owned enterprises such as Iscor and Sasol, as well as the major conglomerates. Creamer (2011:*5 Aug*) states that it "provides something of a mirror image of South Africa's recent economic and industrial past" and that "its funding has supported 'old economy' and energy-hungry mainstays, such as miners and steelmakers, fertiliser and aluminium manufacturers, and even an unlikely coal-to-fuels success story". In 1998 it owned 11.3 per cent of Gencor, 14.4 per cent of Iscor, 9.1 per cent of Billiton and 8.2 per cent of Sasol (Roberts 2007:27). Between June 1994 and June 1999 over half of its investments by value were in basic metals (IDC 1999, in Roberts 2007:27). In mid-1990s its lending "went predominantly to large-scale, capital-intensive operations" (Roberts 2007:7). However as section 6.9.3 discusses, the IDC announced recently it would invest R22.4-billion in labour intensive green industries and advanced manufacturing projects including solar, wind and agricultural processing projects, in alignment with the country's New Growth Path. This is in comparison to R22.1 billion earmarked for the institution's more traditional areas.

4.1.4 Private Conglomerates

In South Africa, close relations of big business with the state has seen business influencing the policy agenda, meaning that change has in many ways been on their own terms" (Chabane et al 2006:568)

Some of the world's largest resource conglomerates are at the centre of the MEC, some of which are both coal miners and major energy users and South Africa's largest emitters of greenhouse gases. They include BHP Billiton, Anglo-American Corporation (AAC) and Xtrata and form part of the Energy intensive User's Group (EIUG)[9] set up in 1999, which has 36 members and consumes around 44 per cent of the electricity sold in South Africa. South Africa's mining industry has evolved from the six 'axes of capital' (box 4.1) identified by Fine and Rustomjee (1996:96-118), which controlled industry

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[9] http://www.eiug.org.za/membership/

under apartheid and held simultaneous control over the country's mining, industrial and financial sectors. Innes (1984:55) refers to these as the 'group system' which he traces back to the emergence of the gold mining finance houses in 1890s. These are now "large and internationalised firms" (Roberts 2007:26) and continue to dominate the economy. With the exception of iron ore which fell under the domain of the steel parastatal Iscor, mining subsidiaries of the six 'axes of capital' mined more than 70 per cent of all major minerals in South Africa by 1980s, collectively holding 82.5 per cent of share ownership on the JSE by 1988 of which more than half by AAC (Fine and Rustomjee 1996:100- 103). AAC consolidated its power over South Africa's gold mining industry in 1950s and 1960s and has held a leadership position in the country's financial, mining and manufacturing sectors (Pallister et al 1987, Innes 1984) which it still strives to retain (Chabane et al 2006:568).

The extent and patterns of the control of these groups have varied over time and have declined in significance since democratisation in 1994. This is largely due to changes such as the unbundling of traditional conglomerates, trends in financialisation (section 4.1.5), the transfer of primary listings from the JSE to overseas stock exchanges such as London, and the gradual emergence of black owned groups (section 4.1.6) (Chabane et al 2006).

Box 4.1: The Six Axes of Capital

i) **Anglo American Corporation:** Listed on the JSE, headquartered in London and listed on the London Stock Exchange since 1999, it is now a global mining house with key interests in gold, platinum and coal. It is the country's largest coal producer and one of the world's largest diversified mining groups (Eberhard 2011:9). It was formed in 1917 by Oppenheimer with capital from UK, US and South Africa (Chabane et al 2006:551). In 1960s it absorbed Rand Mines and Johannesburg Consolidated Investments and went on to acquire minority interests in Consolidated Gold Fields, Genmin and Union Corporation. Of all the subsidiaries discussed here, only Anglo-Transvaal remained beyond its influence (Innes 1984:159). In late 1990s it restructured into six operating divisions and three big listed companies, including De Beers (Chabane 2006:569) (see also Box 7.1).

ii) **Rand Mines** (a subsidiary of SA Mutual), formed in 1893 and absorbed by AAC during 1960s (Innes 1984:55&159).

iii) **Gencor** formed in 1980s with the merger of General Mining and Finance Corporation (Genmin) and Union Corporation, both founded in 19th century in which AAC acquired a large minority share (Innes 1984:160, Fine and Rustomjee 1996:153).

iv) **Anglo Transvaal**

v) **Johannesburg Consolidated Investment**: Formed in 1889 as a mechanism through which diamond magnates secured European financial support to purchase areas for potential gold mining (Innes 1984:55). Absorbed by AAC during 1960s

vi) **Consolidated Gold Fields of South Africa**: Formed in 1887 and registered in London (Innes 1984:46). Initially one of AAC's major competitors, AAC finally acquired a 28.9 per cent stake in it in 1980 (Innes 1984:160)

Described by Fine and Rustomjee (1996:97) as being "at the historical core of the MEC", the Chamber of Mines was set up in 1890s in order to control and coordinate the interests of South Africa's mining and finance houses, first gold and later other raw and processed mineral commodities including coal, diamond and platinum. Cooperating closely with the EIUG, it is a "principal advocate of major policy positions endorsed by mining employers" (DMR 2010:1) and continues to play an important role as the representative and consultative body of the mining industry[10]. Until the end of apartheid, it was dominated by the six mining groups discussed in box 4.1. The Chamber was joined by the Transvaal Coal Owners Association in 1940s (see chapter 7), itself a cartel dominated by 'English' mining houses that controlled the domestic coal market. Today the Chamber's members are categorised into financial corporations; mining companies of chrome, coal, diamond, gold, iron ore and platinum; contractors; base metals and minerals exploration companies; and manganese companies. Financialisation has been central to the restructuring of these conglomerates since the end of apartheid (Fine 2008:3) and as now discussed, its significance in governance and policy terms is embedded in the economic and political strength of such institutions.

[10] http://www.bullion.org.za/content/?pid=24&pagename=Members

4.1.5 Financialisation

"South African conglomerates and state elites are being absorbed into a broader transnational capitalist class project where global financial capital, given its greater fungibility and mobility, and hence structural power, sets the agenda" Carmody (2002:266).

"Financialisation" which refers to "a self-absorbing process that does not necessarily return money into the real economy of production" (Freund 2010:21) is a central feature of South Africa's MEC. As a 'landscape' trend since 1970s this includes the proliferation of financial markets and institutions, the expanding range of financial services, increased international integration of national economies and the separation of industrial from finance capital as driven by trends of neo-liberal economic development. The result is that economic and social life is made vulnerable to financial instability (Fine 2008, 2009; Ashman et al 2011). In South Africa's case it refers to the liberalisation of capital flows into and out of the country which has resulted in increasing levels of capital flight and disinvestment and the often illegal expatriation of domestic capital by large conglomerates that could otherwise have been used for national development. A key feature of the activity of South Africa's financial sector since 1960s (Fine and Rustomjee 1996:247), this has increased dramatically in the post-apartheid era[11] (see figure 4.2, Ashman et al 2011). South Africa's financial services sector now accounts for about 20 per cent of its GDP. Following the debt freeze of 1985, capital controls meant that internally-generated profits were confined to accumulation within the South African economy, which resulted in the creation of a "huge and sophisticated financial system" (Fine 2008:3) still in place today, of which the JSE is just one example. However this failed to facilitate industrial investment and diversification (Fine and Rustomjee 1996:247) and was paralleled by illegal flows of capital flight. These capital controls were gradually removed after apartheid.

The role of international finance capital has grown in importance as a result of increased international flows of goods and capital, and changes to the country's economy in the 1990s. These include: increased liberalisation of trade and exchange controls, the increased international integration of the South African economy and macro-economic policies such as higher interest rates (Roberts 2007); the introduction of specific measures to increase the economic weight of black investors; and privatisation and regulatory reform (Chabane et al 2006). Roberts (2007) finds that liberalisation appears "to have reinforced the existing patterns of comparative advantage based on

[11] Fine and Rustomjee (1996:247) estimate that as much as 7 per cent of GDP per annum was subject to capital flight between 1970 and 1988). More recently Newman (2009) finds that capital flight between 2001 and 2007 averaged at 12 per cent of GDP per year

natural resources, cheap energy and previous government support”, and that the overall capital-intensity of South Africa’s exports has remained the same.

The development of financialisation has been documented by a number of writers. Makgetla and Seidman (1980:95) referred to a “symbiotic relationship between foreign transnational corporations and banks and the South Africa state and domestic capital” under apartheid, which was exemplified by AAC. Marais (2011:347) describes South African corporate capital as “globalised, sophisticated and socially remote” and states that “economic restructuring undertaken in the 1990s has undermined the state’s leverage over the handful of conglomerates that dominate the economy, leaving it weaker perhaps than any point in the previous half-century”. Freund (2010:21) adds that the trend of financialisation “has also eased the passage of key players and capital out of South Africa entirely in a process of capital flight whose importance we probably have been too faint-hearted to acknowledge as fundamental and perhaps irreversible”. McDonald (2009:9) discusses the increasing financialisation of ‘traditional’ MEC conglomerate stakeholders who are also moving towards the services sector. Following Fine and Rustomjee (1996) he states that finance has become its own entity at the heart of the MEC and now consists of a ‘separate but related’ set of economic activities, creating a finance led ‘system of accumulation’ that is less reliant on the South African economy and mining activity (McDonald 2009:11).

Ashman et al (2011:13) further explain that the relisting of major corporations in London, such as AAC, De Beers, Old Mutual, Sasol and BHP Billiton has also facilitated the removal of large amounts of capital. A further example of this trend is plans for a merger between South African mining company Xtrata with the commodity trader Glencore which already owns a 34 per cent stake in Xtrata agreed in February 2012 which would create a natural resources powerhouse with a combined market capitalisation of $90bn (Financial Times 2012a). Such a merger “would shake up the mining sector in a similar fashion to the multibillion-dollar combination of BHP and Billiton in 2001 that triggered a decade of consolidation in the industry” (Ibid 2012). The merged company would then “rank as the world’s fourth largest mining group by market capitalisation, behind BHP Billiton, Vale of Brazil and Rio Tinto” (Ibid 2012) and become the world’s largest zinc miner, producing 11.5 per cent of global supply (Financial Times 2012b).

4.1.6 Regime shifts: Black Economic Empowerment and the mining charter

While South Africa's democratic transition in 1994 transferred political power to the black majority, the control of its economic power remained in the hands of the white minority. Black Economic Empowerment (BEE) which is central to corporate governance in South Africa was established to address the economic disadvantage of historically marginalised people created by the legacy of apartheid. The BEE commission was set up in 1998 and led by Cyril Ramaphosa, a former ANC activist and now a prominent business personality (Hamman et al 2008:26) who has profited from a number of BEE deals including in renewable energy (section 6.5). Critics from the media, politics, trade unions and civil society have maintained that despite some gains, BEE is primarily about the enrichment of an unproductive black elite with limited trickle down potential, rather than a tool for genuine socio-economic transformation (Tangri and Southall 2008, Mbeki 2011). Moreover it is subject to high levels of rent-seeking, corruption, greed and collusion between political and business interests (ISS 2006, Cargill 2010). Criticisms have also come from the country's main opposition party the Democratic Alliance, and from within the ANC's own ranks by its Secretary General Kgalema Motlanthe, Finance Minister Trevor Manuel, Cosatu General Secretary Zwelinzima Vavi and Deputy General Secretary of the South African Community Party Jeremy Cronin (Southall 2006:177).

Following its limited gains as an unregulated mechanism to facilitate empowerment in the country's economic sectors beyond minimum actions in the areas of ownership and management, the Broad Based Black Economic Empowerment Act was promulgated in 2004. This Act empowered the minister of trade and industry to issue and monitor Codes of Good Practice which were released in December 2004 and December 2005 (Tangri and Southall 2008:706). The codes related to procurement, licensing and concessions, public-private partnerships, and the sale of state-owned assets or businesses, with which compliance was made compulsory for all state-owned companies and private companies who undertake business with any government enterprise or organ of state[12].

Chabane et al (2006) find increasing examples of how "BEE is being debased by a capitalist class that operates within a sphere of capital accumulation fostered by close connections to the state, usually through the direct involvement of senior ANC members in business". Cargill (2011:8) states that "BEE seemed a tantalisingly simple way to reconfigure the wealth distribution equation. Sell a slice of corporate South Africa, adorned with the right kind of icing (enough political clout mixed with mass appeal) and hey presto, a Rainbow Nation with BEE, the New Economic Insurance". Equally scathing,

[12] http://www.southafrica.info/business/trends/empowerment/bee.htm#ixzz1eR3lDQzH

a *Business Day* (2010) editorial stated that “companies bidding for government or parastatal tenders- especially multinational companies and their South African subsidiaries- do not choose to sell more than a quarter of their equity to ‘empowered’ locals at heavily discounted prices merely because they have an especially well developed sense of social justice and want to do their part to reverse the legacy of apartheid. They do it because South African equity laws dictate that this is the only way they can land the biggest, most lucrative contracts”.

These codes do not apply to minerals and petroleum resources which are instead regulated under the 2002 Mineral and Petroleum Resources Development (MPRD) and its associated empowerment charter. The MPRD Act No 28 of 2002 (Eberhard 2011:32) transferred the ownership of mineral resource rights from the landowner to the custodianship of the state, which is now empowered to “grant, issue, refuse, control [or] administer” prospecting or mining rights over underground deposits (RSA 2002). Section 100 of the MPRD Act provides for the development of the Broad-Based Socio-Economic Empowerment Charter, popularly known as the Mining Charter, promulgated in 2004. This includes specific targets such as the requirement for 15 per cent of each mine’s value to be owned by BEE groups and for 40 per cent of management to be black within five years, and for blacks to own 26 per cent of local assets within ten years (Chabane et al 2006:565). The financing of BEE firms has often been supported by loan and equity finance from the IDC. For instance in financial year 2003/4 BEE approvals formed 53 per cent of total IDC funding (Chabane et al 2006:566).

Building on the MPRD Act, in April 2009 the introduction codes of good practise for the minerals industry defined BEE objectives in more detail in relation to ownership; management control; employment equity; human resource development; preferential procurement; community and rural development; beneficiation; and housing. The codes also emphasise “the objective for 26 per cent ownership (in terms of voting rights, economic interest and net value) by historically disadvantaged South Africans by 2014.

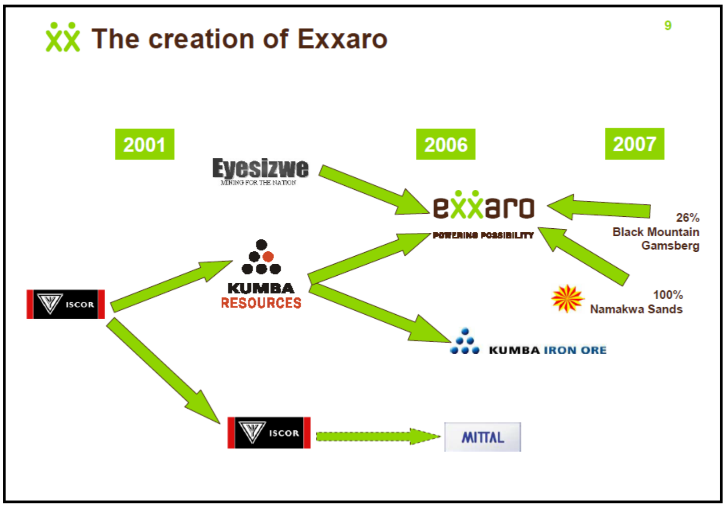
Many have argued that the MPRD Act and the mining charter in particular serve the MEC’s core interests. Freund (2010:21) states that “it is not an accident that the mining sector was the first to proclaim BEE targets and that the big boys of BEE, Motsepe, Sexwale, Macozoma and the like have been linked to the heart of the MEC whilst very highly paid black executives have taken over key parastatals”. Freund (2010:10) also finds that industrial policies are subordinate to the requirements of BEE and “dissolve into favouritism and crony capitalism”. Chabane et al (2006:565) found that “as they basically brought political capital, rather than managerial skills, black managers were very often sidelined in business structures and found themselves confined to non-operational, public relations positions".

Further examples of the implications of BEE for South Africa's power sector are discussed in relation to the Chancellor House contract for the construction of the Medupi coal-fired power plant (chapter 8). Though it is too early to say how BEE requirements will play out in relation to the emerging renewable industry, this is briefly discussed in chapter 6. On that note an August 2010 opinion piece in *Business Report* pointed out that "one also can't dismiss the observation that many South African political leaders, or members of their families, have financial interests in the mining industry, which has much to lose from a focused switch away from fossil fuels towards renewable sources. Those links haven't yet been forged in the renewable energy space" (Business Report 2010).

Box 4.2: From Iscor to Exxaro
A central MEC stakeholder, Exxaro is given particular attention throughout this thesis for its strategic reproduction of power within the coal-based regime and the renewable energy niche. Producing approximately 45.2 million tonnes of coal per annum it is one of South Africa's five largest coal producers (chapter 7). Its portfolio includes mineral sands, base metals, industrial minerals and iron ore and has operations in South Africa, Namibia, Australia and China (Business Excellence 2011). Formed in 2006 (figure 4.5), its creation stems from the former steel parastatal Iscor set up in 1928 and privatised in 1989. In 2001 with support from the IDC (Roberts 2007:20), Iscor's mining division was restructured, leading to the creation of Kumba Resources which was listed on the JSE. Kumba then became a subsidiary of AAC who acquired 66.62 per cent of the company in 2003 (Exxaro 2007). However the IDC opposed AAC's acquisition, arguing that it would lead to a loss of competition and undermine black participation in the mining industry (Chabane et al 2006:570). This lead to a battle "over whether a historically privileged mining house should be permitted to take control over another class of mineral asset" (Competition Tribunal of South Africa 2006:45). Meanwhile Iscor retained its steel interests and was converted into Mittal Steel South Africa in 2006. Roberts (2007:20) states that as part of this arrangement, Mittal Steel South Africa was assured 25 years of iron ore at cost plus a 3 per cent extraction fee and that meanwhile "there was no strategy as to how this would benefit the local economy, including through ensuring competitively priced steel to local industries". In turn the iron-ore mining assets of Kumba Resources were transferred into a new listing called 'Kumba Iron Ore,' while its coal, base metals, mineral sands and industrial

minerals operations relisted as Exxaro in November 2006. The formation of Exxaro took place through a BEE empowerment transaction that involved Kumba, AAC, the IDC and BEE company Eyesizwe Mining (Proprietary) Limited[13], in which the latter AAC holds a 11 per cent interest, BHP Billiton 9 per cent and Price Waterhouse Coopers 4 per cent (Competition Tribunal of South Africa 2006:1). Exxaro in turn also has a 20 per cent holding in the Sishen Iron Ore Company, which is itself a subsidiary of Kumba Iron Ore (see figure 4.6, Exxaro 2007).

Figure 4.5: The Creation of Exxaro

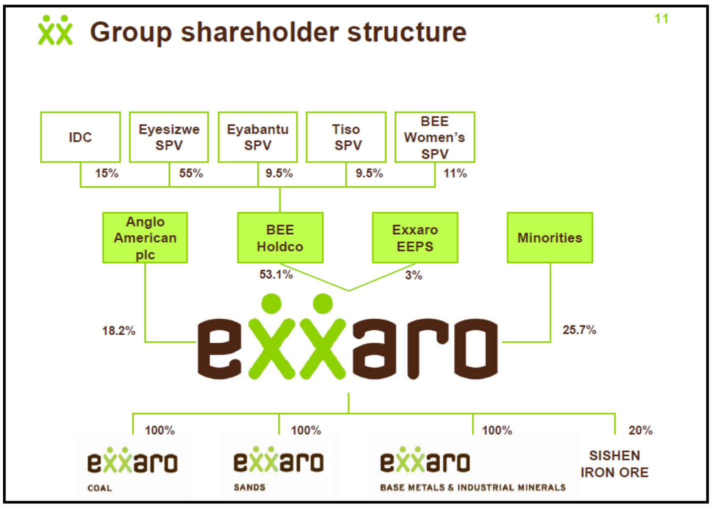


Source: Exxaro (2007)

The formation of Exxaro is highly illustrative of what Fine and Rustomjee (1996:10) referred to as “an extensive pattern of interpenetrating directorships and ownership of shares between [mining houses] and a highly concentrated ownership of other companies within the economy as a whole and abroad”. It is also reflective of post-apartheid corporate developments around the MEC’s core in the form of BEE and more recently privately generated renewable energy. What is also notable here is the continued influence of AAC, which holds an 18.2 per cent stake in the company and an 11 per cent shareholding interest in the BEE company, Eyesizwe mining. This involvement is deemed by the Competition Tribunal of South Africa (2006:5) as “crucial” to Exxaro’s early success.

[13] See: “Empowerment transaction agreements and funding agreements” http://www.exxaro.com/pdf/exxaro_circular/annexure4.htm

Figure 4.6: Exxaro's Group Shareholder Structure



Source: Exxaro (2007)

4.2 Electric history

"One of the most sophisticated energy systems was created before the start of the First World War in a relatively undeveloped part of the British empire. Why, why then and why there?" (Christie 1984:6).

The history of South Africa's electricity sector is one illustration of the role that monopoly governance structures and parastatals have played in the MEC and the country's socio-technical regime. This section discusses the conflicts and cooperation that exist between public and private capital and their struggle for control over the parastatal. The role of large coal suppliers and energy-intensive users in shaping electricity policy-making and the significant role that bilateral financial and technical assistance has played in the development of electricity infrastructure and policy is introduced here and explored in subsequent chapters.

The political complexities of the governance of South Africa's electricity sector are paralleled by the relative simplicity of the fundamentals of the actual system, that of the generation of electricity from low grade coal for the cheap and abundant supply of electricity. As Marquard (2006:66) explains, the lack of complexity of SA's energy system is characterised by an entire lack of process heat, a small proportion of gas, and a lower percentage of liquid fuels. Though Marquard (Ibid 2006:123) states that by comparison to other countries South Africa's electricity is largely economically independent from world energy markets due to low imports of oil and gas, increased international demands for the country's coal in recent years (chapter 7) may change this.

South Africa’s electricity industry was set up by the mining industry in the late nineteenth century, taking off after the creation of the Victoria Falls and Transvaal Power Company (VFTPC) by Cecil Rhodes’s British South Africa Company in 1905. This was spurred on by gold mining developments which required electricity to power new machinery and simultaneously reduced the requirement for human labour. By 1923, “the VFTPC sold more power than was consumed in the cities of London, Birmingham and Sheffield combined” (Christie 1984:6). Marquard (2006:124) describes it as “a private electricity generation monopoly on the Witwatersrand”. The Electricity Supply Commission (ESCOM)[14] was conceived under the Smuts government in 1922 partly in response to geographical difficulties experienced by the coal-fired South African Railways (SAR) network in transporting higher quality but more expensive coal (Marquard 2006:72) from the Natal coal-fields to its mining customers in the Transvaal and to Durban for export (Christie 1984:75). According to Christie (1984:75-76) SAR wanted its coal-fired rail network to be electrified and for the electricity to be supplied by a state-owned institution which would be more reliable and cheaper than a private supplier who may also be weaker in dealing with strikers.

The development of national industry was another motivating factor in ESCOM’s creation that Freund (2010:6) describes as an example of state intervention in the construction of the country’s industrial economy. It was pushed by Hendrik van der Bijl, government scientific and technical advisor and an ambitious industrialist. He became chairman of ESCOM in 1928, chairman of the iron and steel parastatal Iscor in the same year and subsequently chairman of South Africa’s IDC in 1940. As with ESCOM, SAR was anticipated to be Iscor’s main customer for basic items such as rail and structural steel though initial plans for a completely integrated steel plant had to be scaled back due to rising costs (Clark 1994:87).

Also involved in ESCOM’s establishment was Charles Merz, a British engineer and technological consultant to many governments, municipalities and railway systems worldwide. Christie (1984:76) states that “Merz represented British finance capital, in which banks and manufacturers combined to export to the formal and informal empire”. He both created demand for the supply of heavy electrical equipment from UK as well as supporting local South African manufacturers in their push for industrial development (Christie 1984:81). Hence Christie (1984:76) concludes that “ESCOM is as much the creation of Merz wishing to sell British technology as it is the creation of South African industrialists”. This example of the significant role that foreign interests and technical assistance has

[14] Eventually converted to Eskom in 1987 (see section 4.5.2)

played in shaping the country's electricity sector can be related to more recent examples discussed in subsequent chapters.

Merz emphasised that economies of scale would make power cheaper and that large power stations could supply the railway networks as well as other industries, municipalities and farms. Moreover establishing a monopoly of cheap supply before implementing further industrial development based on coal and iron would avoid the creation of a piecemeal supply system. He recommended an act of parliament to regulate this which came into force on 1 September 1922 and set up the Electricity Control Board to control and license the supply of electricity and ESCOM "to stimulate the provision of a cheap and abundant supply of electricity" (1922 Electricity Act, in Christie 1987:84). ESCOM was not permitted to make either a profit or loss and was exempt from corporate income tax (Eberhard 2007:217).

Steyn (2006:10) states that "within the first two years of its existence, ESCOM established itself as a central player in the ownership of new large-scale power stations", while control of the transmission and distribution networks was retained by the VFTPC. Between 1933 and 1948 the consumption of electricity that ESCOM generated grew five-fold with most of its power sold at cost to the VFTPC which then made a vast profit by on-selling to the gold-mines which it failed to pass on to them (Christie 1984:104). The VFTPC's profits were generated from cheap labour, decreasing costs of already cheap electricity from ESCOM as the cost of generation declined and an increase in electricity consumption by the mines per tonne of gold produced due to the mining of lower grade ores at increased depths[15]. These profits, made while gold mine-owners were experiencing declining profit margins, rising costs and increasing capital requirements (Clark 1994:154), were hidden and some held in accounts in London to avoid possible nationalisation (Christie 1984:108) relating to the theme of capital flight (section 4.1.5). For example the VFTPC accumulated a profit of more than £6 million during the Second World War (Clark 1994:155). This infuriated the gold mine owners who consumed about 59 per cent of generated power at the time, with AAC as the biggest consumer and one of the electricity sector's major coal suppliers (Fine and Rustomjee 1996:182). Meanwhile the VFTPC's rejection of any suggestions to expand the grid ran counter to one of the main objectives of ESCOM (Clark 1994:154). According to the VFTPC's original licence, the Power Act of 1910 and the Electricity Act of 1922 the state had the right to buy the VFTPC with two years notice which it issued in 1948

[15] For example, electricity bought by the goldmines increased from 1243 GWh in 1930 to 3191 GWh in 1948 (Christie 1984:106)

(Christie 1984:104). Under the directorship of van der Bijl, ESCOM took over the VFTPC and was assisted with financial and political support from the AAC under the chairmanship of Ernest Oppenheimer (Clark 1994:154).

The takeover of VFTPC by ESCOM is one example of the historical influencing role that the mining industry, in this case gold has had over the establishment of the electricity supply industry and its development. Steyn (2006:11) further explains how this fundamentally influenced Eskom's management culture until the early 80s and that "many high level meetings...were held with stakeholders [of the gold mining industry] in the 1950s and 1960s to discuss their needs". The extent to which and in what way mining conglomerates still influence the country's electricity supply industry is a key theme of this thesis.

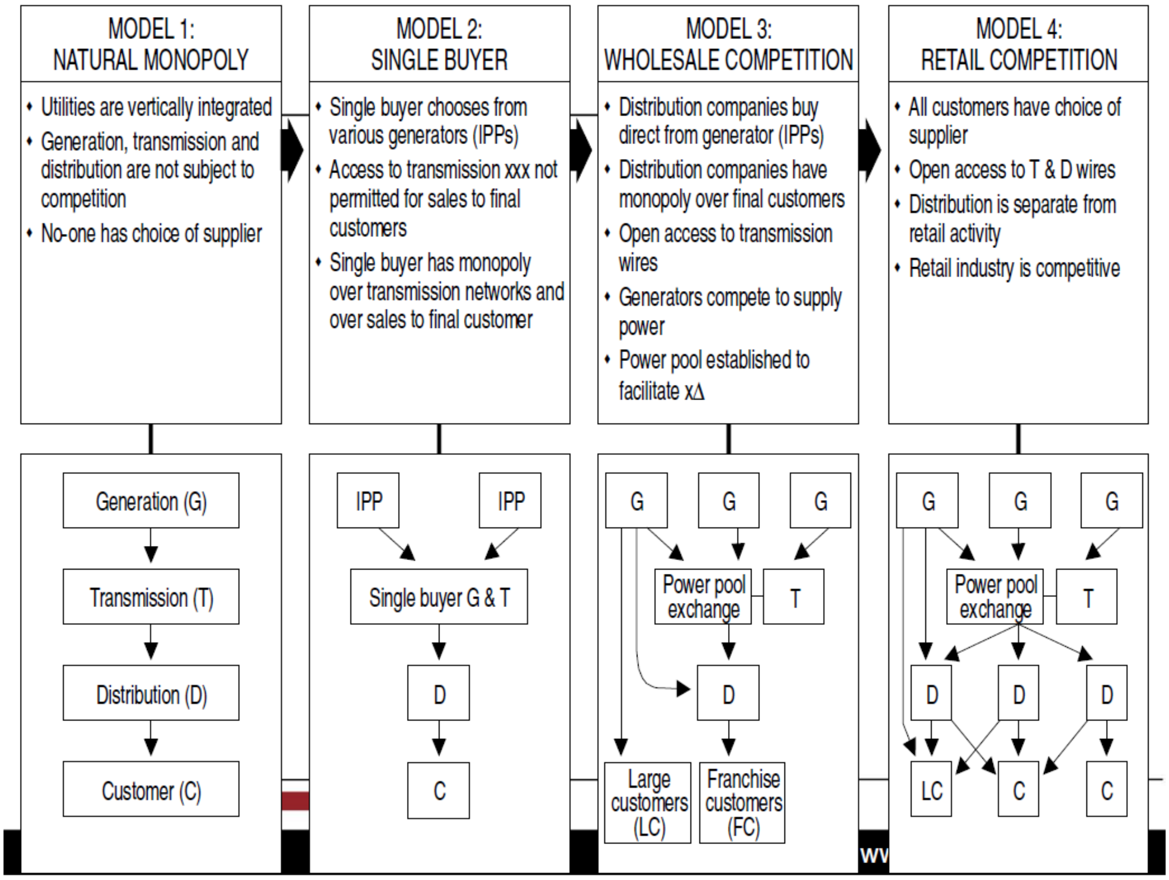
The nationalisation of the electricity industry was followed by the expansion of the national grid and a corresponding power station construction programme in 1950s (Fine and Rustomjee 1996:157). "By 1952 ESCOM owned power stations near all of the major industrial centres in the country, stations that spanned most of the white owned land in the country with the exception of the northern Transvaal and the northwest Cape...By 1969 the national grid was complete, allowing Cape Town for the first time to enjoy the benefits of cheap electricity generated on the Transvaal coalfields" (Clark 1994:157). Christie explains how from the outset ESCOM, now Eskom was "constructed to display an independence of the government and of Parliament" (1984:86), which is still an inherent characteristic of its current governance.

4.3 South Africa's electricity sector in an international context

Eskom evaded the global trend of power sector liberalisation in the 1980s and 1990s as a result of which it has so far kept its monopoly control. In terms of international landscape level trends in the post WWII era, the electricity sector was traditionally the domain of the state with generation, transmission and distribution being controlled, operated and managed by vertically-integrated state-owned utilities (Ljung 2007:32). This was based on the rationale that the state was "the custodian of the public interest" (Gratwick and Eberhard 2008:3948). The move away from this model to a liberalised structure was pushed by the World Bank as part of structural adjustment programmes in 1980s and 1990s and was informed exclusively by experiences in the UK, USA, Chile and Norway (Ibid). It attempted a shift away from a publicly-owned utility to a model based on privatisation and competition (Dubash 2002). This would see the unbundling of the utility into separate transmission, generation and distribution companies. Eberhard (2010) and Pickering (2010) explain that there are four main ways to organise the ESI market structure (illustrated in figure 4.7). These models can also indicate the series of stages that can be undertaken in order to generate increased competition with Model 4 being the final aim. The 'standard model' as it was known was based on the notion that public ownership in developing countries was hampered by poor technical and financial performance and high investment requirements. On this basis the role of government was to shift from an energy service provider to that of policy maker, regulator and facilitator of private investments (Ljung 2007:35).

Gratwick and Eberhard (2008) explain how this "standard model" of power sector reform became accepted universally and the role that ideology, consultants and donors, and the World Bank and other institutions played in its attempted global implementation. This model was part of broader trends in the privatisation of public infrastructure including water which has often had disastrous social and economic consequences (Hall and Van Niekerk 2010, Bayliss and Fine 2007, Tellam 2003). Its applicability has since been challenged (Wamukonya 2003, Williams and Ghanadan 2006, Yi-chong 2006), while Besant-Jones (2006:1) has advocated a "tailor-made solution" in order to cope with the diversity of economic and political/institutional conditions. Gratwick and Eberhard (2008:3958) assert that this model is now in demise, and serves "neither a descriptive nor a prescriptive role". Due to South Africa's political and economic isolation under apartheid, the absence of a heavy debt burden, cheap and abundant supplies of indigenous coal and a well-developed transmission network many IFI-driven conditions of economic liberalisation were not implemented in the country. Despite this, attempts to unbundle South Africa's electricity sector took place at the end of the 1990s as the following section discusses.

Figure 4.7: Emergence of the standard model of power sector reform



Source: Eberhard (2010)

4.4 Eskom: the monopoly parastatal

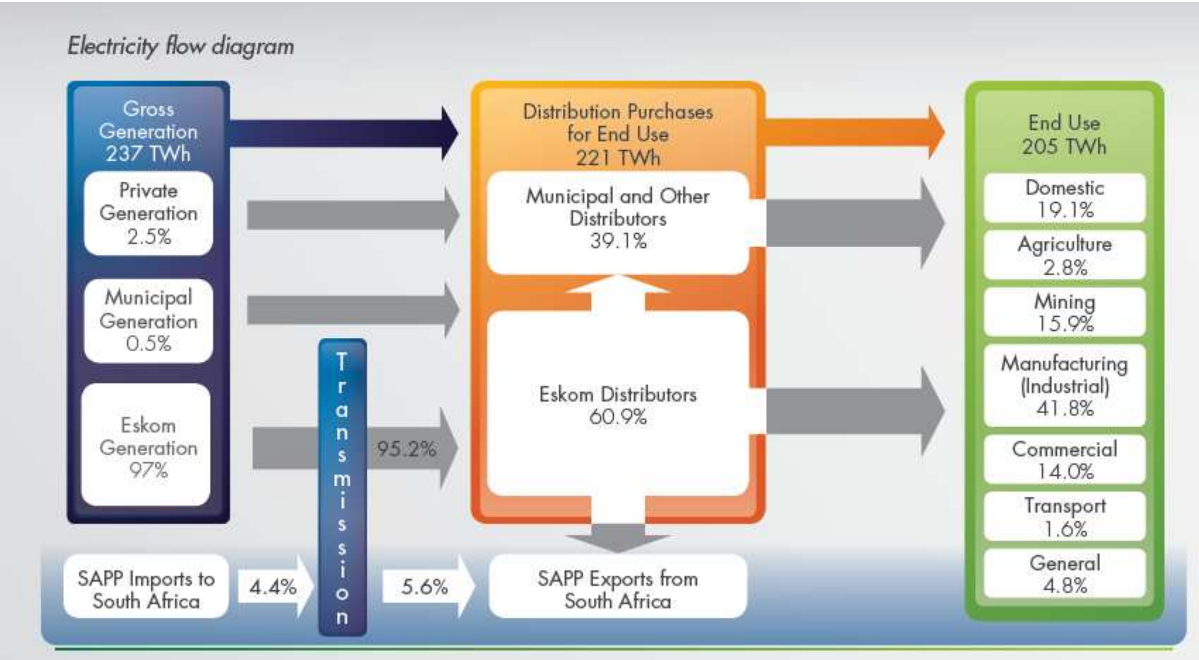
"Electricity is most efficiently supplied, under capitalism, by a monopoly"

(H.J. van der Bijl, [government scientific and technical adviser] 'Electric Power Development in the Union of South Africa', Trans First World Power conference, (1924) vol. IV, p.1368 in Christie 1984:27)

The energy sector is governed by a monopoly. Huge profits are made by lucky winners. People are trying to put this into the renewable market such as wind. The creation of monopolies is a key theme in energy governance in South Africa. Every player in the market is trying to create their own monopoly. Lack of knowledge and lack of transparency allow this to happen." (Energy Specialist, December 2010).

As South Africa's vertically integrated monopoly, Eskom is the sole transmitter of electricity via the country's high-voltage transmission grid, generates 96 per cent of national electricity and is responsible for 60 per cent of distribution which is consumed by one third of South Africa's customers. Municipal distributors purchase their energy and services from Eskom Distribution and supply about two thirds of the country's customers who account for 40 per cent of total sales (figure 4.8, Odubiyi and Davidson 2004). Municipal distributors are dominated by the large metropolitan distributors such as City Power which reap significant profits from their on-selling. Described as "a monster of apartheid" by government representative (1), bilateral donor (2) referred to Eskom as "a country within a country[16]", and added that "as long as it is providing cheap power no one minds, but since 2007/2008 its public image has been affected". According to GroundWork (2007:34) "it has been at the centre of mega-project deals since the 1990s, offering the cheapest electricity in the world to new aluminium and steel plants". Gentle (2009:51) describes the changing character of Eskom as an "index" of the changing character of the political configurations of South African accumulation.

Figure 4.8: Energy flow between role players in SA's electricity supply industry (2006)



Source: NERSA (2006:34)

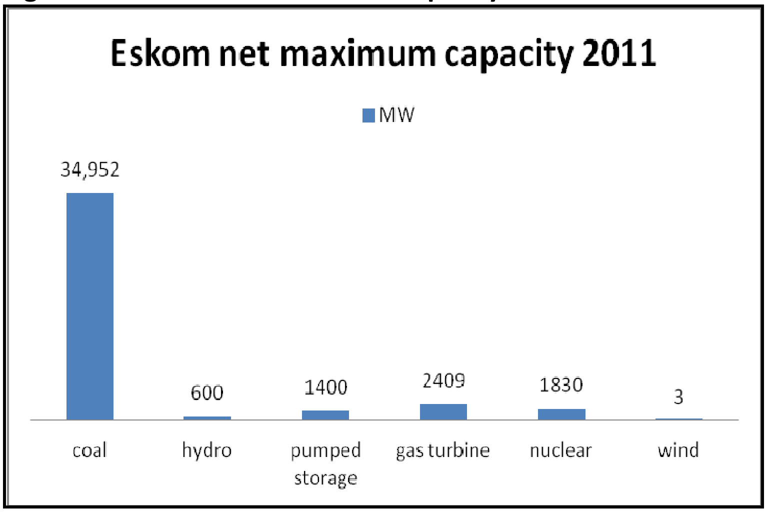
Following Fine and Rustomjee (1996:97), Eskom as a state-owned sector has "fulfilled a particularly important function in lubricating both the growth of MEC core sectors and the ascendance of large-scale private capital". The largest 36 customers consume over 40 per cent of the energy of which BHP Billiton's aluminium smelters such as Hillside in South Africa and Mozal in Mozambique consume 5

[16] On visits to the utility I noted that it had a swimming pool, tennis courts, a hairdresser, shops and a bank within its premises.

per cent of the country's 40 000 MW capacity according to *Engineering News* (Creamer 2011:*5 Aug(b)*). However, while Eskom has long served to benefit the interests of the coal miners who supply it at one end and the energy-intensive users who benefit from it at the other at the other, this thesis considers the extent to which its monopoly control may be shifting. On that point Wind IPP (3) speaking in a personal capacity stated "the way Eskom is moving it is anticipated the monopoly will come to an end. A natural demise is taking place. As long as Eskom continues to increase its tariffs it will lead to the demise of the monopoly."

In 2010 Eskom's carbon emissions stood at 230.3 million tonnes (Eskom 2011:324) which represents 45 per cent of the country's emissions (CDP 2011). In comparison, neighbouring Namibia's emissions stood at just 3.93 million tonnes in 2008. The utility has 26 power plants in South Africa that make up 41.2 GW of the country's 43.9 GW capacity. Of this 34.7 GW comes from its 13 coal-fired power plants in the northeast (Eskom 2011:326), many immediately adjacent to privately owned coal mines. The remaining generation comes from six hydro-electric stations (600 MW), the Koeberg nuclear power station (1 830MW) in the Western Cape, two pumped storage power stations (1 400 MW), four gas fuelled turbine stations (2 409 MW), one wind energy power station (3 MW) (Eskom 2011:326) and imported hydro electricity (figure 4.9). Eskom ranks first in the world as a steam coal user and seventh as an electricity generator (Eskom 2009). It is Africa's largest energy utility and the world's fourth largest (Daniel and Lutchman 2006).

Figure 4.9: Eskom net maximum capacity



Source: adapted from Eskom (2011:13)

4.5 From surplus to crisis, and "from state to market and back again"[17]

[17] Eberhard (2005)

4.5.1 Surplus

In the course of just two decades South Africa has gone from a period of electricity surplus in the mid-1980s 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, an emerging supply crisis and imminent deficit, resulting in load-shedding in 2008 (Eberhard 2011). Here it must be noted that 'surplus capacity' is a technical term and does not reflect the fact that until 1993, only one third of the population was connected to the grid. No new capacity has been built in South Africa since Eskom's ambitious expansion programme in 1970s and 1980s which included the construction of new coal-fired power plants and the Koeberg nuclear plant near Cape Town. By end 1983 ESCOM had ordered an additional 22 260 MW of generation capacity, double that which was already being operated (Eberhard 2007:219) in a similar tale to its current capacity expansion programme. This resulted in tariff hikes in the late 1970s and early 1980s (which were reduced again in the 1990s) soaring debt, the mothballing of a number of coal-fired power plants and the decommissioning of older plants (Steyn 2006:36-37). Eskom completed its last coal-fired power station Majuba in 1991 for which mining industry expert (2) claims that construction was delayed due to over-capacity at the time. In 1992, maximum generating capacity exceeded peak demand by 40 per cent (Eberhard 2007:221).

Ziramba (2009) states that heavy investment during the 1980s was part of the country's efforts to maintain its self-sufficiency under the economic embargo and continue to meet the needs of the industrial sector and the white minority. Steyn (2006:32) described this programme as highly flawed, based on "managerial incentives to construct excessive and inappropriate power plant projects" and exaggerated demand growth which placed the economic and financial risks of new projects onto the consumer base. Questions have been raised as to what extent Eskom's current capital expenditure programme and the Integrated Resource Plan 2010 (chapter 5) may end up replicating this pattern.

Excess capacity in the 1980s spurred growth in the domestic coal market which was paralleled by Sasol's investment in coal-to-liquid plants (Eberhard 2011). Export-oriented minerals beneficiation projects also profited from low cost electricity contracts promoted by Eskom (Eberhard 2007) and between 1980 and 1997 the growth of electricity sales exceeded that of growth of GDP (Eskom Systems Operation and Planning 2010:9). Meanwhile in 1992, the IDC justified a R12 billion spend on an aluminium smelter and stainless steel plant by citing the 40 per cent excess in generating capacity (Fine and Rustomjee 1996:110). A more recent example of government support for capital and energy-intensive projects includes the aluminium smelter in the Coega Industrial Development Zone, approved in 2007 (Roberts 2007:20). According to DTI (1), "historically cheap electricity has provided an implicit subsidy for the growth of the MEC. It is important to create a link between that and the way in which energy-intensive users price their output. There is a monopolistic pricing of steel for example".

4.5.2 From ESCOM to Eskom

The tariff increases discussed above in 1970s and 1980s to fund ESCOM's expansion programme lead to a public outcry and eventually resulted in the De Villiers Commission of Enquiry in 1984 (Bekker et al 2008:3127). This criticised Eskom's management and governance structure, forecasting methods and accounting. Its recommendations led to the Electricity Amendment Act in April 1985 which converted the Electricity Supply Commission (ESCOM) to Escom to be governed by a new 19-member Electricity Council, of which members would be appointed by the Minister of Mineral and Energy Affairs (Steyn 2006:77). The Electricity Council would appoint the management board. While the outcomes of the De Villiers Commission improved the utility's financial and commercial performance, Steyn (2006:34) finds that, "the opportunity to introduce improved regulatory or parliamentary oversight was also not seized. The net effect was that Eskom's performance was still not subject to any significant external review". In effect, the utility still retained its power and was now exempt from having its prices regulated by the Electricity Control Board. It was also released from the previous constraint of not being allowed to make a profit or a loss and kept government intervention at bay (Bekker et al 2008:3127). Instead, a pricing compact was set up which resulted in a more "arms-length relationship" between the government and the utility (Eberhard 2007:220). Two years later in 1987 Escom became Eskom under the Eskom Act (Steyn 2006) at which time its governance was restructured to a new two-tier system, modelled broadly on the German corporate governance system (Eberhard 2007:220) which promoted standard business accounting conventions (Steyn 2006). It then became an entity on the JSE. Gentle (2009:51) describes this as "change from a form of Keynesian racial capitalism… to a neo-liberal state attempting to open up new arenas for commodification"

4.5.3 National electrification programme

Excess capacity in the early post-apartheid era assisted South Africa's remarkable and rapid national electrification programme under the ANC's 1994 Reconstruction and Development Programme (RDP), which saw domestic connection rates rise from approximately 30 to 70 per cent of the country's population (Bekker et al 2008). The legacy of apartheid was such that nearly all white South African households were connected to the grid including remote farms, while few black households had access (Eberhard 2005:5310). By 1999 at the end of the first phase of the National Electrification Programme this had been increased to 66 per cent, exceeding initial targets (Winkler 2009:34) and between 1994 and 2002, 3.8 million new households were connected (Eberhard 2005:5309), of which two thirds by Eskom and the remainder by local authorities. However progress slowed in the early 2000s partly because the programme had begun to focus on sparsely populated rural areas thereby requiring additional infrastructure. In addition the costs of basic commodities such as steel, copper and aluminium had increased (Bekker et al 2008:3132). Currently 30 per cent of the country's population still do not have access to electricity, particularly in rural areas, and disconnection rates have risen in recent years (IDASA 2010). Despite the free basic electricity tariff of 50 KWh per month, millions of low-income houses do not have enough regular income to buy enough electricity, even if they may be grid-connected (McDonald 2009:16). Consequently other sources such as paraffin and coal are prioritised over electricity which leads to related problems such as poisoning and shack fires (CURES 2009). Land ownership is also an issue as Eskom will not supply consumers who do not have legal tenure (Wamukonya 2003:1281).

4.5.4 From state to market and back again

"Power networks are so large and take so long to build that once a vested interest is established 'entry into the market' is exceedingly difficult. Nevertheless entries are made, and competition does occur at the boundaries of networks. The sheer size, however, of investments in electricity systems, means that high risks are run where systems compete" (Christie 1984:27).

"Our view is that the development of post-apartheid energy policy has not been particularly coherent. In the immediate post-apartheid period there was a long period of uncertainty and policy paralysis about whether to adopt a privatised energy supply or retain a public sector model" (DTI 1)

Roberts (2007:6) describes industrial policy in South Africa as "an interesting case study of both government intervention in the form of the lingering effects of the apartheid state's industrial policies, and the outcomes of liberalisation and limited incentive programmes". The case of Eskom is no exception. In 1994 the Department for Public Enterprises (DPE) of the new democratic government announced plans to improve Eskom's governance and restructure it, along with the country's four largest state-owned enterprises (Dubash 2002:1420, Eberhard 2005). Subsequently the 1998 Energy White Paper allowed for 30 per cent of electricity generation to come from private developers, including renewable energy (DME 1998) and anticipated the restructuring of the electricity distribution industry to consist of six independent regional electricity distributors (REDs), an independent transmission company and system operator (Bekker et al 2008:3129, Gaunt 2008). The White Paper also envisaged that Eskom would be corporatised and outsource various functions. A separate transmission utility (Transco) would then be created and owned by the state, with a view to possible sale in the future.

Electricity sector reform in South Africa was to be a two fold process, that of the electricity distribution industry (EDI), which began in 1992 and the electricity supply industry (ESI), starting in 1993 following the 1992 ANC workshop in electricity and the formation of the National Electrification Forum (Dubash 2002, Gaunt 2008:3450). The EDI consists of Eskom which is responsible for 60 per cent of distribution, 187 municipal distributors (since 2005, see Gaunt 2008:3452) which are approximately 40 per cent of distribution and a few private interests. The ESI includes Eskom terms of its exclusive control over electricity transmission and 97 per cent of generation, and a small number of private and municipal interests involved in generation (Dubash 2002, see figure 4.8). Dubash (2002:xiii) states that South Africa had a more open reform design process than other countries and greater engagement by a range of ministries and more participation by outside experts.

Following the 1998 White Paper, The Eskom Conversion Act of 2001 which in bill form was put forward by the DPE and met with strong opposition from the unions in particular COSATU, replaced the Eskom Act of 1987. This 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, distribution and generation entities and the creation of different generating companies to create internal competition. The stakeholder-based electricity council was replaced by a board of directors and the government represented by the Minister of Public Enterprises is Eskom's sole shareholder. It was formally converted to Eskom Holdings Ltd in 2002 (Bekker et al 2008:3129, Gaunt 2008).

In 2001 cabinet ruled that Eskom no longer be allowed to build new generation. Eberhard (2007:231) describes this move as South Africa's "self-imposed" structural adjustment programme which was part of improved efficiencies in government-owned entities. This was outlined in the 2000 DPE publication "A Policy Framework: An Accelerated Agenda towards the Restructuring of State-Owned Enterprises" which he says carefully avoided the use of the word "privatisation" due to union objections. As discussed in chapter 6 unions continue to express caution of the entry of private generators into the sector. For example, Union (1) stated "Energy is a strategic sector for South Africa.

Its control should always be at the hands of government. If IPPs participate they should be controlled and we need policy measures for that. Eskom have become lax and they are not bothered about giving a good service. IPPs could help, but there should be measures such as job creation and pollution control".

The DPE's publication paralleled the country's 1996-2000 Growth Employment and Redistribution Strategy (GEAR)[18] programme characterised by economic efficiency, fiscal prudence and trade liberalisation and of which a major component was the privatisation of state-owned enterprises. Eberhard (2005: 5214) states that reform was driven by "the convictions of a small group of analysts and government officials that were observing international trends in power sector reform and were beginning to be concerned with the potential problems of monopoly power". That its main supporters were "industrial electricity users who wished to contain future rises in electricity prices" (Eberhard 2005:5214) is paradoxical given the monopoly control that a number of them have in the coal mining industry as further discussed in chapter 7. Assistance for a strategic plan to unbundle the sector was provided by PriceWaterhouseCoopers[19] in the late 1990s (Odubiyi & Davidson 2004, Steyn 2006). It is of note that PriceWaterhouseCoopers is also involved in the selection of bidders for the renewable energy procurement process (chapter 6). In 2000 the World Bank sponsored a seminar on the restructuring of the ESI at which a number of foreign experts spoke in favour of privatisation with careful design (Eberhard 2005:5315).

According to energy-intensive user (1), the White Paper "was informed and motivated by the global privatisation drive of the time and the strong belief that 'privatisation was better than government' following examples such as British Rail in UK. Its aim was to break Eskom into separate entities for generation, transmission and distribution". Hence key industry and energy stakeholders undertook missions to Latin America, UK, Sweden and California to look at lessons of privatisation. "There was fierce resistance to this within Eskom" (energy-intensive user 1).

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[18] This set macroeconomic policy from 1997 onwards. Its key aims included: reduce the budget deficit, accelerate tariff reduction and reach inflation targets (Winkler 2009:32), while its social development objectives referred back to the ANC's 1994 Reconstruction and Development Programme. A major component of the GEAR's macroeconomic strategy was the privatisation of state-owned enterprises, including Eskom. Lesufi 2002 (in Büscher 2009:5) says that "all the evidence shows that, on the one hand, those targets promoting the interests of capital have either been met or exceeded; while those targets concerned with the interests of the poor have not been met at all". GroundWork (2006:119) states that the GEAR's strategy, which emphasises economic growth as the driver of development is in tension with the focus of reconstruction and development of the RDP.

[19] "PwC states that it is "the world's leading advisor to the energy and utility industry, working with every segment of the business, such as the new renewable sector criss-crossing between the more traditional energy and utilities sectors" http://www.pwc.com/za/en/industries/renewable-energy (accessed Jun 2011)

However between 1998 and 2003 no new generation was built. Various reasons are offered for this, including: resistance from Eskom; tensions within the DME; the loss of project and management expertise as white staff members left the country after apartheid; and surplus capacity from 1980s which reduced incentives for any new construction. Eberhard (2011) refers to union resistance, inadequate political buy-in and tacit resistance from Eskom while Energy-intensive user (1) stated "Eskom had already paid off previous generation capacity and was still making returns so had no incentive to increase prices". Wind IPP (5) stated that "within the DME there were factions pro and anti-Eskom". Energy-intensive user (1) added that, "the then DME did not put in an appropriate policy, the regulator was not sufficiently empowered to make things happen, the ministry didn't fully understand and the DPE failed to step up. There were also drivers within Eskom not to cooperate with the introduction of private generators". Hence "by end 1998 Eskom had completed a major expansion programme and amassed a very substantial organisation. But after that they downsized. Many skills left the country [in the post-apartheid era] and there were no project management skills left".

On this point, mining industry expert (2) asserts that in 1994 a new wave of fresh faces moved into Eskom "whose main role was to collect money from consumers", and that "people who currently work for Eskom may have 16 years of experience, but they have never built, or overseen the construction of a power station. The CEO level of Eskom has a limited choice of jobs to move on to. This has lead to a gradual deterioration of Eskom's assets, roles and infrastructure. Eskom is an uninformed user and buyer because the current staff have never built a power station. So they are easily duped by companies involved in the power sector". S/he added: "Eskom's problems are organic. It completed its last power station in 1996 (Majuba) for which construction of this was delayed due to overcapacity. In 1994 there was the election and no new power was required so most expertise was paid off, retired or left the country as part of the post-apartheid reforms." The lack of expertise within Eskom seems to apply to power station construction rather than electricity planning given that Eskom's Systems Operator is project-manager of the national integrated resource plan for electricity in response to the DoE's own lack of expertise. This is discussed in chapter 5.

Eskom's System Operator (1) explained that despite the approval for the entry of private electricity generators, it was not clear to whom they would sell their electricity and with the electricity price already well below cost at R0.25 kWh no independent power producer could compete with Eskom prices. By 2003-2004 government had begun to rethink its strategy. Faced with falling reserve margins[20] and an imminent energy crisis, a cabinet memorandum in 2007 put together by the DPE (NERSA 1) approved that Eskom should be re-allowed to construct more power plants but that 30 per cent of new generation should be built by private players. In 2007 Eskom announced plans to raise its capital expenditure in the electricity sector to R150 billion between 2007 and 2012, of which the bulk on new generation (McDonald 2009:11).

The privatisation drive in all sectors slowed right down in the 2000s due to "the demise of the Washington consensus globally in the late 1990s" and trade union resistance at the local level (Marais 2011:348). Eberhard (2005) has described this sequence of events as a move "from state to market and back again", which relates to broader national debates over the role of the state in industrial policy and the Developmental State (Edigheji 2010), 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. As Gumede (2007:305) explains, "the ANC has always been seen as a broad church, with communists, Christians, conservatives, social democrats, Christian democrats, Christian socialists, liberals, Africanists and traditionalists all claiming it as a political home".

Such a scenario is nothing new in South Africa's electric history. For example Fine and Rustomjee (1996:157) document that shortly before the state took over the electricity industry in 1948, private power generators refrained from investing in new capacity due to uncertainties over their future in state hands. Similar to today's scenario, this led to periodic power shortages in the early 1950s coupled with growing demands for electricity from the Orange Free State goldfields, the post-war industrialisation drive and a coal supply crisis due to a shortage of railway infrastructure (Christie 1984:152). Also of note is that the swing from state to market and back again is not necessarily the case of two dichotomous positions. As DTI (1) asserts, "there wasn't a coherent ideological battle with one set of people clearly advancing one point of view. There wasn't a sharp pro/anti-privatisation debate". Wind IPP (5)'s claim adds to this: "policy chaos in South Africa's electricity sector set in when the post-apartheid government told Eskom that they could no longer decide policy. But the government now had to cater for 48 million, not four million and did not have the expertise. Policy confusion ensured and there was a war between policy makers and implementers".

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[20] The 'reserve margin' is the excess of installed capacity over peak demand. The appropriate reserve margin is considered to be about 15 per cent by Eskom. In 2008 it was at 6 per cent (IBRD 2010:11)

4.5.5 Electricity distribution industry: failed restructuring

After almost two decades of failed attempts to restructure the EDI the process was finally shelved in 2010, after which the former boss of EDI Holdings became CEO of the National Energy Regulator (Yelland 2011b). The process was to have integrated Eskom's electricity distribution business with approximately 180 electricity municipal distributors to create six regional electricity distributors (REDs) (Yelland 2010b). According to Gaunt (2008:3450) this was an attempt to depoliticise the electricity industry and tackle the racially segregated structure of local government electricity departments, responsible for approximately 40 per cent of distribution. This was in view of financial strain, lack of technical capacity, fragmented governance structures, poor infrastructure maintenance, and lack of income-generating industrial customers experienced by many small black municipal distributors. In some cases these were in danger of collapsing, and unable to finance new connections or subsidise poor customers (Eberhard 2007:5310, Yelland 2011). The backlog of infrastructure maintenance and refurbishment requirements of over R32 billion for the country's electricity distribution sector is an unsolved problem for the country and was described as "a ticking time bomb" by the then CEO of NERSA in 2008 (van de Merwe 2008b).

While the amalgamation of racially segregated local governance structures since 1994 reduced the number of electricity distributors significantly, problems still remained. Resistance to the process lay partly in the fact that the on-selling of bulk electricity by municipalities to end users has historically been a major source of local government revenue (Eberhard 2007:5311, Cartwright 2010:22), particularly for the larger metropolitan municipalities such as Johannesburg's City Power, Cape Town, Durban and Ekurhuleni who have used the profits to subsidise other loss making service activities (Yelland 2010b). This has also resulted in an inconsistency of tariffs between different municipality distributors and Eskom.

Key objectives of the EDI restructuring process included: universal access to electricity, independent financial viability of the regional distributors and competition in electricity sales (Gaunt 2008:3450). In 2003 EDI Holdings was established to oversee the restructuring under which the six REDs were to have been established as public entities. According to a parliamentary announcement in 2004 by President Mbeki the process of restructuring was to have been completed in 2007. In July 2005 'RED 1' took over the electricity distribution formerly controlled by Cape Town's municipal authorities. However due to agreements apparently relating to municipal and state level legislation the distribution licence was revoked two years later and awarded instead to the city council by NERSA (Gaunt 2008:3452). By way of a political explanation, Cartwright 2010 concludes that "in general municipalities have resisted the formation of REDs so as to protect the revenue that they currently generate from on-selling bulk electricity". In relation to this energy analyst (4) stated that "one of the aims of the REDs was to take power away from metropolitan municipal distributors to poorer electricity distributors. Twenty years ago all white city councils were subsidized by electricity sales. This is still the case. Any attempts to restructure the industry have been hit by old interests".

4.5.6 Crisis

Eskom has long been historically popular with international industrial investors due to low power tariffs (Sebitosi and da Graça 2009:2030). Until the tariff increases approved by NERSA in 2010, Eskom had the cheapest electricity prices in the world at average R0.25 cents per kWh (Edkins et al 2010:14) but in July 2011 Canada surpassed South Africa as the cheapest provider of electricity (Njobeni 2012:*28 June*). In 2003 industrial customers paid an average of 2.2 US cents/ kWh while residential customers paid 5.6 cents kWh (Eberhard 2005:5309). In 2009 a R2 c/ kWh levy was introduced on electricity generated from non-renewable sources (Edkins et al 2010:14). Further to an approved year on year increase of approximately 25 per cent over three years between 2010 and 2013, it is expected that the utility will request additional increases by 25 per cent in both 2013/14 and 2014/15. By 2020 they could be as high as an average of 110c/kWh (Creamer Media 2011:12). South Africa's electricity prices are now internationally uncompetitive when compared with India and China. Does this electricity crisis coming only a decade after an apparent power surplus represent an "erosion of the MEC's interests and/or failure to meet them" (Fine 2009:35) or is it merely a reflection of electricity as "subject to the cyclical forces of capitalist crises" (McDonald 2009:7)?

In 2005 Eberhard (2005: 5310) referred to Eskom as a seemingly well-functioning, financially viable utility with sufficient generation capacity and able to raise local and international capital. This has since changed. The era of cheap electricity from cheap coal, of particular benefit to the country's large energy-intensive users is no longer sustainable. South Africa now faces a generation crisis which resulted in blackouts in the Western Cape in 2005 and 2006 and load-shedding in March 2008 which resulted in mine closures (Winkler 2009). More recently in February 2012, various ferrochrome producers including International Ferro Metals (IFM), Xstrata and Samancor came to an agreement with Eskom to shut down some of their operations in order to accommodate the imbalance in the country's reserve margin, for which they would be compensated financially (ESI-Africa 2012a). Since 2005 the utility has been struggling to build an additional 17 000 MW of generation capacity by 2018 whilst facing a funding crisis (Eskom 2011:61). In 2010 Eskom received a $3 billion loan from the World Bank as a "lender of last resort" (World Bank 2010:1).

4.6 From crisis to tariff hikes

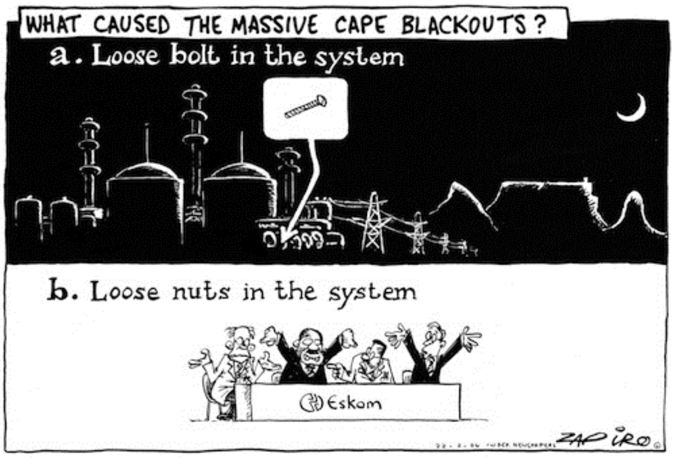
4.6.1 Energy crisis or poor management?

How did Eskom fail to see much less solve- the existing supply crisis? (Olsen 2007)

The electricity supply side crisis, the culmination of events over many years (Chettiar et al 2009) can be referred to as a “trigger event” in policy terms (Keeley and Scoones 2003). Subsequently the importance of security of supply for economic growth has been used as a legitimising discourse for Eskom’s capacity expansion programme, the IRP 2010, the electricity tariff hikes and the World Bank loan for the Medupi coal-fired power plant. Fear of further power cuts and load-shedding has been cited to justify the urgent need to construct new power (Peters and Hogan 2010). The crisis also presented windows of opportunity for the renewable energy niche that has in turn used it to argue for large-scale renewable energy and a feed-in tariff to incentivise this. In this sense Energy Analyst (1) surmised that the electricity crisis challenged the legitimacy of South Africa’s energy policy community and Eskom and required that the DoE start to play a strategic role in energy policy making whereas before it had merely “played with” electricity. This follows Jessop’s (1990:40) claim that “crises act as the steering mechanism of state intervention”, which to a certain extent resulted in a reorganisation of forces in the electricity generation sector in response to this supply side crisis, as chapter 5 will explore.

In 2008 the country’s reserve margin fell to 6 per cent (IBRD 2010:11) after which load-shedding was instituted to avoid system collapse, leading to a government declaration of a national power emergency on 25 January (Chettiar et al 2009). This saw mines and heavy industrial customers particularly affected and subject to electricity consumption quotas for the rest of the year (Eberhard 2011:17). This was not the first time that South Africa experienced an electricity supply crisis and responded with the construction of power stations funded by the World Bank. In 1950s following the rationing of coal supplies which de-prioritised black consumers in favour of railways and mining, there was still insufficient power to meet the demand of the goldmines (Fine and Rustomjee 1996:158). This led to the construction of three large power stations next to the coal fields thereby minimising the need for coal transportation, two of which were funded with loans from the World Bank.

Figure 4.10: Eskom blackouts cartoon



Source: Zapiro (2006)[21]

While the crisis was used by government departments, industrial users, Eskom and the emerging renewable energy industry, a closer look reveals complex reasons for why it took place. These include a legacy of mismanagement and disorganisation by the utility as inferred in figure 4.10, particularly with regards to Eskom's failure to enforce contracts with its coal suppliers (NGO 1, Olsen 2007) further explored in chapter 7. Indeed in its 2010 annual report, Eskom's Generation Business conceded that the 2008 blackouts were due "partly to technical problems and unexpectedly high unplanned shutdowns for repairs and maintenance at some of the power stations, exacerbated by the continuous growth in the demand for electricity". It also conceded that "low coal stock levels at some power stations in early 2008 resulted in these stocks being vulnerable to excessive rain, the coal being too wet to feed into the power stations and contributing to the shortages of electricity supply" (Eskom 2010:96).

Eskom's capex and financial crisis

Eskom is currently undertaking a capital expenditure programme (capex) initiated in 2005 which will increase its generation capacity by 17 120 MW and its transmission lines by 4700 km (Eskom 2011:3). Costs of this expansion which is now behind schedule have increased continuously and are now expected to reach up to R500 billion by 2017, excluding borrowing costs (Eskom 2011:88, Creamer Media 2011:10). Based "almost entirely on an expansion of its fossil fuel base" (Earthlife Africa 2008), the programme includes the construction of the Medupi and Kusile coal-fired power plants both 4800 MW each, the return to service of three mothballed coal fired power stations and energy

[21] http://www.zapiro.com/Cartoons/m_060222indep.jpg

efficiency investments. The renewable component consists only of the 100 MW Sere wind farm now funded by the World Bank (section 6.10) and the 1352 MW Ingula pumped storage programme.

Eskom's capex is being funded by debt raised by Eskom; Eskom's internally generated cash flows; contributions from National Treasury; electricity tariff increases; and loans from the World Bank and African Development Bank (chapter 8). Thus far it has received a R60 billion subordinated loan and R176 billion guarantee facility from the South African government in 2009, of which the latter was extended by another R174-billion to a total of R350-billion in late 2010 (Donnelly 2011). Prior to the pursuit of these funds, Eskom's income was determined almost entirely by its electricity sales tariffs as regulated by the National Electricity Regulator (NERSA). The financial sustainability of this programme was questioned by a number of interviewees. Energy-intensive user (1) stated it was not a cheap option. "When Eskom approached suppliers of components for coal-fired power plants such as General Electric and Alstom, their books were already full with orders from countries such as China and India. So it was a seller's market. This has contributed to increasing costs of these coal-fired power plants." In November 2010 mining industry expert (2) said "Pravin Gordhan [the Minister of Finance] doesn't realise that the R174 billion he has just approved will not be enough. R174 billion is the overnight cost, but added to that will be delays and other expenses. They should be looking at completion costs rather than overnight costs".

4.6.2 The MTPPP: facilitating 'own generation'

Eskom's capacity expansion programme has been accompanied by the Medium Term Power Purchase Programme (MTPPP), a competitive bidding process designed to facilitate the entry of 3000 MW of electricity supply from coal-fired independent power producers and co-generators[22]. The MTPPP would see energy-intensive users such as Xtrata, Anglo-American, Sasol, Ipsa, Sappi, Arcelor Mittal and Exxaro building their own generation using discarded coal (Seccombe 2010). Quoted in *Business Day*, Mick Davis, the CEO of Xtrata said "A solution to the power constraints … for energy-intensive companies is 'own generation' to meet their requirements while taking the pressure off Eskom" (Seccombe 2010). What this means in practice is that they would sell it to Eskom's grid and buy it back again, paying Eskom a 'wheeling' tariff for the power's transport. As such independent projects are privately funded, smaller than Eskom's large baseload coal-fired power plants and can be built relatively quickly. The MTPPP aims to assist Eskom with its short to medium capacity constraints. However, it was delayed in 2009, due to "regulatory and funding challenges" (Eskom

[22] Cogeneration is the simultaneous production of power and heat from the waste products of industrial processes.

2010d:89). As in the case of the introduction of renewable energy IPPs disagreements over who the buyer of power will be caused delays to their implementation (section 5.3.8).

4.6.3 The end of cheap tariffs

Until NERSA's approval in February 2010 of an increase in electricity tariffs of approximately 25 per cent per year for three years under the second Multi-Year Price Determination (MYPD2), South Africa was one of the cheapest electricity producing countries in the world. The main rationale for this increase was to finance Eskom's capex, particularly the Medupi and Kusile power stations (Pienaar and Nakhooda 2010:2). R12 billion was also set aside to buy power from IPPs, of which R8.8 billion to procure the first 1025 MW of the renewable energy feed-in tariff up to 31 March 2013 (Creamer 2011:*8 March*, DoE 1). These increases met with considerable public resistance and shock, as illustrated in figure 4.11. Nakhooda (2011:11) stated that "many stakeholders, particularly from civil society and the media, stressed that approving such a large tariff without a robust, publicly consulted long-term IRP was a betrayal of the constitutional principle of public participation included in the National Energy Act (Idasa 2009, WWF, 2009, Mail and Guardian 2009)"[23]. By way of explanation for such a dramatic rise, NERSA (2) stated that the country's tariffs had not been reflective of the replacement capital costs of coal-fired power plants since 1980s. Instead only the costs of operation and maintenance had been included in the tariff calculation, keeping them artificially low. S/he concluded, "a lack of boldness dragged us into the security challenges we are now facing".

Figure 4.11: Electricity bill shock cartoon

Source: Zapiro (2003)[24]

[23] see Edkins et al(2010:3) for detail

[24] http://www.zapiro.com/Cartoons/m_030313so.jpg

4.6.4 Special tariff deals

'Special purchasing agreements' between Eskom and energy-intensive users, some of which were agreed during a time of surplus capacity under apartheid (Creamer 2010:*12 March*) were the subject of heated public debate during the latter half of 2009 and early 2010. While these contracts have not been made public, Earthlife Africa (2010c) states that they were loss making and include BHP Billiton's Mozal smelter in Mozambique and Anglo American's Skorpion Zinc mine in Namibia. Moreover "four users consumed about as much electricity as four million households and have paid a fraction of the residential tariff" (Ibid). The minister for Public Enterprises Barbara Hogan (2010b) stated that "Eskom currently has less than five special contracts with two customers, and they are in discussions about these". Eskom admitted that two companies would be excluded from the recent tariff increases approved by NERSA (Creamer 2010:*12 March*). Meanwhile said Hogan (2010b) "all other customers (including the large industrial customers) supplied by Eskom are on standard retail tariffs and subject to the tariff increases as approved by the National Energy Regulator of South Africa (NERSA)". The confidentiality of these agreements were justified in the interests of international competitiveness "the companies concerned had international contracts elsewhere in the world"(Hogan 2010b).

4.7 Chapter summary

The historical perspective adopted here has uncovered how South Africa's electricity utility Eskom as a core MEC stakeholder has developed in order to supply the mining and related manufacturing industry with cheap electricity. We have also seen how due to the country's economic isolation and independence under apartheid, the utility managed to resist the largely unsuccessful trend of power sector liberalisation, which was imposed upon most other sub-Saharan African countries under structural adjustment programmes. Such a factor has added to the unique nature of Eskom as a monopoly-run parastatal that has largely escaped public accountability but whose current structure may now be under threat from amongst other things, a financial crisis and loss of expertise in the construction of coal-fired generation. An exploration of electricity policy since the end of apartheid has also reflected the diversity of thinking within the ruling party, which has swung from a developmental state approach to one of market liberalisation.

The chapter has further uncovered how South Africa's electricity sector has been subject to a series of crises, of which this may be the latest. However as crises are endemic to the capitalist accumulation process one could argue that these are merely mirrored in the electricity generation system that fuels this process. Drawing on the sustainability transitions literature Meadowcroft (2011) in acknowledging the inevitability of such crises, asserts that the role for sustainability transitions is "to exploit the ups and downs of the economic cycle". To an extent this is what the renewable energy 'niche' has done, responding to the supply-side crisis by arguing for financial incentives for renewable energy generation as a solution to it. But at the same time, so have entrenched coal-based regime interests, in the form of large coal-fired power plants in Eskom's capex and privately generated small-scale coal fired power plants by energy-intensive users under the MTPPPP. This is now explored further in relation to two key policy processes in chapter 5 which also discusses the shifting role of Eskom in relation to recent policy developments in the electricity supply sector.

5 Chapter 5: Power struggles over policy

5.1 Introduction

"*Currently, climate policy, energy mix decisions and industrial policy exist as different terrains of policy engagement without a proper vehicle or platform to connect the dots between them*." Fakir (2010b)

Despite intense interest following the announcement of South Africa's renewable energy feed-in tariff (REFIT) in 2006/7 from renewable energy independent power producers (IPPs) waiting to construct and connect their projects to the country's electric grid, numerous policy uncertainties and delays ensued. Greater certainty was eventually provided by the launch of the renewable energy independent power producers procurement programme (RE IPPPP), formerly REFIT in August 2011 and the finalisation of the country's long-awaited Integrated Resource Plan (IRP 2010) in May 2011, which is to shape the country's electricity mix for the next 20 years. This chapter provides a rich narrative description and in-depth analysis of these two key processes. These in turn provide a context for the emerging wind industry and Medupi coal-fired power plant, explored in subsequent chapters with which they are inextricably bound up. I investigate how both processes, which underwent public consultation and key developments throughout the period of field work in 2010 and beyond were negotiated. This involves a consideration of stakeholders from the levels of the regime, the niche and the landscape. In particular it unearths conflicts within and between different government departments involved in driving and/or opposing these processes, and traces how attitudes towards renewable energy shifted over time. It also analyses non-governmental and external actors that were involved or influential in the formulation and early implementation of these processes and the influence that different groups and networks - including civil society[25], unions, development finance institutions, donors, and industry coalitions- have had over different government departments.

[25] The term 'civil society' is used to refer collectively to national NGOs such as SAFCEI, international NGOs with South African offices such as WWF and Greenpeace, new social movements such as the Durban Social Forum, and community groups such as the Soweto Electricity Crisis Committee. Unions are referred to separately from civil society, despite there being some crossover between members.

In analysing the complexity of competing interests and priorities in South Africa's electricity sector, this chapter provides an in-depth study of the policy process and speaks to its non-linear nature as discussed in chapter 3. This follows Wildavsky's (1979) argument that policy analysis is concerned with both planning and politics, and that due to the difficulty in defining policy analysis it "should be shown not just defined" (Ibid p 410). Here I illustrate how the contested and complex nature of policy-making generally constitutes a series or web of decisions that take place over a long period of time and is often carried out by a complex network of actors. Following Keeley and Scoones (2003:17) I analyse how expertise engages in the policy-making process and the institutional location of that expertise. Interpreting technological expertise of electricity as an aspect of science I ask: "How did science and different forms of expertise interact in the policy process?" and "What were the politics of policy-making" (Ibid).

The questions that this chapter addresses most directly are:

- *How are environmental, social, economic, political and technical priorities reflected in electricity decision-making in South Africa?*

- *How has the introduction of renewable energy in South Africa been negotiated and implemented, and who and what have been the key drivers and forces of influence?*

5.1.1 Policy Chaos

Demystifying the complexities of the policy-making in South Africa's electricity sector in a context of constantly moving goal posts and a multitude of processes is an enormous challenge. The lack of alignment and integration between significant, yet at times conflicting policy developments taking place at the national level being run by various different departments (table 5.1) has been discussed by a number of analysts (Pienaar and Nakhooda 2010, Tyler 2010). Interviewed in December 2010 Trade and Industrial Policy Strategies[26] (1) explained "there are coordination issues and a cluster of policies taking place. A number of different targets are being carried out in parallel and it is a big problem. There has been little staging or sequencing." In October 2010 Department of Environmental Affairs (DEA) (1) added "too many things are happening now in the energy sector and there is not enough capacity".

[26] An independent economic research institution

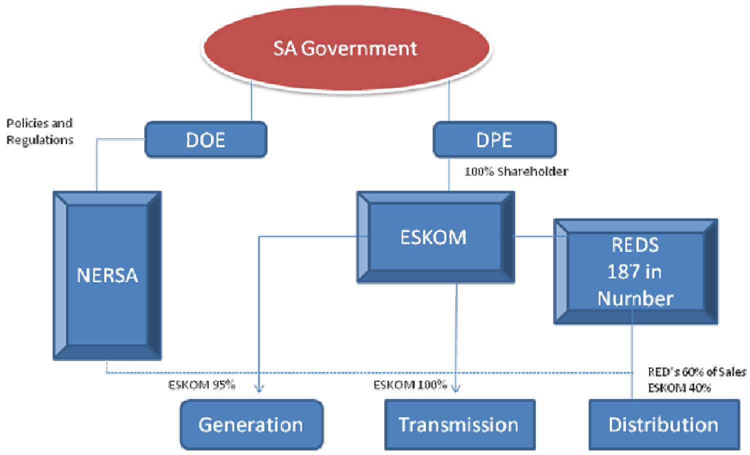
Table 5.1: Policy developments related to renewable energy			
Instrument	**Responsible Department**	**Details/ relevance to RE**	**Timeline**
Integrated Resource Plan 2010	DoE is responsible but it was produced by Eskom's Systems Operator. Inputs were also provided by: Inter Departmental Task Team, Working Group 2 of Inter-ministerial Committee on Energy and the IRP Technical Task Team.	The Final draft states that new generation from RE to contribute up to 17 000 MW or 42% of new generation capacity, of which wind + 4 GW.	Initiated 2009. Final version promulgated May 2011.
REFIT, now RE IPPPP	NERSA, DoE, Treasury	The majority of initial interest in REFIT came from the wind industry which was to have formed 700 MW of first round of 1025 MW.	Initiated 2007. Procurement process and selection criteria eventually finalised in September 2011
Integrated Energy Plan	DoE	Required under the 2008 Energy Act. This caters for all energy sources. The IRP is a subset of this.	Required since 2008. To be carried out in 2012
Renewable Energy White Paper revision	DoE	Originally published in 2003 to be revised every 5 years. Allows for "10,000 GWh (0.8 Mtoe) RE contribution to final energy consumption by 2013..." About 3% of current total capacity	Revision scheduled for completion in March 2011 though delays expected
LTMS	DEA (though LTMS process managed by Energy Research Centre of UCT)	RE to provide 15 per cent of electricity by 2020, 27 per cent by 2030 and 50 per cent by 2050 (check- LTMS or CC strategy). Not legally binding	Began 2006 and agreed in July 2008.
National climate change strategy	DEA	To inform the country's climate change policy	Released for comment in Nov 2010. Finally released in November 2011
Industrial Policy Action Plan 2	DTI	States that priority support should be given to CSP as most promising RE generation option in SA. No planned industrial development based on wind	2011-2014
New Growth Path	EDD	Wind included in *Sub-programme 5: Green Economy* as a potential low carbon industry. Development of low carbon economy seen as critical. Emphasis on	Published 2011

		synergy between economic development and environmental management	
Capacity expansion programme	Eskom	100 MW Sere Wind farm is included in this	On-going
National Development Plan	National Planning Commission	Transition to a low carbon economy identified as one of nine key challenges	Published June 2011

5.2 Formal and informal electricity governance explained

The way energy governance is connected right now is not logical. The DoE is not in charge of the energy parastatal. Meanwhile the DPE minister Barbara Hogan is not in high political standing and has limited clout. It is not just Eskom that is in trouble, all parastatals are, but they are still paying huge bonuses. Is the DPE able to turn this around?" (Mining industry expert 2)

Figure 5.1: Formal electricity governance in South Africa



Source: Godongwana (2010)

Figure 5.1 illustrates the formal governance structures of South Africa's electricity sector. However as this thesis explores it is not always evident how and where electricity policy in South Africa is being made, returning to Lukes' (2004) question discussed in chapter 2 of how to investigate the role of influencing in the policy process. Though the DoE is responsible for setting energy policy and planning, in reality formal and informal influence over many decisions made in the DoE's name is exerted and contested by numerous entities. The Department of Public Enterprises (DPE) has had oversight responsibility for Eskom, as for other parastatals since end 1980s. It is the utility's principle shareholder and is responsible for the funding of different power stations and the operability of the entity. NERSA, set up in 2004[27] determines electricity tariffs, sets the conditions under which electricity may be sold in the country, approves licences for generation, distribution and transmission, and oversees the import, export and trading of electricity. As with the DoE it also reports to the energy minister. The Treasury meanwhile looks at

[27] Under the National Energy Regulator Act. Previously the National Energy Regulator (NER), a recommendation of the 1992 National Electrification Forum (NELF) became a legal independent institution in 1995 with jurisdiction over the electricity supply industry

the financial exposures of Eskom. Other formal institutions of national governance involved include the DEA, metropolitan and municipal governments, and the Inter-Ministerial Committee on energy.

Less formally, influential stakeholders include the Chamber of Mines and the Energy intensive User's Group (EIUG) which has a membership of 36 companies that includes the country's five main coal miners (chapters 4, 7). As discussed in section 5.5 such companies have "enormous collective bargaining power" (Nakhooda 2011:21). Unions also have leverage over issues of energy policy, though as Michie and Padayachie (1997) suggest, are not always representative of the mass unemployed. NERSA (1) stated, with regards to decision-making around energy: "there are a lot of tensions. For instance, the EIUG is a big player and provides lots of inputs. It has a lot of engineers and necessary skills to make contributions. The Chamber of Commerce is also influential, as is organised labour and the Chamber of Mines". The influence of such entities however is rarely public, relating to Marquard's (2006) description of the impact of the culture of secrecy on policy making, a continuing legacy of the apartheid era.

5.2.1 Changing departments: weak institutional capacity

Weak institutional capacity has inevitably influenced policy making in the energy sector (Newbery and Eberhard 2008).Moreover the history of energy governance at a departmental level reflects national uncertainty over how it should be implemented. The NGO IDASA (2010:4) highlights "a systemic lack of clarity concerning roles and responsibilities in the electricity sector, with an associated extended period of policy opaqueness and uncertainty" and finds that "a lack of policy coordination has contributed to chronic under-capacitation, compounding the complex and profound social and environmental challenges that confront the country". 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). Almost two decades later in 2009 following President Jacob Zuma's inauguration the functions of the Department of Minerals and Energy (DME) were separated into two departments, the Department of Minerals (DMR) and the Department of Energy (DoE).

According to Reddy (2009) the DME was central to the creation and supply of "cheap, dirty energy" which fed the power needs of mines and heavy industry, and lead to "rapid wealth accumulation in the 1980s". Furthermore in the aftermath of apartheid, the department's commitment to the universal provision of electricity was in conflict with its continued servicing of the needs of industry. Relating to the discussion on BEE (section 4.1.6), DTI (1)'s analysis expands on this: "Part of the explanation for the policy vacuum on the energy side was because of the overwhelming focus of the DME on distributing rents in relation to mining licences. They had a narrow focus on using mining rents for class formation of a narrow group of black capitalists. The distribution of mineral rents enjoyed pre-eminent focus with a relative neglect of other policy imperatives, including the growth of mining employment; safety conditions in mining; and energy policy. This was one but not the whole reason for the neglect of energy policy [by the DME]". According to Wind IPP (1) "the DoE is weak in part because all the good people went to DME when the department split in 2009. There is more money in the DME".

Lack of expertise within the DoE and the DPE was frequently cited as a determining factor of the country's electricity policy making. For example in April 2010 bilateral donor (4) stated that "the DoE are still getting set up and have just moved offices. The DoE lacks control and has no teeth". Consequently, according to Energy analyst (1) "officials are learning about issues as they implement policy". McDaid (2009:2) explains that, "decision makers are unfamiliar with the technology and international best practice regulatory and policy systems that could promote renewable energy". Bilateral donor (2) added "there is a gap between policy makers and the knowledge in the field. The DoE has theoretical concepts in mind but it lacks knowledge and experience of how to put them into practise". More critically, Wind IPP (5) stated "the problem is that there are policy makers who do not understand the technology and the people who do understand the technology are confusing them. The coal and the nuclear industry are feeding the policy makers". Meanwhile the DEA which was responsible for the long-term mitigation scenarios (LTMS) has been a key pioneer of renewable energy. According to bilateral donor (2) "the DEA has taken the lead on a lot of projects. One of their members pushed heavily for the renewables component in the IRP".

In addition to an absence of capacity, lack of political will and political control within the DME/DoE were also identified as key factors in policy making (e.g in interviews with bilateral donor 4, energy analyst 3). A mistrust of renewable energy within the DoE was also evident. For example South African energy specialist (1) found that in the early 2000s at the time when the renewable energy white paper was being developed, limited capacity and skills in the DME was accompanied by a rejection of the notion of renewable energy. "Staff in the DME were referring to ‘renewable energy’ as ‘rural energy’, perhaps because renewable energy was often associated with a rural setting”.

5.2.2 A shift of opinion

However there has been an increased acceptance of renewable energy within the DoE. While this is reflected in public statements by the DoE throughout 2010, it is evidenced most concretely in the adoption of the RE IPPPP and the greater allocation of renewable energy from the first draft of the IRP in January 2010 to the final version in May 2011. In October 2010 DEA (1) stated that “two years ago one had to explain the basics on wind and solar, baseload and capacity factor etc. There has been a big turnaround in the DoE and cooperation is now much better. There is now a new breed of ministers who are supportive of renewable energy such as Ebrahim Patel. There has been a paradigm shift in thinking and developmental priorities. People have realised that the economy is very energy-intensive and does not provide as many jobs are previously claimed.”

Similarly bilateral donor (1) stated in October 2010 that “there is a sense of a real mind shift in DoE and Eskom at the higher levels. Generally in South Africa to get things done you have to convince at least the Departmental Director General.” It also appears that development of renewable energy expertise across the board has increased dramatically. In December 2010 Eskom (2) said, “the limited number of people working on these issues are gaining knowledge at the speed of white light. I have learned a lot. People have a lot to learn before they can do their job”.

5.2.3 Eskom: strategic planning

Due to its lack of expertise, the DoE often delegates to Eskom on matters of planning, despite Eskom’s lack of expertise on power station construction identified in chapter 4. For example, the IRP 2010 was project-managed by Eskom’s Systems Operator. Self-described as the “electricity transport and distribution supervisor”, its current functions include: balancing supply and demand; managing grid and system stability; monitoring and managing power system risks; and providing real time information on status of the power system (Lakmeerharan 2010). As Eskom (3) explained “The DoE takes decisions but Eskom do the research”. Similarly, Reddy (2009) states that Eskom serves as the implementing agency of the DME’s policies and more or less runs the department’s power section. DTI (1) concurred: “in the absence of a strong policy department, Eskom will exert a strong influence”. Wind IPP (5) added “Eskom still wants to make policy decisions. People with expertise write the plans and Eskom has the expertise. All roads lead to Eskom”. Trade and Industrial Policy Strategies (1) concurred “Capacity is an issue. Not just of individuals but there is also a massive turnover. This is why Eskom ends up writing the IRP and not DoE. Eskom knows how to. But they end up getting input from people who do not". This is further discussed in 5.4.6.

Marquard (2006:129) describes an "enduring relationship between Eskom and the political elite, both before, during and after apartheid. Since Eskom's formation, its leadership has had ready access to the premier, and what might be termed the 'industrial policy elite'. Key policy developments have usually been negotiated through these informal networks, rather than through formal policy structures. After a brief period of uncertainty, these relationships have been re-established with the post-apartheid political elite". GroundWork (2007:31) concurs with this perspective, stating that throughout the transition to democracy Eskom has defended its monopoly "on strategic information and planning capacity in the power sector and dominated the DME. This strangle-hold has been weakened, but not broken, with the establishment of the National Energy Regulator of South Africa (NERSA)".

Union (1) adds that "Eskom seems to get away with a lot of consequences. It is accountable to DPE. If it accounted to DoE and the Energy Portfolio Committee, things could be different". Also of note is that within Eskom itself there has not been a harmonious relationship between departments. Eskom (3) stated that "many departments within Eskom and within governments have been working in silos". While Eskom has clearly exercised disproportionate power in policy, the extent to which this will continue in the face of its financial crisis and the introduction of IPPs is a key question raised by this research. One evident challenge to its power is discussed in relation to the DoE's seizure of the RE IPPPP discussed in the following section.

5.3 Renewable energy procurement process: a niche policy intervention

South Africa has put in place a generous feed-in tariff to cover the cost differential between the general electricity tariff and the cost of renewables. However, its budget is limited and it is therefore currently only designed to finance procurement of a limited volume of renewables" (DTI 2010:10)

"I am glad to say that the wait has been long but it is over now as procurement process is in motion" Media statement by DoE, 31 August 2011 (DoE 2011)

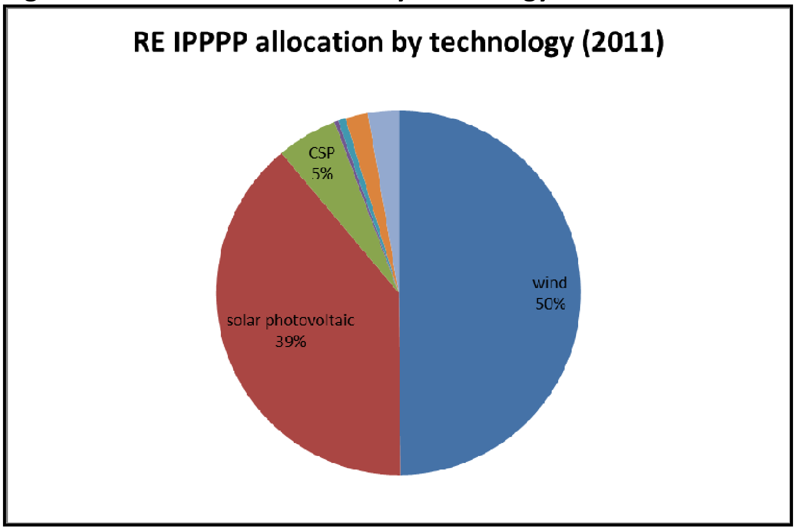
This section traces a niche intervention initiated in 2007 by individuals within the national regulator, to the launch of the RE IPPPP in August 2011 and the selection of the first and second round of successful projects in December 2011 and May 2012. RE IPPPP is the first renewable energy initiative in South Africa to have gained traction at the national level[28] , and will facilitate the entry of renewable energy IPPs into the country's electricity grid. In examining how such a policy process gained momentum, this section corresponds in particular to the question *how has the introduction of renewable energy in South Africa been negotiated and implemented, and who and what have been the key drivers and forces of influence?* This analysis uncovers evolving attitudes within and between different government departments, the private sector, Eskom and banks, as well as the influence of bilateral donors and key interactions between niche, regime and landscape level institutions and processes. The process has been paralleled by the increased acceptance of renewable energy within South Africa's electricity planning and policy arena discussed above. In considering the evolving relationship between private capital in the electricity sector and the state as a central feature of South Africa's MEC, this case also illustrates conflicts between NERSA backed by Eskom, and the DoE backed by National Treasury. This includes NERSA "acting beyond its mandate" (Energy analyst 1) by promulgating REFIT in the first instance and the eventual seizure of the process from Eskom and NERSA by the DoE and Treasury in November 2010. The chapter explores the role of IPPs and associated banks as examples of policy entrepreneurs (Kingdon 2011:122) who pushed for a regulatory framework and generous tariff, upon which they eventually had to compromise in exchange for a foothold in the regime.

South Africa's RE IPPPP, conceived in 2007 as the renewable energy feed-in tariff (REFIT), was at least four years in the making, despite intense interest from the outset from renewable energy IPPs waiting to construct and connect their projects to the country's electric grid. Throughout its negotiation the process was subjected to numerous delays due to disagreements over the appropriate regulatory framework, skepticism of renewable energy from certain factions of government and industry, perceived political and financial risks and the replacement of the feed-in tariff with a competitive bidding system at the eleventh hour. Its final form approved in August 2011 RE IPPPP allocates 3725 megawatts (MW) for renewable energy sources of which 1850MW for wind, 1450 MW for solar photovoltaic, 200 MW for concentrated solar thermal, 12.5 MW for

[28] A previous initiative, the Renewable Energy Fund and Subsidy Office (REFSO) in 2005 was unsuccessful as the subsidies it offered were considered insufficient (Holm et al 2008).

biomass, 12.5MW for biogas, 25MW for landfill gas, 75MW for small hydro and other small projects 100MW (figure 5.2).

Figure 5.2: RE IPPPP allocation by technology



There was significant conflict at the national level over whether a tender system which eventually won out or a feed-in tariff system should be implemented. At the DME organised Renewable Energy Summit in March 2009, the then 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). A feed-in tariff sets a fixed price for the purchase of renewable energy, which pays generators a higher rate than that of the retail price for each unit of electricity fed into the grid. Its aim is to “help spur technological development through rapid deployment and economies of scale, thus decreasing generation costs of renewable energy sources and improving their competitiveness compared to conventional electricity systems based on coal, gas, oil and nuclear” (Mendonça et al 2010:xxii). Meanwhile, a tender system based on competitive bidding means that potential project developers are invited to bid for a renewable energy contract (Ibid 2010:174). In South Africa’s case, bids must demonstrate firstly how they will meet socio-economic development criteria and secondly offer a price below a certain cap. The bid that meets the requirements at the lowest price wins the contract. Eskom is excluded from bidding with its role confined to the buyer of power and connecting the projects to the grid. It is estimated that the RE IPPPP will add an average incremental cost of $660-million to South Africa's yearly electricity bill up to 2044 which will be borne by electricity consumers under the MYPD 2 and tariff hikes (Creamer 2011:*31 Aug*).

Following global trends, the greatest interest in South Africa's REFIT/ RE IPPPP originally came from the wind industry though since 2008, solar technologies have gained ground as their international market price and capital costs have dropped markedly (REN 21 2011). REFIT's initial allocation was to have amounted to 1025 MW, would have run for three years until end 2013 in keeping with the target in the renewable energy white paper and determined by the first IRP (section 5.5). Of this wind was to have constituted 400 MW (Eskom Renewable Engineer 1, DEA 1), later increased to 700 MW in the October 2010 draft of the IRP 2010 (DoE 2010c:17). After 2013 a second allocation was to have taken place with the expectation that tariffs would be reduced (Eskom 3) but details were never finalised before the process was converted to the RE IPPPP. The limited amount of MWs available under the first round of REFIT were criticised for being too small scale and too short term to encourage the development of a critical industrial mass, for creating unnecessarily fierce competition amongst IPPs, and for the failure to allow for strategic long-term infrastructure planning.

Box 5.1: Renewable energy white paper: "activist process funded by the World Bank"

By way of background, the renewable energy white paper was the government's overarching policy document on renewable energy. Described by Eskom (1) as "a visionary blip on the horizon," it was published by the then DME in 2003 with Danish support, just missing the World Summit on Sustainable Development hosted by South Africa in 2002 and set a minimal target of 4 per cent of the estimated electricity demand by 2013 (DME 2003). This was largely to be achieved though 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 2010a).

Funded under the World Bank's Renewable Energy Market Transformation Project (REMT) and managed by the Development Bank of South Africa (DBSA), 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 IRP 2010's content. Energy Analyst (2) explained "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". This offers an interesting example of a niche-level policy innovation supported by the World Bank as a landscape actor which in other instances has provided greater support to regime level developments, notably the Medupi coal-fired power plant. It also illustrates how niche processes are often initiated by outsiders, supporting individuals within the regime or the niche.

5.3.1 NERSA: the 'activist regulator'

"It is worth remembering, at this stage, that it is Nersa's mandate to implement policy; and it is the department of energy's mandate to make it". Johan van den Berg, CEO of the South African Wind Energy Association, August 2011 (SAAEA 2011)

The initial push for REFIT in 2006/7 came from individuals within NERSA's Electricity Regulatory Division who together with representatives from Treasury, DPE and the DEA had been inspired by study tours to Germany and Denmark (bilateral donors 1 and 3, NERSA 1). This took place despite opposition from within the regulator itself (NERSA 2), the DoE and a general resistance within Eskom towards renewable energy. As energy analyst (2) described "Thembani Bukula, NERSA's director, brought the world's wind developers to South Africa to beat a path to the DoE's door" with the result that by November 2010 Eskom (3) conceded "within Eskom there is now resignation for wind. But there is no enthusiastic help for it either".

In developing REFIT, NERSA was acting beyond its mandate 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 (RSA 2006). Energy analyst (2) acknowledged "NERSA was kind of out of line, despite the fact that we all wanted a renewable energy industry". However NERSA (2) noted that strong resistance to the process from the renewable energy directorate of the DoE under whom the process should have fallen meant that the regulator continued to push the process. More diplomatically, NERSA (1) added that "REFIT was supposed to be a policy matter to have been developed by the DoE, but due to a number of administrative issues and challenges the Regulator ended up initiating this process as long as it was within the legislative framework". Wind IPP (3) speaking in a personal capacity added "if it wasn't for NERSA who took a leading role in pushing REFIT, it may not have happened. NERSA used the Regulator Act to motivate for REFIT to be carried out. They tried to devise a mandate for themselves". Bilateral donor (4) supportively noted that "NERSA does admirably well in light of its limited resources".

Having gained traction at the board level of NERSA in June 2007, REFIT was developed in two phases. Phase I, for which regulatory guidelines were eventually published in March 2009 (NERSA 2009d) was for wind, small hydro (less than 10 MW), landfill gas methane and CSP parabolic trough with storage (NERSA 2009a). Phase II, for which tariffs were approved in October 2009 was for CSP trough without storage, large scale grid connected PV systems, solid biomass, biogas and

CSP Tower with storage of 6 hours per day (NERSA 2009c). Draft criteria for the selection of renewable energy projects were published by NERSA in February 2010 (NERSA 2010) followed by a two day hearing (Holman, 2010) but they were never finalised and instead integrated into the final procurement programme, launched August 2011. Until then wind IPPs had expressed frustration over their lack of clarity stating that they were risking large amounts of capital without knowing the criteria upon which their projects may be selected.

5.3.2 From niche innovation to regime ownership: the role of technical assistance

By late 2010 REFIT had become high profile and apparently irreversible, with an estimated potential of 13 000 MW of wind projects for an allocation of 700 MW by November 2010 (Eskom 2). At this point the DoE supported by National Treasury who cited concerns over the programme's financial implications (DEA 1, Treasury 1) took it over, removing it from the jurisdiction of NERSA and Eskom and altering the New Generation Regulations in order to facilitate this (section 5.4.3). Geels and Schot's (2007:406) claim that "the demonstration of viable alternatives may change perceptions of regime insiders and lead to reorientations of (innovation) activities", though which rarely occurs without conflict and power struggles is highly relevant to this move. A 'request for information' (RFI) published in September 2010 by the DoE in order to encourage potential renewable energy developers to submit information on the progress of their projects (Aphane 2010) received responses from over 300 renewable energy projects amounting to a total capacity of 20000 MW, of which the majority from wind. However only thirty of these projects amounting to just 1000 MW of capacity were reported to have received grid connection approval from Eskom (van der Merwe 2010b). Others declared that the cited 20000 MW likely included double counting, cases of different IPPs believing that they have secured the same piece of land and intent by various different IPPs to feed into the same sub-stations where this would be technically impossible (Eskom 3, Wind IPP 7, bilateral donor 1, Smit 2010).

The Development Bank of South Africa (DBSA) (Aphane 2010:5) and the Danish, German and Spanish embassies provided technical and/or financial assistance for this process, paralleled with the recruitment of various renewable energy consultants (Treasury 1). As Treasury (1) explained, "human capacity is a huge factor in REFIT in light of the volume of applications and the capacity to process them". Danish consulting firm EA Energy Analyses (2011a) had a contract from October 2010 to March 2012 to assist the South African government to develop a regulatory framework for the promotion of investments from renewable energy IPP. A consultant selected by the Spanish Embassy and supported by the European Investment Bank advised the government specifically on the PPA (Treasury 1). Meanwhile the DoE released terms of reference for transaction advisors to the government for the procurement of independent power under REFIT who were to be appointed through the DBSA and managed by Johannesburg based law firm Webber Wentzel (DoE 2010a, Treasury 1). In December 2010 the government subsequently advertised for "a team of legal professionals with extensive knowledge of the regulatory environment and the licensing of activities needed to govern the electricity sector and enable private sector investment in the generation of renewable energy" (National Treasury 2010).

5.3.3 New Generation Regulations: turf battles

The parallel evolution of South Africa's New Generation Regulations for electricity which are central to the procurement of privately generated renewable energy reveals how the DoE, backed by Treasury seized control of the RE IPPPP from NERSA, ultimately securing a much greater level of Ministerial discretion over the selection of power projects.

On 30 January 2009, the then DME introduced a consultation paper entitled *Electricity Regulation*, under the Electricity Regulation Act of 2006 to deal with the procurement process of new generation of electricity for IPPs (DME 2009a). The paper which failed to mention the feed-in tariff was described by energy analyst (1) as "the DME's counter move to NERSA's REFIT", for which the consultation process had already begun. It ran contrary to REFIT because it was to establish a bidding system, as opposed to a tariff system (IDASA 2010:15) and shifted "strategically important planning responsibilities from NERSA to Eskom, and [gave] the Minster of Energy wide discretion regarding NERSA's REFIT process" (IDASA 2010:18).

Then in March 2009 NERSA published its approved REFIT guidelines with minimal reference to the DME's electricity regulations (NERSA 2009d). Five month's later in August 2009 the DME's *Electricity Regulations on New Generation Capacity* were approved, which by then had a dedicated section on procurement of renewable energy and cogeneration (DoE 2009a). In October 2010, mining industry expert (2) described this as "the only document that has been produced which describes how to procure IPP power. But it referenced many things that did not actually exist for example an Independent Systems Operator". Then on 30 November 2010 a second version of these Regulations revised with technical assistance from Danish consultants, was promulgated for public comment in the government gazette (DoE 2009b). This altered the roles and responsibilities outlined in the August 2009 document and in effect transferred powers away from NERSA and Eskom to the DoE and National Treasury[29].

In November 2010 DoE (1) defensively stated that the August 2009 version of the Regulations allowed "Eskom to do all sorts of funny things with IPPs, renewables and planning. The latest version of the Regulations gives all of that back to us. The Minister will determine who does what. This new version of the New Generation Regulations gives the power and control of the procurement process for REFIT back to the DoE". S/he concluded that "the New Generation Regulations now enable government to control the procurement process. The market indicated to us that in light of Eskom's financial position, it was not willing to enter into a PPA arrangement with Eskom unless they had a government guarantee... So we decided to change the New Generation Regulations so that it is easier for us as government to control the procurement process... We are trying to separate the procurement process from Eskom and make it government owned. Eskom comes in only as an off-taker in the PPA." Emphasising Treasury's influence in this decision s/he added that "if National Treasury is not happy with the documents then they will not be supported financially by government". Treasury (1) explained that it was necessary to take over the financial aspect of REFIT out of concern for the country's balance sheet and to ensure an appropriate allocation of risk in the PPA which will be government guaranteed.

Finally in May 2011 a third version of these regulations was published, this time with all references to REFIT removed (DoE 2009c), revised under the Johannesburg legal firm Webber Wentzel working as the head legal advisory team for the government (DoE 2010).

5.3.4 From REFIT to 'REBID': moving the goal posts

In August 2011, National Treasury declared that South Africa's REFIT was illegal following an audit carried out by Johannesburg law firm Webber Wentzel that "showed that the predetermined tariff would fall foul of South Africa's procurement rules" (Creamer 2011:*23 Aug*). The DoE similarly affirmed that REFIT was illegal on the basis that NERSA would determine the tariffs (Aphane 2011). In what could be interpreted as an admission of defeat, on 23 August 2011 *Engineering News online* reported: "NERSA's Thembani Bukula said that the regulator had moved ahead with the design of a REFIT in line with government policy and national legislation. But he

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[29] For example under the August 2009 Regulations, Eskom's System Operator was to have been responsible for selecting REFIT participants but the November 2010 version stipulates that the entity responsible for this selection must be designated by the DoE and obtain National Treasury approval. NERSA's power to draw up the PPA and selection criteria was also removed as these were now to be drawn up as part of the Request for Proposals (RFP) (DoE 2009b:8).

said that framework changed on May 4, 2011 when the New Regulations on New Generation Capacity were promulgated and made no reference to REFIT. Therefore, on July 29, 2011, NERSA concurred with government's competitive bidding process" (Creamer 2011:*23 Aug*). Similarly Alternative Energy Africa (2011) quoted Bukula as saying "in a way, yes [the Energy Ministry and National Treasury] consulted with NERSA; initially we did not concur, but when the law was changed in a way that rendered the REFIT [policy] inapplicable, we had to concur."

This use of rules and procedures, or the reshaping of existing rules by the DoE to prevent unwelcome challenges from NERSA or Eskom illustrates how policy making is as much about attempts by some factions to secure a specific outcome as it is "changing the rules of the game" (Ham and Hill 1993:16) by others, thereby protecting vested interests. Or following Meadowcroft (2011:71) how "choices among alternative technological pathways involve struggles among rival commercial groups, and this spills over into conflicts over regulation and property rights". In this case, while the conflict was reported in the press, it was prevented from entering the political arena, because by Bukula's own admission, NERSA and Eskom no longer had any legal power to argue. DoE (1) further surmised: "in most instances the government does not agree with the utility, but we have legislation that we can use to our advantage." This change in legal regulations has both served to marginalise NERSA, the initiator of the process whilst facilitating the entry of IPPs into the electricity generation sector.

The tender documents for the RE IPPPP, including the PPA and the Request for Proposals (RFP) were compiled by Webber Wentzel and were made available on 3 August 2011[30] subject to a fee of R15000. The programme allocates 3725 MW to renewable energy as compared to 1025 MW proposed in the earlier REFIT. The new RE IPPPP or 'REBID' as it has also been coined consists of a two tier process in which developers must first demonstrate how they will meet socio-economic development criteria and secondly submit an offer on price below a certain cap. Scoring is allocated 70 per cent on price and 30 per cent on socio-economic development (Norton Rose 2011) which includes factors such as job creation, participation of historically disadvantaged individuals, protection of local content, local manufacturing, rural development, community involvement and skills development, (Creamer 2011:*31 Aug*). The price submission will only be considered once the socio-economic criteria have been met.

[30] At the following website: http://www.ipp-renewables.co.za/

Prices were capped below levels approved by NERSA in 2009. Bidders must also raise a bond of R100000 for every MW of capacity eventually bid. The first bid submission date in November 2011 (Business Report 2012) resulted in the selection of 28 successful projects in December 2011, coinciding with the UNFCCC conference in Durban (table 5.2). Projects selected in this first bidding window must begin commercial operation before end June 2014, except CSP technologies which must begin before end June 2015. In the second bid submission of 5 March the DoE received better offers on price and economic development than the first (Creamer 2012:*29 March*) and received 79 tenders to a total of 3233 MW of potential power generation capacity, almost three times the 1275 MW allocated and still greater than the 2300 MW left for allocation in subsequent rounds. IPPs and renewable energy industry associations have since called on the DoE to increase the target (ESI Africa 2012c) which has indicated that allocations may yet change in light of oversubscription from some technologies and under subscription from others. Subsequent bidding dates were set for 20 August 2012, 4 March 2013 and 13 August 2013. Projects submitted for any other window must begin commercial operation before end 2016.

Table 5.2: Selected preferred renewable energy bidders announced December 2011[31]

	MW allocated in first round	Number of projects	Total number of MW allocated for RE IPPP	Percentage of total allocation for RE IPPP
Solar PV[32]	631.5	18	1450	42.6%
Solar CSP	150	2	200	75%
Wind	633.99	8	1850	34.3%

Table 5.3: Selected preferred renewable energy bidders announced May 2012[33]

	MW allocated in second round	Number of projects	Total number of MW allocated for RE IPPP	Percentage of total allocation for RE IPPP
Solar PV	417.1	9	1450	28.8%
Solar CSP	50	1	200	25%
Wind	562.4	7	1850	30.4%

The South African Wind Energy Association (SAWEA) stated that the original REFIT was relatively speaking less complex, lower in compliance costs and greater in investor certainty. “While REFIT

[31] adapted from: http://www.ipp-renewables.co.za/index.php/press/detail/recommended-preferred-bidders-window-1

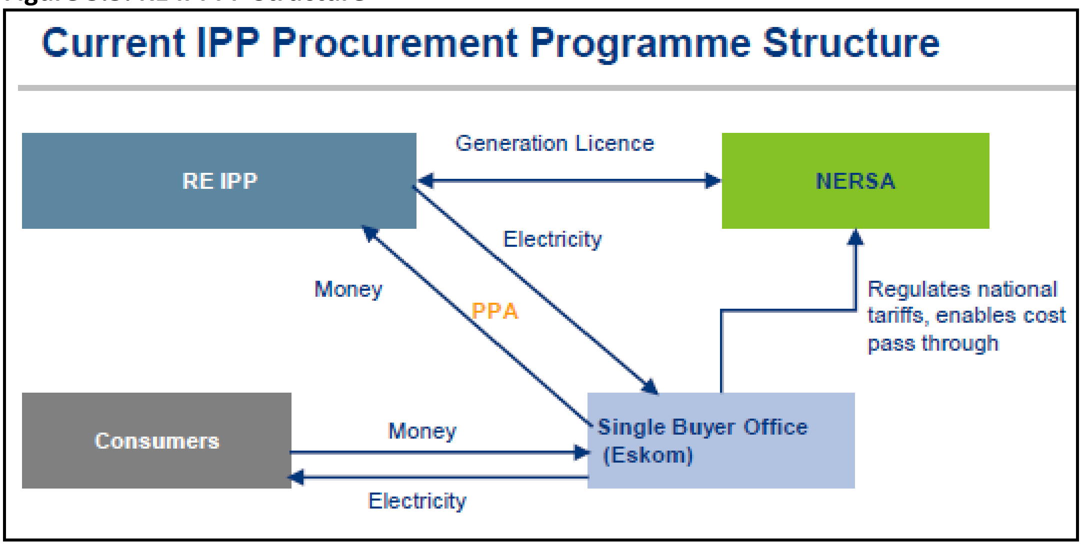
[32] It is likely that the reduction in allocation for Solar CSP is due to significant reductions in PV costs in 2010 which have challenged the growing CSP market (REN 21 2011:25). According to UNEP and Bloomberg New Energy Finance (2011), the price of PV modules has fallen by 60 per cent per MW since the summer of 2008.

[33] Adapted from: http://www.ipprenewables.co.za/#blog/post/view/id/182

was “exhaustively workshopped”, RE IPPPP was “unilaterally handed down” (SAWEA 2011). The alignment and trust with the renewable energy industry engendered by the NERSA’s REFIT process was compromised by RE IPPPP’s “unilateral process without any public consultation and with uncoordinated statements in the press” (Ibid). Moreover when the process was under NERSA many of the relevant documents were publicly available and followed by public hearings but the final RE IPPPP documents are subject to a fee of R15000 and stringent confidentiality requirements (DoE 2011b). SAWEA also declared that the localisation and socio-economic requirements were “very high’” (Creamer 2011:*23 Aug*) and saddled a young industry with a heavy and unanticipated compliance burden. They concluded that while renewable energy was moving forward, the process by which it was being implemented had gone backwards. Despite such complaints, SAWEA still conceded that it had not yet found a single issue of ‘unbankability’ and hoped the programme would succeed (SAWEA 2011), a tacit indication that a compromise had evidently been reached in exchange for a foothold in the regime.

Returning to the theme of secrecy in energy policy-making, Yelland (2011c) surmised that the secrecy of the RE IPPPP “serves to fuel concerns that a whole gamut of parasitic and non-value-adding parties were lining up again for an even bigger feeding frenzy than that of the R30 billion arms deal, the Chancellor House involvement in the Medupi and Kusile boiler contracts, and other major public sector procurements”, a claim relating to BEE discussions in chapters 4, 7, and 8.

Figure 5.3: RE IPPPP Structure



Source: Standard Bank 2011

5.3.5 "Pork barrel politics"? Setting and revising the tariff

I think the high tariffs are driving too much interest, too much risk and causing fear of lawsuits"

Eskom (2)

A key challenge for feed-in tariffs is to balance investment security for developers with the avoidance of windfall profits (Mendonça et al 2010:14). Scrase and Smith (2005:720) caution against "a descent into pork-barrel politics" in the creation of a process "through which large numbers of potential entrepreneurs can access funds for niches". This relates to Moe's (2010:1732) point that new technologies can become vested interests in their own right, a concern expressed repeatedly in 2010 by a variety of interviewees in light of the scramble provoked by the small number of very lucrative tariffs proposed in 2009.

Participation in this process has favoured companies with large corporate assets in light of the time and the uncertainties involved and the huge up front capital requirements. As a smaller wind energy company (IPP 1) explained "big internationals can take the risk. They have deep pockets, time and lots of capacity". IPPs bring their own finance, invest at their own risk and only get paid when their project is connected to the grid and starts to deliver. Waiting has been a costly business for IPPs given that until recently there was little guarantee of what or whether the return will be at the end of it all. However until NERSA's March 2011 consultation paper that proposed downward tariff revisions, the return for IPPs who could afford to sit it out would have been highly lucrative with the wind tariff set at R1.25 per kWh.

5.3.6 Private persuasion

Setting the tariffs has an interesting history. NERSA's December 2008 REFIT consultation paper stated that the proposed tariffs were "close to international standards". They proposed a wind tariff of R0.66 per kWh in 2008, to decrease year on year to R0.58 per kWh by 2013 (NERSA 2008:8-9)[34]. Yet parties at the REFIT public hearing in February 2009 stated that "the tariffs offered by NERSA under REFIT are too low to make any renewable energy project viable" and

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[34] Calculated on data from a 2004 report *Economic and Financial Calculations and Modelling for the Renewable Energy Strategy Formulation* (NERSA 2008:9) written by Conningarth Economists as part of the Danish-funded Cabeere-programme, and published by DME (2004). NERSA (2008:7, footnote) states "the levelised costs for renewable energy technologies established in this study were adjusted upwards to take into account high inflation in the price of commodities such as steel since 2004. In addition, a discount rate of 12% was used instead of that of 10% used in the Macro Economic Study. The intention is to provide a FIT that encourages rapid development of renewable energy in South Africa, so a more generous discount rate was regarded to be appropriate". The model was based on a "specified set of RE technology supply curves" (NERSA 2008:9).

called for NERSA to review them in order to create a “bankable” renewable energy market (NERSA 2009a:4). In NERSA’s subsequent guidelines of March 2009 the tariffs had shot up, in the case of wind to R1.25 kWh[35].

Table 5.4: REFIT/ RE IPPPP phase 1 tariffs				
	Wind	Concentrated solar power (CSP), parabolic trough with storage	Landfill gas	Small hydro (less than 10 MW)
December 2008	0.66	0.61	0.43	0.74
March 2009	1.25	2.10	0.90	0.94
March 2011	0.94	1.83	0.54	0.67
August 2011 (upper cap)	1.15	?	0.60	1.03

Explanations for how these tariff levels were reached were opaque but a number of interviewees implied that the private sector had been influential in their calculation. Treasury (1) stated that the 2009 tariffs were calculated on the basis of a high interest rate and high dollar assumptions with input from developers who were also hoping for high returns. According to NERSA (2), “the most vociferous submissions came from developers”. It is understood that input provided by an informal advisory committee including representatives of South African banks namely ABSA, Nedbank, Standard Bank, Rand Bank and Investec was influential over the second tariff determination. In November 2010 NERSA (1) stated that “right now we are incentivising because the industry is still small, so we need to give people an opportunity to invest and make a good killing. The private sector can make or break you so you need to manage that eventuality”.

Many parties interviewed in 2010 considered the tariffs set in March 2009 to be too high, even certain banks who privately questioned the ability of the national public purse to sustain such generous levels which would be set for a 20 year term and linked to South African inflation (CPI), claiming that they would create an excessive profit for IPPs at the expense of the electricity consumer with the poorest hit particularly hard (Bank 2, Energy Analyst 2). DTI (1) stated “if you set your tariffs too high then you can end up being behind the technological learning curve, and encourage relatively inefficient operators”. This was backed by SARi (2010:21) which found that

[35] NERSA stated that these higher tariffs were “established through the Levelised Cost of Electricity calculated for discount rate 12%. The FIT were adjusted using the latest publicly available international cost and performance data for renewable energy sources and the screening curves (levelised cost) model of the National Integrated Resource Plan 3 (NIRP3)” (NERSA 2009d:27).

“expected costs required in South Africa are significantly lower than suggested by the current level of REFIT, particularly for wind” and that the anticipated risk premium had been overestimated. Fears were also raised that the high tariffs would create corruption in the bidding process given the extreme competition for what at the time was only 1025MW of capacity (Salgado 2010). Due to lack of clarity over the selection criteria, some interviewees mentioned concerns over possible law suits from IPPs should they be unsuccessful in the first round of REFIT. Eskom (3) said: “right now, decisions on who gets REFIT tariffs are very subjective. This could lead to lawsuits, which would stall the process of creating a sustainable renewable energy industry even further and have serious financial implications”. But other private sector representatives concurred that the high tariffs agreed in 2009 were still justified in order to kick-start the industry at a national level citing significant ‘risk’ involved in implementing renewable technologies in an ‘immature’ market such as South Africa.

In an unexpected turn in March 2011 a NERSA consultation paper proposed downward revisions to the tariffs of between 7 and 40 per cent approved in 2009 (NERSA 2011b, table 5.3). Such a move perturbed renewable energy IPPs who said the tariff drop would create further market uncertainties (van der Merwe 2011). NERSA said it was forced to do this because the financial and economic parameters used in the 2009 determinations were based on the assumption that the REFIT programme, now stalled due to institutional delays would have started immediately after the tariff approvals. It said that the new tariffs were in keeping with international trends in the cost of renewable energy technologies which had since decreased significantly. Jonathan Curren of Johannesburg-based CAMCO, who had been involved in the design of South Africa’s REFIT, conceded that “the new rates are probably more in line with international norms” (in Creamer 2011:*22 March*). While this may be true, one can also speculate that this revision formed a last ditch attempt by NERSA to hold onto the process they had initiated which was removed from their control in May 2011. The sudden downward revision may also have been an inevitable trade off for an increased allocation of renewable energy in the IRP 2010 (section 5.4). As Bank (1) stated in November (2010): “we are less worried about the REFIT tariff getting cut as we think that project developers, investors and lenders will accept this provided the allowed volume of MW in the IRP 2010 is increased. If the price goes down, the volume can go up and localisation can be phased in overtime”.

5.3.7 The elusive 'bankable PPA'[36]: whose risk?

The initial draft power purchase agreement (PPA) for REFIT drawn up in July 2009 by NERSA (2009b) was heavily criticised by developers and investors for allocating too much risk to renewable energy project developers as compared to Eskom who would be the buyer of power (Waller 2010:47). Banks insisted that the PPA be underwritten by government in light of Eskom's financial instability as this would legally enforce the government's commitment (Banks 1, 2). A joint response to the draft PPA was compiled by London and Johannesburg-based staff from an international legal firm in consultation with numerous private sector stakeholders (lawyer 1). This was financed by the World Bank under the DBSA-managed REMT (REMT 2008). It resulted in a detailed set of comments being submitted by REMT to NERSA as part of the public consultation process, the same law firm presenting on behalf of REMT at the public hearings on 3 September 2009.

Subsequent to this, the law firm was appointed by the DBSA "to carry out work from a private sector perspective on three PPAs, agreements on grid connection and the use of system, and a direct agreement with lenders. The law firm declined to act for the government on the grounds of conflict of interest with its private sector work" (Lawyer 1). In November 2010 mining industry expert (2) stated "NERSA did much work with REMT to put together an acceptable PPA. However this is now being entirely reworked by the Treasury". At end 2010 Webber Wentzel took up the role of legal advisor for the government-managed procurement process with other law firms appointed by government to assist with the process and documentation (DoE 1, section 5.4.2).

The inability of different stakeholders to agree over the apportionment of risk was a key reason for the stalling of the PPA. Lawyer (1) explained that there is no static definition of a 'bankable PPA'. "Whilst there are certain minimum requirements for a bankable PPA, Banks move towards and away from risk. When money is freely available, banks are less risk averse. When finance is tighter, they have much more stringent conditions". Treasury (1) stated that "we are trying to avoid a large burden on the country's balance sheet. To guarantee all of Eskom's risk is too much for us. However, the market won't accept Eskom's risk either". NERSA (1) stated that "the tendency of private sector investors is to shift the risk. They do not want to absorb it... You have to be careful not to get ripped off".

[36] A popular term used at conferences of investors and industry

5.3.8 Power purchase and a shift in Eskom's monopoly

The Independent Systems and Market Operator (ISMO) is of supreme importance to IPPs as it indicates who will be the off-taker of their power and with whom they will sign the PPA. In September 2007 cabinet designated Eskom as the single buyer of independent power (Department of International Relations and Cooperation 2007) to be carried out by the Single Buyer Office (SBO) housed within Eskom's System Market Operator Division[37]. However during REFIT negotiations, Eskom's position as the majority generator and buyer of power was criticised on the grounds that its position as 'player and referee' (DEA 1) posed a serious conflict of interest and that a neutral power purchasing agency was required. Without certainty on this issue IPPs stated their reticence to proceed. For instance in February 2010 Mainstream Renewable Power's Irish CEO, Eddie O' Connor was quoted as saying "There is no rule to say who pays for the electricity and we cannot get access to the grid that is owned by Eskom. There are a lot of uncertainties that need to be cleared...Eskom does not want renewables. They do not want competition" (in Njobeni 2010:*12 Feb*).

Wind IPP 3, speaking in a personal capacity said that the delay in establishing the ISMO and the failure to publish the appropriate legislation "illustrates a desperate protection of Eskom's monopoly". S/he added, "if/when the mechanism is implemented, it would be responsible for planning and managing transmission, the IRP and the single buyer. Transmission sits between generation and distribution. If you put transmission into the ISMO then Eskom will be broken up and ISMO will become a powerful entity. The ISMO is being postponed indefinitely. Who has the most to loose from setting up the ISMO? And who has the most to gain? ISMO is a critical decision".

Similarly NERSA (1) stated, "as long as [transmission and distribution infrastructure] is owned by Eskom, the private sector will be considered by Eskom as a competitor who will take away its business and threaten its survival. Eskom will always play dirty tricks as a monopoly and put up barriers to access. The will employ a 'low cost leadership position' and charge low tariffs because they are subsidised by the state. As long as they charge low tariffs, it will not be profitable for the private sector to try to enter that space. So the appetite for private sector investment is eroded from the outset. The monopoly will use this to its advantage as a way of protecting themselves". Treasury (1) also stated "Eskom is in conflict as developer, procurer, negotiator, evaluator etc.

[37] http://www.eskom.co.za/c/73/ipp-processes/

However because Eskom are so powerful, they can deny people access to the grid if they are unhappy. So there is a balance to be struck.” In November 2010, DoE (1) clarified that the main resistance within Eskom to the ISMO is that it means that there will be an independent entity overseeing the performance of their power stations. S/he said: “Eskom will have to join the queue. The existing fleet will be transferred, but what is critical is the performance. If you do not deliver you will not be paid. They will also have a PPA like any IPP.”

In 2010 the government announced on a number of separate occasions that an ISMO separate from Eskom Holdings would be set up, including in President Zuma’s annual State of the Nation address (Zuma 2010). However in August 2010 Eskom was quoted as saying that it could take up to five years before the ISMO is completely independent (Donnelly 2011). Under the new IPPPP Eskom is still the current buyer of power and steps to establish a single buyer and unbundle the transmission system away from Eskom continue. On 13 May 2011 the DoE published the ISMO Establishment Bill in the Government Gazette (DoE 2011c), formally introduced into parliament on 9 March 2012. How this is implemented will be key to the break up or continuation of Eskom’s monopoly.

5.3.9 RE IPPPP summary

It is evident that the RE IPPPP has crossed the boundary from the niche to regime since its inception in 2007, which has been paralleled by shifting attitudes within government to renewable energy. This also illustrates the important role played by landscape actors such as bilateral donors and technical assistance in supporting such innovations. The RE IPPPP is a clear example of Geels and Schot’s (2007:400) assertion that niches are often supported by outsiders and get traction with the regime when there are gains to be made. Delays to the process relate to Meadowcroft’s (2011:73) reference to the strong “tendency to defer decisions” by entrenched interests and Heclo’s (1972 in Ham and Hill 1993:12) assertion that political activity is concerned with maintaining the status quo and resisting challenges to the “existing allocation of values”, with various government departments resisting pressure to take decisions and move the process forward.

RE IPPPP has also illustrated shifting power dynamics between and within different government departments in that a process that was initiated by NERSA acting beyond its remit and supported by Eskom was eventually seized by the DoE and Treasury when it became evident that demand from privately generated power could no longer be ignored. The RE IPPPP also fits with Geels’

(2011:25) assertion that it is unlikely that "environmental innovations will be able to replace existing systems without changes in economic frame conditions (e.g., taxes, subsidies, regulatory frameworks). These changes will require changes in policies which entails politics and power struggles, because vested interests will try to resist such changes". As we have seen, the role of property rights drawn up by lawyers has been fundamental in consolidating the emerging niche and setting the terms of the policy. That said, as the next section considers, "the 'right' policies may be inadequate to bring about purposive change in the face of powerful actors contesting future directions and competing over material commitments" (Scrase and Smith 2009:710).

Box 5.2: International cooperation and donor assistance

"International donors are pushing green agendas. They spent thousands pushing capacity in the DoE, particularly the Danish Embassy" Energy analyst (1)

As this thesis documents, finance and technical assistance from foreign donors largely Denmark and Germany has heavily influenced South Africa's renewable energy development. They have played a considerable role in shaping policy, directing research, and training staff in Eskom, NERSA and the DoE as well as a limited amount of project development. Technical and financial support from Denmark began in earnest in 2001 with the Capacity Building Project in Energy Efficiency and Renewable Energy (CaBEERE), funded by DANIDA which ran until 2005 (DME 2002) to which the Danish government contributed 27 million Danish Kroner (approx $5.2 million). While the programme was more successful in energy efficiency initiatives than in renewable energy (South African energy specialist 1), it still led to the publication of the 2003 Renewable Energy White paper and at its completion had undertaken resource studies for all renewable energy technologies and documented that the country had enough wind for commercial application, recommending a feed-in tariff as the way to implement this.

German GTZ's (GIZ since January 2011) involvement has included technical assistance and funding for a 2009 study on integrating wind energy into the grid in the Western Cape. In 2010 GTZ supported a capacity credit study for wind together with Eskom, the DoE and South African company Windlab (chapter 6). GIZ also has a project within the DEA on the development of the climate change green paper, assisted with setting up of the South African Wind Energy Centre (SAWEC) and supported the visit of Chinese experts from a GIZ supported programme to South Africa in November 2010. To a lesser extent technical assistance has also been provided by the DBSA the Global Environment Facility and UNDP. The World Bank and the African Development

Bank have also been involved, for instance with the renewable energy market transformation project, but their assistance for renewable energy has been vastly outweighed by their support for coal (chapter 8).

Though not specific to renewables, French influence in the energy sector is also clear. For example French company Alstom, can be described as a niche, regime and landscape stakeholder with a diversity of interests in South Africa's power sector. As mining industry expert (2) observed, "Alstom is a major controller of South Africa's power. It is involved in OCGT, nuclear, coal, solar and wind in South Africa. The French are becoming very heavily involved in South Africa's energy sector. It feels like they own it. This drive and involvement in the country is quite recent. Alstom is owned by the French. AFD gave 350 million euros to the Sere Wind Farm. Siemens, Alstom and ABB (a conglomeration of German and other European companies) are three companies who are heavily involved in SA's power sector. ABB sold its power assets to Alstom."

Less explicit cooperation from China and India is also evident. China has a growing involvement in South Africa's infrastructure development including nuclear energy (*BuaNews* 2012), with increasing financial and trade relations between the countries. The country has been South Africa's primary trading partner since 2009 and is a key source of investment. In the first half of 2011, 13.4 per cent of South Africa's exports went to China while 13.2 per cent of South Africa's imports came from China (Economist Intelligence Unit 2011:34). The industrial and commercial bank of China acquired a 20 per cent stake in Standard Bank in 2007 (Standard Bank 2012) in order to pursue joint investment in the African continent to meet China's growing demand for mining, metals and hydrocarbons (Fine 2008). China's increasing influence over South Africa was also reflected by the failure of South African authorities to grant the Dalai Lama a visa on time to celebrate Archbishop Desmond Tutu's 80^{th} birthday in October 2011 (Ibid p30).

5.4 Integrated resource plan 2010: high carbon lock-in or low carbon transition?

5.4.1 Electricity generation: the politics of planning

"*For too long, vested interests have kept renewables restricted to niche applications while persuading our decision-makers that the exploitation of stock energy, with its higher short-term profit to investors, is the only possible route to development. Yet if the next major phase of energy investment goes to conventional energy (extraction of stock energy), we may well see massive stranded assets as fossil fuel prices escalate and the poor remain dependent on a centralised energy system that they cannot raise the cash to access*" (Earthlife Africa Johannesburg, in Banks and Schäffler 2006:iii).

South Africa's second Integrated Resource Plan (IRP 2010) approved in May 2011 is an electricity master plan covering total generation requirements from 2010 to 2030 which plans to double national capacity from approximately 41000 MW to 89532 MW by 2030. This has been celebrated in some arenas for diversifying the country's energy mix away from coal and allowing 23559 MW of grid-connected renewable energy of which the majority will come from IPPs. However figures 5.6 and 5.7 reveal that while renewable energy will account for about 40 per cent of South Africa's *new* generation capacity over the next 20 years (of which 9200 MW wind, 8400 MW PV and 1200 MW CSP) (DoE 2011f:14), 16 383 MW of new coal will also be introduced, accounting for 29 per cent of new generation capacity (Ibid). Hence while the proportion of coal in the overall electricity mix decreases from 85 to 46 per cent (Ibid), in absolute terms it will increase from 34952 to 41071 MW. The final plan claims to be consistent with an emission constraint of 275 million tonnes of carbon dioxide annually after 2024 (Ibid p6) though the actual emissions associated with it have not been specified (Winkler 2011). An ambitious nuclear fleet is also planned whose cost has yet to be determined. A project must be in the IRP in order for NERSA to be able to grant it a licence (Pienaar and Nakhooda 2010), though according to the latest new generation regulations for electricity the minister holds the right to license generation capacity if s/he deems fit.

This section examines the way in which IRP 2010 as a crucial national planning instrument for electricity was negotiated. It was the outcome of a delayed and protracted process battled in earnest throughout 2010 as part of a stakeholder engagement process that included coal, renewable, nuclear industries, energy-intensive users, financial stakeholders, civil society and academics. As this chapter discusses, government was heavily criticised from all sides for the rushed nature of the plan's negotiation process, the lack of transparency of critical assumptions, problems with its methodology and input parameters, costs, the overall energy mix, the feasibility of the plan and its potential impacts on the poor (Lund 2011). Despite this, it was considered by many stakeholders as a significant advance on previous electricity planning processes (Hughes 2010, Mainstream Renewable Power 2010b). Nakhooda (2011) adds that while the process was dominated by relatively specialised stakeholders able to engage with the inevitable technical complexity of electricity planning, opening it up to public participation still sets an important international precedent. Though not explicitly recognized thus, it could be considered an example of Transitions Management discussed in chapter 3.

IRP 2010 claims to "indicate a balance between different government objectives, specifically economic growth, job creation, security of supply and sustainable development" (DoE 2011f:13). With such potentially conflicting objectives in mind this section is particularly pertinent to the question, *how are environmental, industrial, social, economic and political priorities reflected in energy decision making in South Africa?* In light of the scale of the IRP and its consultation process, I have been unable to undertake an exhaustive analysis of all its aspects and dynamics. Instead, in order to illustrate key examples of national debates on electricity policy and planning, I focus on: transparency and participation; the role of scientific and technical expertise in the modelling and policy-making process; the introduction of nuclear energy; energy efficiency and demand-side management; and the demand forecast upon which the plan is predicated.

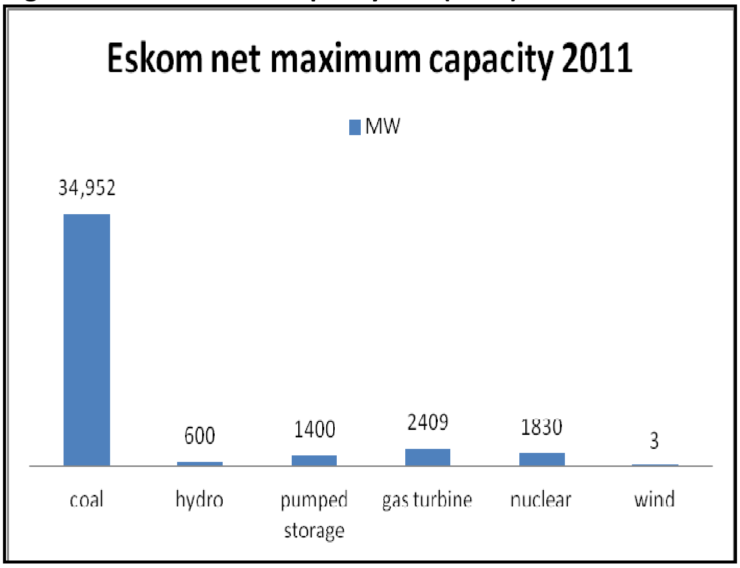
On a methodological point I carried out a textual analysis of a large volume of public documents issued by the DoE and other government departments; presentations at IRP hearings; articles and statements in the press; and interview data. As written inputs to IRP 2010 were not generally publicly accessible, I have relied on selected powerpoint presentations given at public hearings in Pretoria in June and in Johannesburg, Durban and Cape Town in November/ December 2010. These were made available on the DoE website dedicated to the IRP consultation process[38]. Presentations were made by: renewable energy companies and related national industry associations; coal mining companies and fossil fuel industry bodies; energy-intensive users; nuclear energy companies; private banks; NGOs and community groups; and academia. While written inputs by civil society to the IRP process were easy to access and largely public, it is clear

[38] www.doe-irp.co.za

that other inputs, particularly of heavy industry were carried out behind closed doors and in the case of the technical advisory team (section 5.4.6) subject to confidentiality agreements. It is also the case that evidence either does not exist or was beyond my access for invisible and informal channels of influence over the DoE and Eskom, the two main departments implementing the plan. I was present at the hearings in Cape Town in December 2010

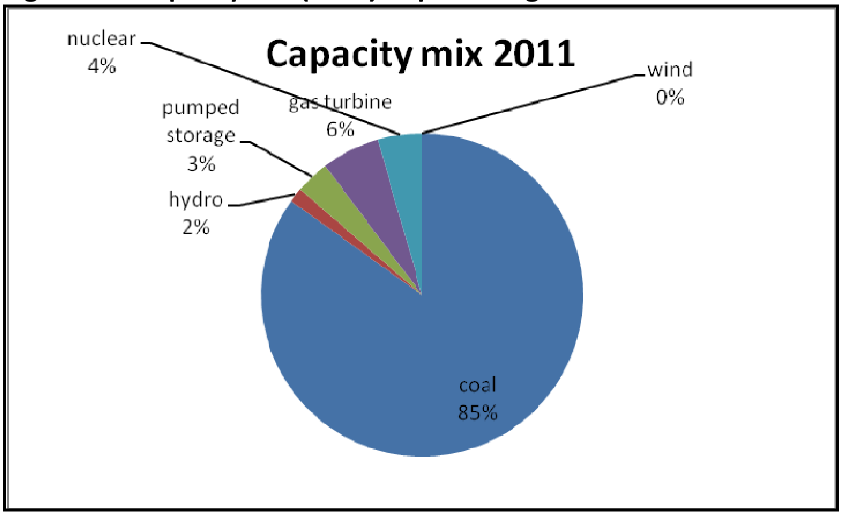
A broad spectrum of civil society organisations made significant inputs to the IRP 2010 including groups and networks with a grassroots community orientation such as Climate Justice Now (Western Cape), Earthlife Africa (Johannesburg), South African Faith Communities Environment Initiative (SAFCEI) and the South Durban Community Alliance and NGOs operating in the advocacy space at national and international levels such as WWF-SA, IDASA and Greenpeace. Of note is that according to publicly available information, union input was largely absent (see DoE 2011e).

Figure 5.4: Generation capacity mix (2011)



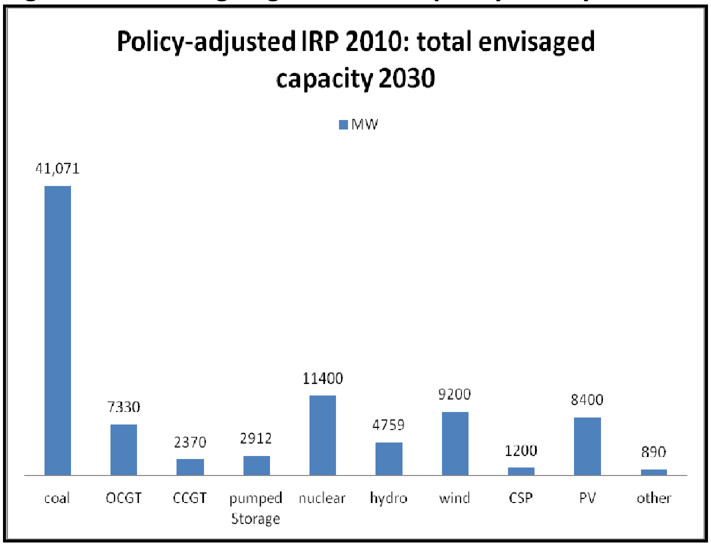
Source: Adapted from Eskom (2011:13)

Figure 5.5: Capacity mix (2011) as percentage



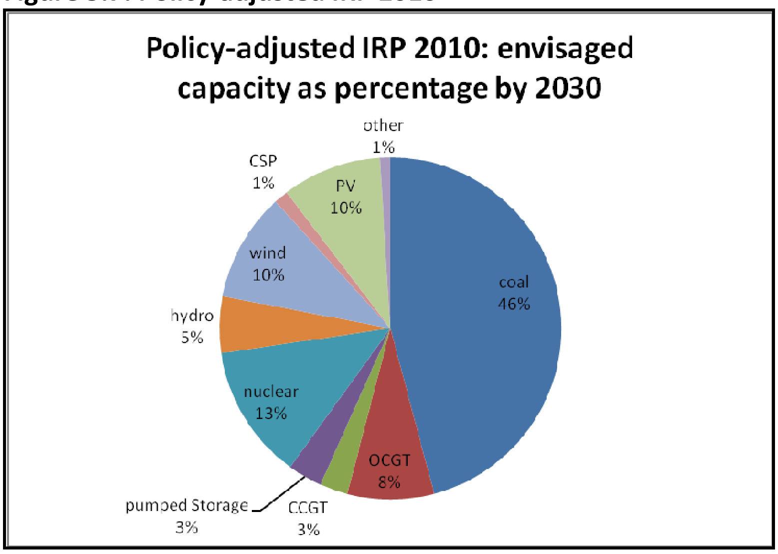
Source: Adapted from Eskom (2011:13)

Figure 5.6: Envisaged generation capacity mix by 2030



Source: Adapted from DoE (2011f:14)

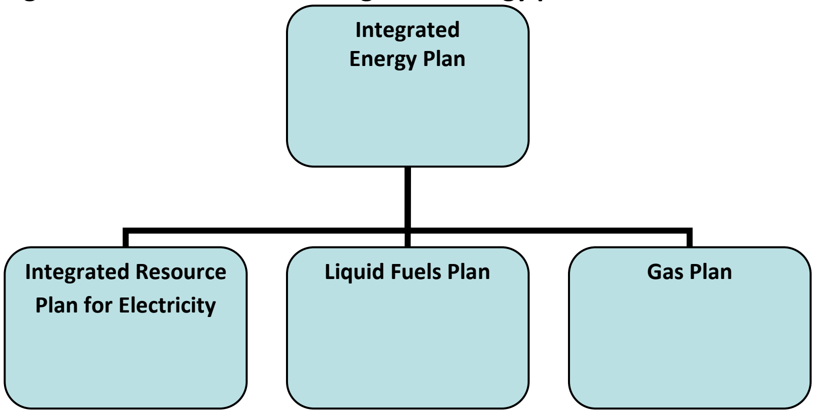
Figure 5.7: Policy-adjusted IRP 2010



Source: Adapted from DoE (2011f:14)

5.4.2 Background

Figure 5.8: South Africa's integrated energy plan



Source: Adapted from DoE (2010f)

The IRP is a subset of the integrated energy plan (IEP, figure 5.6), required under the National Energy Act 2008. This requires that the minister review and publish it every year, that it be publicly consulted on and that it incorporate projections of supply and demand for 20 years (The Presidency 2008:Chapter 3). However as the IEP was yet to happen while the IRP was being drawn up, the process has been described as "back to front" (Greyling 2010). In a letter to NGOs on 21 June 2010, Energy Minister Dipuo Peters herself conceded that "logically, the development of the IEP should precede the development of the IRP" in order to ensure that the "IRP is aligned with the broader Energy Plan for the country, of which it is a sub-set" (Peters 2010b).

The IRP came under one of nine work streams under the Inter Ministerial Committee on energy which was chaired by Public Enterprises Minister, Barbara Hogan until she was replaced in November 2010. Funding is a serious and unresolved issue with regards to this plan and the majority of projects are likely to be privately funded with the exception of nuclear and Eskom's committed capacity expansion. The IRP was produced by Eskom's Systems Operation and Planning Department in consultation with the DoE and NERSA (DoE 2010c:1).

5.4.3 IRP 1: "Short term plan with long-term implications"

The first IRP, just three pages long to cover the period 2010 to 2013, was published on 31 December 2009 (DoE 2009d) in the government gazette. This took place at a time when many South Africans were on summer holiday and therefore unaware of its approval. It was pushed through to comply legally with the subsequent electricity tariff increases approved by NERSA in February 2010, and so that the subsequent parliamentary approval for Medupi and Kusile would be justified (Pienaar and Nakhooda 2010, Trade and Industrial Policy Strategies 1). This three page document preceded a longer one written in November 2009 which was leaked but never formally published. In January 2010 Peet du Plooy, then WWF's Trade and Investment advisor was quoted as saying that the three-pager effectively rubber-stamped the longer unpublished draft and "consisted of little more than an extract from one of the tables in the initial document, with modification to the energy savings expected under Eskom's Demand-Side Management programme the only new addition" (in van der Merwe 2010d). The document was re-issued on 29 January 2010 with minor changes (DoE 2010d). It was described by bilateral donor (4) as "a short-term plan with long-term implications". As the REFIT projects were grouped together with co-generation projects (under the MTPPP) the quantity of renewable energy in this plan went unspecified, with the exception of 150 MW for the Sere wind farm and Upington CSP plant which were not built in 2010 as assumed in table 5.4. According to (Pienaar and Nakhooda 2010:3) the plan was inconsistent with national greenhouse gas emission reduction targets outlined in the LTMS.

Table 5.5: Projected energy mix 2009-2013 from IRP1

	Current Programmes																
	RTS capacity	Medupi	Kusile	Ingula	DoE, OCGT, IPP	MTPPP, REFIT	Sere, CSP	Other capacity and decommissioning	Total	Total system capacity	Peak demand (net sent out) forecast)	Demand side management programme	Net peak demand forecast (after DSM)	Reserve margin	Annual energy (net sent out) forecase	Demand side management programmes	Annual energy (net sent out) forecast
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	%	GWh	GWh	GWh
2009	772	0	0	0	0	0	0	0	772	44157	37845	432	37413	0.1802582	248.517	428	248.069
2010	683	0	0	0	0	343	150	30	1206	45363	39432	923	38509	0.17798437	258.705	1.864	256.84
2011	404	0	0	0	1020	518	0	55	1997	47360	40194	1343	39571	0.19683507	267.771	3.453	264.319
2012	0	738	0	0	0	284	0	0	1022	48382	42373	2118	40255	0.20188796	276.705	6.561	270.145
2013	0	738	723	666	0	0	0	0	2127	50509	44238	3056	41182	0.22648244	288.086	10.642	277.444

Source: reproduced from DoE (2009d)

5.4.4 IRP 2010: Timing, participation and transparency

Following strong public pressure from civil society, business and the media (Nakhooda 2011:11) in February 2010 the DoE announced that a public consultation process would be initiated with the aim of completing the IRP by June 2010 (Davenport 2010). In the event the final plan, referred to as the 'Policy-Adjusted' IRP (DoE 2011f) was promulgated almost a year later in May 2011. Throughout the consultation civil society groups and academics pushed for an extension to the timeline so that the IRP could be aligned with the revision of the renewable energy white paper, the national climate change strategy and ensure sufficient time for public comment (Earthlife Africa 2010b, Bailey 2010, WWF-SA 2010). Meanwhile according to energy-intensive user (1) government was keen for the plan to be approved as quickly as possible in the “rush to create more generation capacity” and in the interest of finalising agreements with international suppliers and contractors for new coal and nuclear build.

The first ‘stakeholder plenary sessions’ were held in June 2010 in Pretoria and extended from one to two days at the last minute to accommodate the volume of interest. These heard a total of 32 presentations (DoE 2010b) and focussed on the input parameters for the IRP modelling (DoE 2011f:7). According to the DoE (2011d) in its briefing to the parliamentary portfolio committee on energy in January 2011, at the first round of consultations 81 submissions were received and “831 specific inputs based on the parameter sheets were captured and analysed”, with the major contributors being 67 NGOs and civil society organisations, 63 academics and consultants and 70 organisations. These submissions were not made publicly available and how they contributed to the IRP 2010 was not clear. Lance Greyling of the Independent Democrats pointed out that of the original 871 (sic) comments, 61 per cent had received no response. He said that “It was not enough for the Department to say that it was capturing all the comments. The Department must give some indication that it had considered these comments and that it had given some kind of response” (in PMG 2011). On 8 October the DoE put forward its ‘Revised Balanced Scenario’ of the Draft IRP 2010 (DoE 2010c) with a 30-day comment thirty day period to run until 10 November 2010, subsequently extended to 10 December 2010. Four days of public hearings in Cape Town, Durban and Johannesburg were held at end November/ start December 2010.

Transparency was one of the key concerns cited throughout the process in particular over a lack of clarity over the IRP’s critical assumptions (Hughes 2010). In June WWF-SA (2010b) said that it was “disappointed that the documentation provided to date, as well as the way in which documents have been released, does more to obfuscate the process and issues, than to enable informed engagement in transparent and accountable integrated resource planning”. In October 2010 an NGO report stated that the DoE failed to respond to many of the comments made in relation to its input parameter documents and that there was no recognition as to whether the technical inputs had been included in the modelling or even meaningfully considered (McDaid et al 2010). In its June 2010 presentation the EIUG (2010a) commended the government on its transparency but stated that it should publish a summary of submissions from the round of consultation and be transparent about the criteria it had used to evaluate scenarios. Sappi, the global pulp and paper giant and EIUG member also called for greater clarity over the 29 parameters issued and for better structure over the way in which they were presented and the ability of people to comment (Sappi 2010).

The DoE's commitment to participation and transparency was criticised by some and welcomed by others. For instance in November 2010 Energy-intensive User (1) referred to it as "the first consultative electricity plan that South Africa has ever had". In August 2011 Standard Bank's head of energy, utilities & infrastructure Paul Eardley-Taylor said "the IRP is an impressive document, both the speed of the document's promulgation and the transparency of the process," (in Pretorius 2011). In November 2010 the DoE (2010e) stated "It is clear that the public relished the participation process and its continued use in long-term planning must be ensured". Energy analyst (1) explained "this public process has allowed the DoE to learn something about what they are in control of. It has exposed them to information".

The October 2010 report "*Power to the People: raising the voice of civil society in electricity planning- IRP 2010 inputs and departmental responses*", endorsed by 28 South African faith-based, environmental and social organisations called for national electricity planning to be developed within the context of "broader sustainable development goals" and to be connected to "various other processes aimed at addressing these issues arising from our historical legacy" (McDaid et al 2010:4). Its main concerns based on the first round of consultations until June 2010 were related to the nature of the IRP process, including failure to uphold national laws on public participation which are central to the post-apartheid regime's principles of empowerment and democratisation such as the Protection of Administrative Justice Act (PAJA) (Nakhooda 2011:8), issues of transparency and representativeness and the inability of the general public to be able to participate, particularly given that the main opportunity to do so was via the internet which would thereby exclude the majority of South Africans. The inability of rural communities who are most affected by the rising electricity prices and poor connections was a key concern as was the complexity of the process which restricted the ability of those with limited education to engage with it (Anti-Privatisation Forum 2010).

5.4.5 Parliamentary oversight

The Parliamentary Portfolio committee on energy has a formal oversight role over the Department of Energy. However the extent to which the committee complies with this role is questionable. For instance the first parliamentary briefing on IRP 2010 wasn't held until 3 August 2010 and was criticised for coming too late, after the first hearing and the critical modelling exercises had taken place (Greyling 2010). Lance Greyling, MP for the Independent Democrats and member of the committee said “I would go so far as to say that Parliament - and, particularly, the energy committee - has been negligent in its duties at providing proper oversight over the energy sector; and in particular, energy planning” (Greyling 2010). There are also questions over the adequacy of the technical expertise of some of the members of the committee. For instance at one meeting in June 2010 one member requested clarification over the difference between a wind turbine and a hydro-electric turbine (PC Energy 2010a). At the same meeting a discussion on PetroSA’s offer to provide committee members with tickets to the World Cup was held, thereby raising questions of influence from hydrocarbon interests. The committee’s timing was better in the second round, however, with a second parliamentary hearing held on 26 January 2011 (DoE 2011e) which gave a summary of inputs and key debates throughout the consultation process.

5.4.6 Technical advice: political process

Essentially then, the department has succeeded in locking all vested-interest groups into the Technical Advisory Panel and even though they claim that it is just about technical expertise, we are not allowed to see the minutes of these meetings; nor are we allowed to see the thinking behind the different energy assumptions that they come up with (Greyling 2010).

This section uncovers how the apparently technical exercise of electricity planning can be inherently political given the strong influencing role of vested interests in this case. A technical advisory group set up to provide inputs into the modelling of the plan’s input parameters was criticised in the media (Yelland 2010), by civil society (McDaid et al 2010) and the renewable energy industry (Mainstream Renewable Power 1) for consisting largely of representatives from government, Eskom, coal miners and the Energy Intensive User’s Group. 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[39], civil society or experts from the fields of social impacts, gender equity and environmental quality (see table 5.5). Confirmation of the committee’s existence and the names and affiliation of its members was only made public in June 2010 after the Minister of Energy responded to civil society’s request for information (see Peters 2010b). Consequently, concern was expressed 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).

[39] While the DoE’s letter listed Glynn Morris from renewable energy company Agama Energy as a member, it was later confirmed that he had not in fact been invited to sit on the panel (Greyling 2010).

The committee's meetings and its minutes were not made accessible to the public and all of its members signed confidentiality agreements with the DoE (Peters 2010b). A letter from the Minister's office of 21 June 2010 responding to civil society's requests for information on the committee took "exception to the classification of [its] Technical Task Team as secretive", stated that the members of the task team were chosen for their technical expertise, and that they "are not meant to represent the interests of their constituencies/employer organisations" (Peters 2010b). The IPP Mainstream Renewable Power (2010) stated that the "inaccuracies and assumptions in the modelling could be better addressed if the renewable energy industry were able to participate as part of the technical task team".

The constitution of this team illustrates 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, despite the incremental steps made by the emerging renewable energy industry. Following mining industry expert (2) the influence of this team could suggest a lack of expertise of Eskom's Systems Operator carrying out the IRP on behalf of the DoE: "the chairman of the technical task team of IRP2 has never built a power station, the Systems Operator have never built a power station either. They are all demand side specialists and have based their assumptions on EPRI reports. The Systems Operator is a black box. It doesn't distinguish between the needs of different types of plant and it doesn't understand local risks either". However rather than a lack of expertise, could it instead be a lack of bargaining power on Eskom's part in the face of the DoE backed by energy-intensive interests? Energy analyst (4) stated that the main lack of expertise lies with the DoE, "Eskom writes the IRP, it goes to the DoE who checks it with its little 'in group', largely coal miners and then carries out consultation with identified stakeholders. These are people with whom the DoE has a relationship. It is not necessarily a big conspiracy, but there is a serious lack of capacity in the DoE."

This example speaks to the assertion of Keeley and Scoones (2003:5) that "a lack of interrogation of the nature of expertise in the policy-making process conceals important power dynamics". It can further be considered an example of "weak" ecological modernization (Dryzek 2005:173) which sees a technocratic/ corporatist style of policy-making, monopolized by scientific, economic and political elites. It also relates to discussions over the definitions and use of technical expertise employed and/or created by government for essentially furthering political ends. Jasanoff (2003:160) surmises that "far from being neutral and apolitical, scientific research follows the preferences of those with the power to set research agendas", and that "expertise has legitimacy only when it is exercised in ways that make clear its contingent, negotiated character and leave the door open to critical discussion”.

Table 5.6: The DoE technical task team		
NAME	SECTOR	INSTITUTION/ AFFILIATION
Neliswe Magubane	Government	DG Dept of Energy
Ompi Aphane	Government	DoE
Ria Govender	Government	DoE
Thabang Audat	Government	DoE
Kannan Lakmeerharan	State Enterprise	Eskom systems operations and planning
Callie Fabricious	State Enterprise	Eskom planning and market development
Mike Rousouw	Business – coal	Xstrata
Ian Langridge	Business – coal	Anglo American
Brian Day	Business - coal/RE	Exxaro (see chapter 4)
Piet van Staden	Business – fossil fuels	SASOL
Kevin Morgan	Business - smelters/coal	BHP Billiton
Paul Vermeulen	Local govt-owned company	City Power (Johannesburg)
Doug Kuni	Coal-related business	SA Independent Power Producers Association
Roger Baxter	Mining-related business	Chamber of Mines
Prof. Anton Eberhard	Academic	Graduate School of Business, UCT
Shaun Nel	Business - project manager	Gobodo systems (Eskom is listed [on their website] as one of their clients)

Source: McDaid et al (2010)

5.4.6.1 Modelling

The 29 parameters drawn up with inputs from the technical advisory group and made available by the DoE in May 2010 were divided into matters of: i) demand: such as price elasticity of demand and energy efficiency ii) supply: such as: reserve margin, discount rate and exchange rate iii) externalities: such as climate change and carbon tax and iv) key outputs: such as base scenarios and rate of inflation. While a number of participants at the hearings felt that publication of the IRP’s parameters was a breakthrough in terms of transparency others found the modelling to be inaccessible and highly specialised.

For example the University of Cape Town’s Energy Research Centre (ERC) found that while the report by US-based Electric Power Research Institute (EPRI) was a good basis to assess technology costs, it was difficult to comment at the time of the public hearing in June 2010 in light of its complexity and because the full report had been made available only one day before (Hughes 2010). Hughes (2010) also pointed to major inconsistencies between the previously-released executive summary and the full report, for instance a tripling of coal costs and that the modelling process had failed to include technology learning rates, which would make wind competitive with nuclear by 2014. It was also unclear if price elasticity would be incorporated into the modelling. In December 2010, Pienaar and Nakhooda (2010:6) asserted that "the comparative life cycle costs of conventional and renewable energy technologies are arguably the most important input into the IRP 2 modelling process as the emergent scenarios are largely being assessed on the basis of expected costs".

EarthLife Johannesburg added that the modelling had failed to include externalities in the cost of coal, including mono-nitrogen oxides (NOx) and sulphur oxides (SOx). In June 2010 Mainstream Renewable Power (2010a) stated that the key parameters were "informed by myths around RE technologies and their benefits" and that fossil fuel externalities such as price volatility and carbon taxes had not been included. In sum it found that the modelling relies on an "outdated least cost/levelised cost approach" and would not be able "to accurately model the proper value of a fully diversified supply side mix".

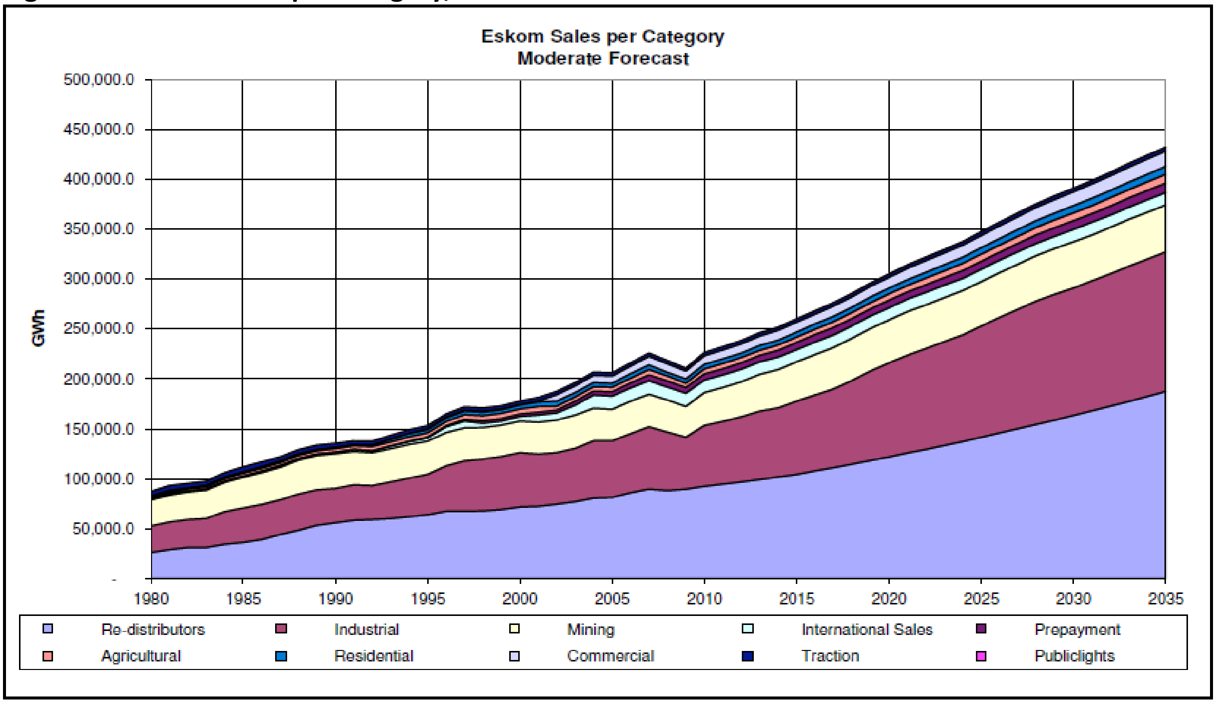
Energy analyst (2) described how the IRP's "base plan and selected scenarios" was modelled on an expansion planning software tool named PLEXOS@R (DoE 2010g:3)which is "very expensive and proprietary" when compared for instance to the IEA's Markal model. The Markal model is used extensively internationally, is the official model used in the UK and is low cost, easy to buy, install and run (Energy Analyst 2). S/he added that "Eskom have hardly begun to use PLEXOS@R capabilities" and had not made the model available. In response WWF-SA commissioned a counter model called the Sustainable National Accessible Power Planning (SNAPP) tool developed by the University of Cape Town's ERC. Freely available on line, this tool allows users to "interrogate proposals for South Africa's new build plan using objective cost analysis, environmental impacts and the reliability of the system" (WWF 2010:22). It allows members of the public to examine the "assumptions and input data and resulting technology choices" of the IRP "without undertaking the complex modelling on which the plan is based". A subsequent report by WWF-SA shows that investing in renewable energy (wind and solar) along with energy efficiency in industry, would provide cheaper electricity for South Africa by 2020 than investing in coal or nuclear power (WWF 2010). Relevant to this point is Jasanoff's (2003:160) assertion that "Science invoked to support policy tends to unravel under the stresses of politics: those wishing to question a given scientific interpretation can generally find errors, hidden biases or subjective judgements that undercut their opponents' claims to truth and objectivity".

5.4.6.2 Demand forecast: "Business as usual on steroids"

Despite significant changes proposed to the generation mix IRP 2010 is based on assumptions that electricity demand is almost set to double by 2030, from 260 TWh in 2010 to 454 TWh in 2030. Winkler (2011) explains that "the growth in electricity demand outweighs the reduction in the CO_2 intensity of electricity" and would result in "GHG emissions from electricity generation increasing from 237 million tons of CO_2 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" (Ibid 2011). This doubling in electricity capacity serves to fuel a demand forecast which, based on the moderate energy forecast in the IRP 2010's Revised Balanced Scenario (DoE 2011f:36) of a 4.51 per cent GDP growth rate (Eskom Systems Operation and Planning 2010:2), anticipates a double fold increase in mining and minerals beneficiation and coal-to-liquids technology (figure 5.7). This was referred to by a representative of the City of Cape Town's climate and energy branch at December's IRP 2010 hearings as "*business as usual on steroids*" (in Donnelly 2010).

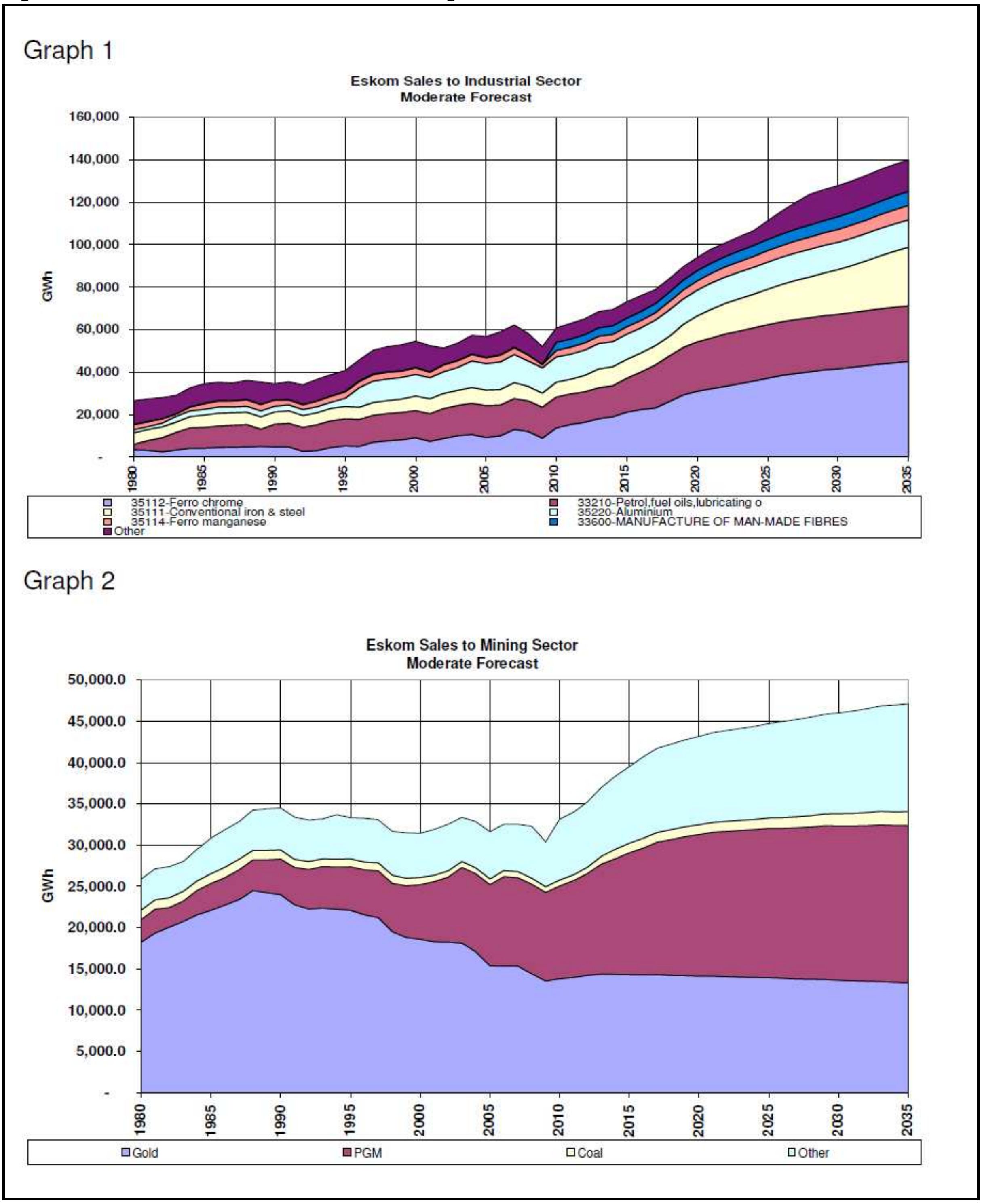
In June 2010 the EIUG (2010a) asserted that it is "essential that we all understand and accept the growth assumptions" of the IRP which are its "key parameter". This was bolstered by statements in September 2010 by executive director of Xtrata Alloys Mike Roussow who asserted that mining and minerals beneficiation has a major role to play in the economy and nation-building, for which energy is essential (Creamer 2010:*28 Sept*). However, despite the EIUG's demands being met in the subsequent demand forecast, their quest to achieve national consensus over such high growth assumptions was challenged by a number of submissions that questioned the blind acceptance of the need to double generation capacity (in DoE 2011f:10, Greyling, in PMG 2011). The Cape Town Chamber of Commerce (2010) for example stated that the "energy plan may provide for more power than we actually need". Details of the demand forecast were not made public, which argues Nakhooda (2011:15) "raises further questions about its reliability, and made it all the more difficult to propose enhancements to the same". Energy analyst (1) stated that the demand forecast was based on a rate of GDP growth which was "politically, not analytically derived".

Figure 5.9: Eskom sales per category, moderate forecast



Source: Eskom Systems Operation and Planning (2010:14)

Figure 5.10: Eskom sales to industrial &mining sector moderate demand forecast for IRP 2010



Source: Eskom Systems Operation and Planning (2010:15)

5.4.7 Renewable Energy: increased allocation

Throughout the IRP consultation process renewable energy IPPs argued that the allocation should be increased given that IRP caps renewable energy participation once targets have been reached, thereby limiting how much NERSA can license and perpetuating South Africa's high carbon and nuclear technological trajectory. The final version of IRP 2010 went some way to responding to this call by increasing the renewable allocation to over 23000 MW (Creamer 2011:*22 March*, see table 5.6). The final version also includes solar PV as a separate technology option which according to the DoE was due to additional research on technology learning rates and the decreasing costs of the technology as raised in comments submitted (DoE 2011f:10,13). It also brought forward the construction "in order to accelerate a local industry" (Ibid p6).

Table 5.7: Renewable allocations in IRP 2010		
	October 2010 (DoE 2010c:17) (Revised Balanced Scenario)	May 2011 (DoE 2011f:14) 'Policy-adjusted' IRP 2010
Wind	4600 MW	9200 MW
Solar PV	600 MW	8400 MW
Solar CSP		1200 MW
Imported hydro	3800 MW	2609 MW
Renewables from 2020 (wind, solar CSP and PV, landfill, biomass etc)	7200 MW	
Total	16200 MW	21409 MW

According to the DoE at the public hearings in November/ December 2010, most respondents in the IRP consultation process called for a "low carbon economy" and for greater emphasis on renewable energy (wind, solar, geothermal and others), which many asserted could supply a range of 20–75 per cent of total energy by 2050 (DoE 2010e). Many respondents were strongly opposed to nuclear and coal as energy solutions (Ibid).

Vestas (2010) argued for increased amounts of wind on the basis that it is a clean technology, is quick to install, has no fuel costs, uses little water, allows for "diversified generation" and is flexible. SAWEA's paper, launched with an accompanying campaign website in May 2010 just prior to the IRP's first round of public hearings in Pretoria argued that wind energy could provide 20 per cent of South Africa's energy mix by 2025 (SAWEA 2010). In June 2010 SASTELA (2010) argued that CSP is able to produce peak, mid-merit and baseload power, does not require back up from other technologies, could provide double the amount of jobs per TWh than a coal-fired power plant and will come down in cost over the next six years. The solar PV industry which was largely absent from the June 2010 hearings provided more inputs in the second public comment period between October and December 2010, reflective of international trends in the increasing viability of the technology in light of decreasing costs.

In its December 2010 presentation Alstom also joined in calls for an increased commitment for national build of wind power to assist with investor confidence. It stated that the potential was far greater than that currently planned and that the transmission network permitting the initial phase should be increased to 1200MW. It made similar calls for solar and asserted that the current solar target would “not motivate localisation of technology” (Alstom 2010b).

In counter to these claims in December 2010 the EIUG stated that the quantity of wind and solar was very “ambitious” and queried the ability of wind to create new jobs. It also stated that the then generous feed-in tariffs (section 5.3.5) were not sustainable and that “new wind projects should compete on an equal basis with other generating types” (EIUG 2010b). It also found that the “carbon dioxide abatement policy is too aggressive and may not be affordable” (EIUG 2010b). Its December 2010 presentation emphasised the need “for available, reliable, base-load and internationally competitive power” (EIUG 2010b) in order to support the “country’s mining, minerals, manufacturing and beneficiation industries”, its key competitive advantage as recognised in the ‘New Growth Path’ (EIUG 2010b).

5.4.8 Independent coal

As discussed in section 4.6.3 electricity generation from small independent coal-fired power plants which allows for the possibility of selling electricity to a large industrial user via a ‘wheeling’ agreement has been offered as a faster solution to power shortages than the construction of large coal-fired power plants such as Medupi and Kusile (SAIPPA 1). The October 2010 Revised Balanced Scenario allowed for 5 GW of new coal capacity from private generators, in addition to Eskom’s Medupi, Kusile and ‘return to service’ power plants, to come on stream in the period 2027-2030 (DoE 2011f:11). However the final version of the IRP 2010 increased this amount to just over 6 GW and brought forward the construction of the plants of which the majority between 2019-2025 (DoE 2011f:14). This complied with requests from potential coal IPPs and was justified by the assumption that by bringing coal forward national emissions would peak by 2026 rather than 2030.

Exxaro (2010c) was a strong proponent of this argument calling for "new build of FBC [fluidised bed combustion][40] coal fired power by IPPs to come in earlier than the originally planned date". This it argued, would remove pressure from Eskom's ageing fleet, the already delayed Medupi and Kusile coal-fired power plants and possible delays in the nuclear construction programme. It would also reduce reliance on more expensive gas and diesel peaking plants, avoid the risk of supply shortfalls and allow for increased flexibility. It would also relieve Eskom's funding burden, reduce electricity costs to the consumer, reduce water consumption in that FBC is dry-cooled and create jobs. Exxaro demonstrated it would be able to provide over 1000 MW under private off-take agreements with energy-intensive users.

Similar arguments were put forward by the Fossil Fuel Foundation (2010) which also asserted that coal should not be phased out in favour of renewable and nuclear energies which still had some way to go to prove their financial and technological viability, or penalised by the premature imposition of a carbon tax. In December 2010 the EIUG endorsed the argument for own generation and competitive IPP power from coal which it said should be "maximised and not limited". EIUG also asserted that the country should import more coal power from the region, namely Botswana and Mozambique and maximise hydro imports (EIUG 2010b).

When interviewed in November 2010 the South African Independent Power Producers Association (SAIPPA) which consists of approximately 15 companies, mainly of coal-fired baseload and co-generation interests explained that it wanted a level playing field for IPPs as opposed the current situation that privileges Eskom. SAIPPA (1) said "if IPPs are allowed to bring in 4/5000 MW of power we would stabilise baseload and create a sufficiency reserve margin, particularly if there is slippage on Kusile and Medupi. We could do this within the LTMS. We would be moving 2027 earlier into our build programme. We would build it now so we wouldn't have to build it later. IPPs could produce as much as 3000 MW in cogeneration and 3-5000 MW in baseload capacity, as in coal and closed cycle gas turbines". SAIPPA (1) argued that the risks inherent in large-scale coal-fired power plants are greater than those of smaller-scale coal-fired and cogeneration IPPs.

5.4.9 Nuclear

"There has been no real debate over whether nuclear power should be an option that South Africa pursues: it appears that it will be pursued through political arrangements". Nakhooda (2011:17)

[40] FBC plants are more flexible than conventional plants in that they can be fired on coal and biomass, among other fuels. They also emit less sulfur emissions than conventional plants.

In the final ‘policy-adjusted’ IRP a nuclear fleet of 9.6 GW, to come on stream by 2023 was justified in the interests of security of supply “in the event of a peak oil-type increase in fuel prices”, the need for baseload power (DoE 2011f:11) and “to account for the uncertainties associated with the costs of renewables and fuels” (Ibid p6). Its implementation has since been delayed due to a safety assessment instituted following Japan’s Fukushima disaster (Creamer 2012:*29 May*). Following inputs from NGOs and academics in June 2010 who asserted that the nuclear power cost estimates in the EPRI report were “unrealistically low” (Nakhooda 2011:16), investment costs in the final plan were adjusted by a possible increase of 40 per cent in order to represent the technology of newer reactors (DoE 2011f:6).

South Africa currently has the only nuclear power plant in Africa, Koeberg in the Western Cape which began generating in 1984. A failed attempt to build the Pebble bed modular reactor under a bid with Westinghouse was abandoned in 2010 resulting in the loss of millions of dollars. Nuclear power development, which unlike the bulk of South Africa’s renewable electricity, will remain state-owned, has been a strong option for the DoE for a number of years and in a media briefing in March 2010, Energy Minister Dipuo Peters asserted that “the future was going to be nuclear” (in PMG 2010). In May 2010 the DoE’s Director General Nelisiwe Magubane justified the department’s support for the technology by saying "the department is being overwhelmed by input from the renewable energy sector, while the nuclear sector is silent, leaving the department alone to state the case of nuclear" (Prinsloo 2010). The comment by Anthony Butler of the University of Cape Town that South Africa’s nuclear programme is driven by the ANC’s desire to become a nuclear power is of note here (Butler 2012).

The French nuclear industry appears to have had a strong influence over South Africa’s nuclear energy development (Butler 2012, Faull 2011) as well as in its coal and renewable sectors (chapters 6, 8). In February 2012 France announced that it was ready to provide “comprehensive cooperation” to South Africa’s nuclear programme (Campbell 2012a). Such a strategy by French nuclear energy companies has been long standing. According to (Makgetla and Seidman 1980:113), during the 1970s “French companies became increasingly involved in providing nuclear technology for the South African regime’s programme” and in late 1970s South African mines signed 10 year supply contracts with France and Belgium for uranium. South Africa has the sixth largest reserves of uranium in the world.

At the IRP 2010 hearings in June and November, nuclear bodies argued that a nuclear fleet would provide cheap and predictable electricity, create jobs and localisation benefits, reduce carbon emissions, provide base load and security of supply and a safe source of electricity generation (NECSA 2010, NIASA 2010, Westinghouse 2010, China Guangdong Nuclear Power Group 2010). It would offer a stable supply, unlike "intermittent" renewable energy, would be cheaper to generate, and unlike renewables would not require the same level of upgrades to the national transmission grid (NECSA 2010, NIASA 2010). Localisation and job creation is also central to the DoE and Eskom's pro-nuclear discourse (Esterhuizen 2012b), and Eskom has reportedly claimed that South Africa's nuclear power programme could create 32000 jobs (Campbell 2012b).Another pro-nuclear argument is that it offers a 'clean energy' solution, relating to the use of 'clean energy' discourse with regards to Medupi (chapter 8). French company Alstom, the "world leader in clean integrated solutions" (Alstom 2010a) emphasised in June 2010 that if 10.5 GWe of nuclear is built then 54.6m tons of CO_2 would be avoided (Ibid).

How realistic is South Africa's ability to construct a nuclear fleet in line with the IRP is unclear. In November 2010 mining industry expert (2) stated "South Africa's capacity to undertake a nuclear programme is a huge issue. The country will have to get in the queue for equipment and construction and it will not necessarily be first in line. It is unlikely to get the six plants it hopes for". At the South African civil society Energy Caucus in September 2010, Professor Steve Thomas of the University of Greenwich, UK argued that "it is likely that South Africa would use Chinese or Korean technology, as this is cheaper than that from Western countries. South Africa would be buying technology from China that China bought from France in the 1970s. It is unlikely that it could then be brought up to the latest standards." (Thomas 2010).

A definitive cost for the construction of 9 600 MW nuclear power stations has still not been provided by the government though a R300-billion figure was outlined in National Treasury's 2012 Budget Review (Creamer 2012:*14 March*). In September 2011 the DoE submitted its nuclear tender proposal to Cabinet at an estimated cost of R1 trillion (Faull 2011). Three preferred sites have been identified at: Duynefontein, Bantamskip and Thyspunt for which environmental impact assessments have now been carried out (Campbell 2012a). The tender process is due to start sometime in 2012 and according to the *Mail and Guardian* in October 2011 bids may be submitted by five companies from France, China, South Korea, Russia and United States-Japan consortium (Faull 2011). In February 2012 the *Mail and Guardian* reported that the South African government had urged Areva and EDF to include China's Guangdong Nuclear Power Group, which has recently built stations under licence from Areva (Butler 2012), in a joint bid (Faull 2012). According to Butler (2012) this Franco-Chinese bid is the most likely to be selected.

In socio-technical transitions terms, Scrase and Smith (2009:711) see nuclear as compatible with existing coal-based regimes and unlikely to facilitate niche developments in renewable energy, stating, “It is understandable that nuclear power and CCS are very appealing for regime members, despite high associated risks and costs, since they promise to cut emissions without disrupting too many alignments and linkages in the existing socio-technical regime”. The authors regard it as a technical fix “given the large-scale, long-lived infrastructure and intense political commitments attending nuclear power” (Ibid). Similarly Unruh (2002) cautions against the expansion of nuclear power due to concerns over technological ‘lock-in’ and Walker (2000) due to institutional ‘entrapment’.

5.4.10 Energy efficiency: “cheaper to build more capacity”

One critique of the final plan was that it failed to allow for vast potential savings in carbon and finance that could be gained from energy efficiency and demand side management (EEDSM) allowing only for a maximum of 3400 MW to be achieved by 2020 (DoE 2011f:55). The absence of a detailed EEDSM assessment from earlier drafts attracted heavy criticism. According to Hughes (2010), an ambitious EE programme “could drop demand by 15-30 per cent by 2030 in relation to a reference case, which would have a dramatic impact on investment requirements” In December SAWEA (2010b) argued that if energy could be conserved below the marginal cost of new generation this would free up funds for low carbon technologies and should therefore be modelled in the IRP 2010. Alstom (2010b) also urged for greater production efficiency of the country’s existing plants stating that doing so would increase the capacity of the country’s existing plants and avoid the need to build additional capacity; extend the utilisation of existing assets; and reduce emissions from CO_2, NOx and SOx.

However the final IRP rejected the option to “increase the assumed EEDSM programme to the 6298 MW capacity option” because the DoE “believes that the risk to security of supply, if relying on this option, negates the assumed benefits” (DoE 2011f:12). The DoE’s Ompi Aphane justified this decision at the departmental briefing to the parliamentary portfolio committee on energy in January 2011, stating that as South Africa is not an energy efficient country, it would be cheaper to build more capacity than not to have it. To make the assumption that the country could achieve high levels of energy efficiency, “might create a very risky kind of situation." Therefore “the impact on the economy was that rather that it was better to have spare capacity than not to have enough and then have blackouts” (DoE 2011d).

5.4.11 IRP 2010 Summary

As a policy measure IRP 2010 simultaneously allows for the entry of low carbon niche developments, supports the expansion of the incumbent coal-based regime and facilitates the introduction of nuclear energy. Hence rather than a definitive move away from one technology to another, it leaves the door open for various different technological configurations which in absolute terms, coal is still set to dominate. How realistic this plan is in terms of technical implementation remains to be seen. To a certain extent all groups involved in the consultation process have succeeded in getting their preferences adopted when compared to the electricity mix laid out in the first draft of January 2009. In political economy terms, this can be seen as the state mediating between various competing fractions “so that capital accumulation can proceed unhindered” (Jessop 1990:30). It can also be seen as an illustration of Fine and Rustomjee’s (1996:8) conceptualisation of the state as “subject to the economic and political forces and interests that operate through it and upon it”.

Through the IRP the MEC maintains a determining role in the economy. Despite plans for significant diversification in the electricity mix, there is no concomitant shift in demand which is set to double, including in the country’s mining and related manufacturing sector which consume over half the country’s electricity supply. This business-as-usual trajectory undermines claims of a socio-technical transition and reveals the fundamental disconnect between the creation of a lower carbon electricity mix from matters of industrial demand. Geels et al’s (2004:6) assertion that in order for transitions to take place, they must do so in a co-evolutionary way, involving both supply and demand is relevant here, as is Moe’s (2010) examination of the symbiosis between changes in resource endowment, energy structures and industrial demands. At the civil society energy caucus in September 2010, Andrew Marquard (2010) of the University of Cape Town’s ERC argued, “viewing demand as God-given leads to an obsession with low prices resulting in overinvestment, surplus capacity, very low prices, and even faster demand growth, and then incentivisation of energy-intensive industries”. This statement encapsulates Unruh’s (2000:826-7) description of technological lock-in whereby investment in new generation capacity expands the technological system, develops increasing returns, drives down costs, encourages consumption and in turn more capacity is constructed and hence “the technological and institutional forces of lock-in solidify”. This also relates to the role of dominant ideologies as a landscape trend regarding the relationship between electricity and economic growth.

While the public consultation process claimed a relatively high level of participation, the ‘technical task team’ in which coal miners and energy-intensive users were dominant was highly influential over the modelling process. This reveals the privileged access that traditional MEC stakeholders have over decision making processes in electricity policy making as compared to emerging interests in renewable energy. It relates to Smith et al’s (2005:1505) assertion that “actors more intensively involved than others in system reproduction enjoy quite powerful positions, benefit strongly from the *status quo*, and occupy important gate-keeping positions”. Also relevant is Moe’s (2009:1739) description of energy giants as “being among the biggest industrial actors on the planet”, with a massive potential for influencing politics “for better and for worse”. As with electricity policy, these resource conglomerates also exert significant influence over the country’s economic sphere (Fine 2008, Ashman et al 2011).

This process also demonstrates that an apparently technical exercise, such as electricity modelling can be inherently political, and that technical and political processes are “deeply intertwined” (Keeley and Scoones 2003:5). Moreover where the state lacks capacity, vested interests have a wide scope to intervene in policy making (Hajer 2002). This comes back to Keeley and Scoones’ (2003:2) question of how expertise engages in the policy-making process, the institutional location of the experts in question and “the political context in which decisions are being made”. It also relates to Fine’s (2009:38) statement that “even if the conglomerates know best and have the best capacity, they do not necessarily do best…those with superior resources may have unacceptable motives and pursue them dysfunctionally for the rest of the population and even for themselves”.

Despite its transformative potential, in May 2011 journalist Troye Lund explained that the IRP 2010 may merely perpetuate high carbon technological lock-in. “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). This relates closely to Meadowcroft's (2011:72) assertion that the real politics of sustainability involves making hard choices, picking winners and losers and "making decisions that are almost guaranteed to be sub optimal and assuming current costs to hedge uncertain future risks". A further question is whether IRP 2010 is merely repeating patterns of the past when Eskom overinvested heavily in capacity expansion based on an overambitious view of economic growth and national demand (section 4.5). As the IRP 2010 states "the risk is that the actual demand turns out to be lower than forecast. In this case the effect would be limited to over-investment in capacity" (DoE 2011f:18).

5.5 Chapter summary

This chapter has illustrated how South Africa's state is mediating conflicts between different fractions of capital over access to the electricity grid "without undermining the continued domination of the ruling class and reproduction of the dominant mode of production" (Jessop 1990:27). While the IRP 2010 and the RE IPPPP illustrate the power struggles and market competition playing out between coal-based regime incumbents and emerging renewable energy niches, as well as the emerging nuclear industry, it would seem that ultimately these policy processes have served to negotiate the maintenance of coal-determined hegemony. Or for the time being at least.This has been achieved with the acquiescence of the renewable energy niche in exchange for a level of access to the grid and favourable tariffs under the RE IPPPP, though not as high as before. In this sense, following Goldthau and Sovacool (2012:235) niche innovations and adjustments taking place in the form of policy developments may merely serve to facilitate technological 'add-ons' than a reconfiguration away from a trajectory based on a high carbon minerals-based growth paradigm.

Yet while coal based regime interests still dominate, this does not mean that they have not had to compromise a certain level of access. Meadowcroft's (2011:72) assertion that political action on sustainability is hampered by uncertainties and that "intervention disrupts established entitlements" is relevant to this. In addition, the creation of winners and losers caused by such political intervention is "a site of conflict" particularly among competing technologies or fractions of capital, as money invested in one particular technological pathway cannot be invested in others. These processes follow Meadowcroft's (Ibid p71) assertion that changes to "the regulatory frameworks within which economic actors conduct their affairs…are essential to encourage sustainability transitions. And that such changes can only be engineered through political processes, and legitimised and enforced through the institutions of the state. So whatever else they may be, sustainability transitions are inherently political." The RE IPPPP is an example of how the introduction of niches is supported by a changing regulatory regime and legal structures.

Moe's examination of the role of politics in the relationship between energy and industry applies here, particularly when considering the role of energy-intensive users who are also South Africa's major coal miners. They are vested interests in both supply and demand. He states that "vested interests tied in with the existing industrial and energy regime is the main factor standing in the way of structural change...and the state the main actor capable (or incapable) of dealing with these vested interests" (Moe 2010:1733). This relates to Trollip's assertion that "The IRP has been captured by traditional energy companies that have a large influence in SA. In order to overcome that regulatory capture, the State has to step in" (in Lund 2011). But these processes have revealed conflicts between and within different government departments and the utility which have been evidenced by the DoE and Eskom cooperating in some instances, as in the case of IRP 2010 and in tension in others as with the RE IPPPP. In socio-technical transitions terms this demonstrates that the regime is far from homogenous. In political economy terms, Poulantzas' conception of the state as a complex social relation and institutional system (Jessop 1990:45) could apply here. Whereas structural change is easier to promote when there is political consensus and social cohesion (Moe 2007), an absence of this makes it easier for vested interests to pursue their own interests as differences of opinion are easier to exploit. Consequently powerful actors are likely to undermine the implementation of the 'right' policies (Scrase and Smith 2009:710). Even though they may have done so secretively, as in the case of the IRP 2010's input parameters and modelling, I would argue that the allocation of electric power in the final version of the IRP 2010 is indicative of the political power they have had over the process.

The RE IPPPP and the IRP 2010 were negotiated by multiple actors and networks, resisted by incumbents, changed form and eventually 'launched' following a series of different decisions. This links to Keeley and Scoones' (2003:3) claim that policy "is co-constructed across space, through particular networks and connections linking global and local sites" particularly in cases where "national science capacity is weak and under-confident." However given the dynamic nature of the policy process (Ham and Hill 1993) and the unpredictability of technological development, how their implementation may develop is yet to be determined. More concrete findings in relation to the wind industry are now discussed in chapter 6.

6 Chapter 6: Wind rush: a shifting regime?

6.1 Introduction

"In general, it is entrepreneurial entrants that challenge and overthrow an existing dominant design with a new technological solution" (Unruh 2000:822)

According to Freeman and Perez (1988:58) "a new paradigm emerges in a world still dominated by an old paradigm and begins to demonstrate its comparative advantages at first in one or a few sectors". As one sector within the shifting paradigm of South Africa's electricity supply, this chapter explores the development of the country's nascent wind industry being developed largely by independent power producers (IPP) supported by private capital and international stakeholders within the context of recent policy developments discussed in chapter 5. Following Geels and Schot's (2007:413) claim that "landscape pressures and regime problems stimulate entrepreneurs and new firms to develop radical niche-innovations", it examines the extent to which wind as a 'niche' innovation has realised incremental gains within the membership of the regime. In doing so, the chapter evaluates the emergence of the industry at the national level within the context of landscape trends, such as developments in the international renewable energy market, norms of international project finance and the Clean Development Mechanism. It also examines the influence that actors such as European bilateral donors and international technology suppliers such as Vestas, Suzlon and Nordex have had over project and industry development. This thesis is cognisant that wind is but one of the niche innovations being developed in South Africa's electricity supply sector, the main others being solar PV and CSP. Despite recent cooperation between these industries at a policy and advocacy level in relation to the formation of the South African Renewable Energy Council (see section 6.1), they are potentially in competition with each other for grid access and financial support under the RE IPPPP and within the limits set by the IRP 2010.

This chapter engages with the following questions:

- *To what extent does the introduction of wind, as a recent development in South Africa's coal-generated electricity sector contribute to a low carbon transition in its minerals-energy complex?*

- *Who and what have been the key drivers of the development of South Africa's wind industry?*

This chapter considers concerns that the country's wind industry may create a new white elite and finds that parallel to the emergence of new companies and foreign investment, entities that have traditionally been involved in South Africa's coal-generated electricity are attempting to spread their interests into wind. It then discusses how emerging market companies, such as India's Suzlon have made significant in-roads into the industry since it began to take off. Possibilities and obstacles for South Africa to develop a local manufacturing base and service industry for wind are considered in light of the importance of 'localisation' in a labour intensive economy with high levels of unemployment. The chapter explores how support for the 'green economy' has gone from being a niche concern promoted by national and international NGOs to a mainstream issue, embraced at least at the level of rhetoric, by government and traditional MEC stakeholders such as the Industrial Development Corporation (IDC).

The way in which political and governance challenges to the take up of South Africa's nascent wind industry are enmeshed with significant technical challenges, particularly with regards to the integration of new renewable energy generation into the national transmission grid are considered. Following Hudson (2011:1) who argues that critical political economy needs to "engage more closely with the stuff that things are made of", a technical understanding of the material possibilities of renewable energy is valuable here in order to challenge the fossil-fuel hegemony of capital accumulation and argue for ecologically and socially just alternatives. The chapter also explores how regime incumbents, Exxaro and Eskom in particular, are undertaking niche-based renewable energy projects in coalition with landscape actors, which constitutes small but significant deviations from their usual business.

6.2 Why wind? South Africa's nascent wind industry in context

South Africa has huge potential for the installation of large-scale wind electricity (Edkins et al 2010) but has only two grid connected wind farms, the 5 MW Darling wind farm and the 3.16 MW Klipheuwel wind farm, both in the Western Cape. A stand alone turbine was erected at Coega in 2010 with a generating capacity of 1.8 MW. Wind is the largest contributor to new installed power generation capacity globally (REN 21 2011, Szewczuk et al 2010)[41] and is the renewable

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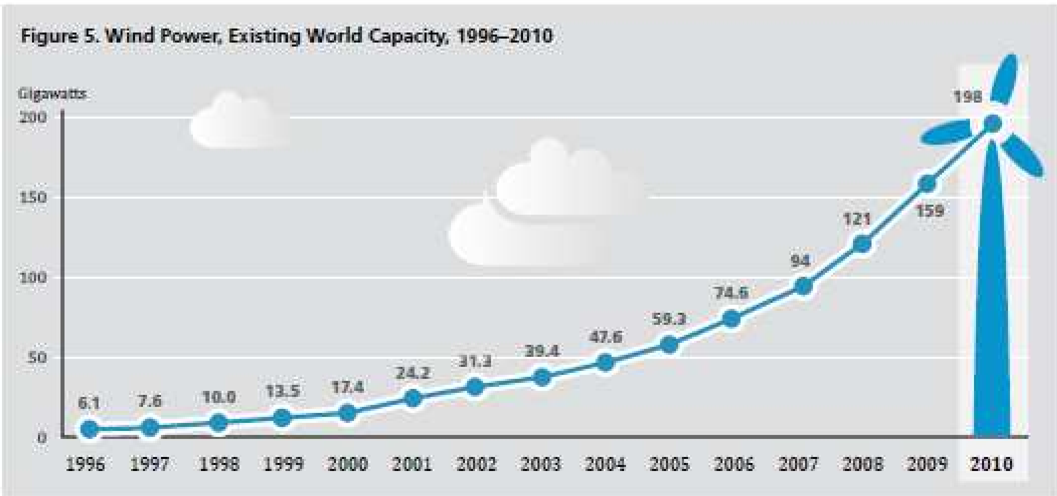
[41] By end 2010 wind constituted over half of the world's existing renewable energy power capacity with a total of 198 GW out of 312 GW (not including large hydro) (REN 21 2011:73)

energy technology with the most operational experience (UNEP/ Bloomberg 2011). Despite significant cost reductions in solar PV in 2011 (REN 21 2011) wind still delivers the lowest cost electricity of all available renewables (SARi 2010:15) and while it is likely that the greatest potential for large renewable electricity projects in South Africa is for solar thermal (Grant 2008, Fluri 2009, Edkins et al 2009), these technologies are less commercially developed (Zadek 2010:1063). South Africa's Industrial Policy Action Plan states, "the scale and maturity of the global wind industry have made it a cost-competitive energy option, compared not just to other renewable technologies, but also to many fuel-based technologies" (DTI 2011:99). According to some studies (e.g Delucchi and Jacobson 2011:1174), onshore wind power is eventually expected to cost less than any other form of large scale power generation. Despite high upfront capital costs wind energy facilities have no fuel costs and relatively short lead times to build in comparison to fossil fuel generated power plants. A wind farm is free fuel and unlike solar technologies requires no water input, a serious issue in water-scarce South Africa. Reflecting these trends, the majority of interest following the initial conception of South Africa's renewable energy feed-in tariff/ RE IPPPP came from wind energy developers (see chapter 6).

Figure 6.1: Wind Power existing world capacity



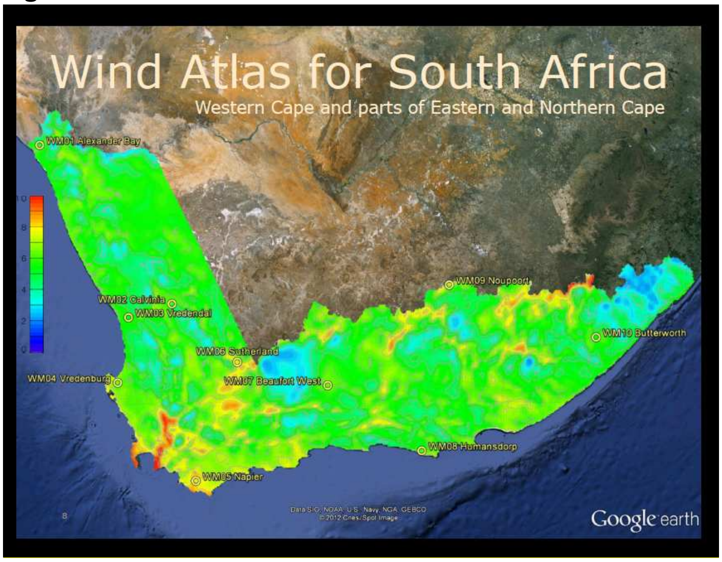
Source: REN 21 (2011:20)

An exact figure for potential wind energy development in South Africa or elsewhere does not exist (REN 21 2011:33), being heavily determined by a complex mix of political, legal, economic, climatic, technological and technical factors. As this chapter discusses, these include the scale of production, profit structures, human capital, technological learning rates (Lund 2009, Torvanger and Meadowcroft 2011), transmission grid capacity, road infrastructure, the overall energy mix and political will. Different types of renewable energy potential in South Africa (theoretical, technical, realisable, mid-term and economic) are explored in Edkins et al (2010). According to analysis by SAWEA (2010:3) wind energy could provide 20 per cent of the country's energy demand by 2025 or "an average daily minimum power output of 7000 MW". This is a similar amount to that of Denmark, where 20 per cent of all electricity is produced with wind power (Lund 2009:61). However others have questioned that, while this is an attractive figure, it cannot realistically be achieved within the anticipated time frame (Trade and Industrial Policy Strategies 1).

Since 1995 estimates of South Africa's wind capacity have increased progressively on the basis of a series of wind map studies[42]. Projects are mostly planned for the Western and Eastern Cape, with a smaller number in the Northern Cape and the Karoo. While previous wind map studies were proprietary, the country's first publicly and freely available wind atlas for the Northern, Western and Eastern Cape was released by the DoE in early 2012 (see figure 6.2). This enables prospective wind farm developers to obtain free, verified modelled wind measurement data and offers an initial assessment of the viability of developing a wind farm in a chosen area (McKenzie 2012). The DoE intends to extend this map to the rest of South Africa and possibly neighbouring countries. The project, which has cost R22-million to date, was funded by the DoE, UNDP, the GEF and the Danish Embassy in South Africa and carried out by the University of Cape Town, Danish Risø-DTU, South Africa's Council for Scientific and Industrial Research, South African National Energy Research Institute and the South African Weather Services.

[42] The 1995 Roseanne Diab Wind Atlas concluded that wind could provide 7.9 TWh/year, around 2.5 per cent of the country's electricity. A second atlas produced in 2001 by Eskom, CSIR and Danida as part of Eskom's South African Bulk Renewable Energy Generation Project (SABRE-Gen) increased the estimations of wind generation potential to approximately 26 TWh/ year (Hagemann 2010). Killian Hagemann of the Climate Systems Analysis Group (CSAG) at the University of Cape Town (UCT) now director of the IPP G7 Renewable Energies created a Mesoscale Wind Atlas in 2008 estimating that wind could provide around 35 per cent of current consumption, or about 26 GW of wind power capacity which equates to 80 TWh/ year. In 2010 Hagemann stated this would also be obsolete by 2011 when the Wind Atlas of South Africa (WASA) would come out.

Figure 6.2: Wind Atlas of South Africa



Source: WASA project, "Wind atlas methodology - the why and the how", Jens Carsten Hansen, *Mid-term Workshop, 14 and 16 March 2012*[43]

6.3 The early niche

This section examines the development of the Darling and Klipheuwel wind farms with institutional support from the South African Wind Energy Programme as an example of what Elzen et al (2004:286) refer to as an "invisible niche period" which opened up possibilities for further wind development in the country. Their construction was also paralleled by Vestas opening a small office in Johannesburg in early 2000s who supplied turbines to the Klipheuwel project and is now set to supply almost 40 per cent of the technology to projects selected under the RE IPPPP (see figure 6.4). These two projects also illustrate the earlier involvement of bilateral donors such as Denmark and multi-lateral agencies such as UNDP and the GEF. However in reference to the early development of South Africa's wind industry, SAWEA (2012) commented: "the going was slow, the set-backs frequent", pointing out that Darling was finally commissioned "eleven years and two High Court cases after its inception" and that "a cynic might say it demonstrated the barriers to wind development far more clearly than it showed how to overcome them".

6.3.1 Darling Wind Farm

Darling, South Africa's first wind project was driven by a highly determined individual called Hermann Oelsner, the CEO of the Darling Independent Power Producing Company (Darlipp). He was supported by development finance institutions, bilateral assistance, committed individuals within government and BEE partners. Both bilateral donor (3) and UNDP (1) referred to Oelsner,

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[43] http://www.wasaproject.info/wp-content/uploads/2012/03/WASA%20Why%20and%20How.pdf

originally from Germany and a former restaurant-owner living in Darling, as “a passionate wind developer” who really drove the process.

The R75 million Darling wind farm 70 km north of Cape Town was funded by Danish DANIDA, the (GEF), the then DME, the Development Bank of Southern Africa (DBSA) and Darlipp (UNDP/ GEF 2001). In 1996, the company Oelsner Group identified the site and founded Darlipp which has a 26 per cent equity stake in Darling Wind Power (Pty) Ltd, to own the demonstration wind farm. A DBSA-funded BEE partner holds 25 per cent equity (Darlipp 2005). South Africa’s CSIR installed the 15 metre wind measuring masts (renewable energy technician 1). The project has a total capacity of 5.2 MW (CEF 2008) with an estimated capacity factor of about 23-24 per cent (van Niekerk 2010).

Though work on the project began in 2001 it only began generating in May 2008, due to delays over what renewable energy technician (1) described as “technical and governance issues” and about which there is limited publicly available information[44]. In 2001 the then Minister of Minerals and Energy Mlambo-Ngcuka was very committed to the project and requested international assistance from GEF and DANIDA (SAWEP, no date). She also ensured state participation via South Africa’s Central Energy Fund (CEF), a government body which has a 49 per cent stake in the project which is the maximum share a government agency can hold in an IPP. A member of the DoE also sits on Darling's board.

The CEF’s role in Darling is controversial given its lack of transparency and suggested corruption in relation to this and other projects (Jordan 2010). Moreover an on-going legal dispute between the CEF and Darlipp for which details are also not public resulted in the temporary closure of the wind farm in April 2009 (Jordan 2010). In November 2009 Hermann Oelsner was reported in the *Mail & Guardian* newspaper of accusing the CEF of "killing" renewables in South Africa (Groenewald 2009). Wind IPP (5) endorsed this view by saying “CEF want to own everything, they have no expertise and they do more harm than good. They are meant to facilitate and invest, but they have a mandate to meddle”.

Despite receiving Danish funding, the project eventually installed four 1.3 MW German Führlander wind turbines though “technical problems” later led to a dispute between Fuhrländer

[44] It is understood that this may be related in part to South Africa’s Public Finance Management Act.

and Darlipp (Groenewald 2009). Meanwhile there was alleged corruption over how Darlipp used the money it was given by the Danish government (renewable energy technician 2, energy specialist). In 2006 The City of Cape Town entered into a Power Purchase Agreement with Darling Wind Power Pty (Ltd) as part of the city's target to source 10 per cent of its overall energy requirements from sustainable sources by 2020 though it took until 2010 before the City announced its plans to sell Green Energy Certificates to consumers who want to buy electricity generated by the Darling project (City of Cape Town 2010).

6.3.2 Klipheuwel wind farm

Eskom's Klipheuwel Wind Farm offers an example of a niche development driven by individuals operating from within the regime, supported by landscape actors. Built in 2002/3 by Eskom as a "demonstration" site by its Resources and Strategy Division (Raab 2008), Klipheuwel is approximately 50 km east of Cape Town and consists of two Danish Vestas turbines and a French Jeumont turbine (Eskom 2010b) which in 2010 was not operational due to a "weather station problem" (Eskom 1). Established at a cost of R42 million (Smit 2005), in 2006 its ownership was transferred to Eskom's Generation Division, for purposes of operation and maintenance. While the wind farm has a total generating capacity of 3.2MW, it has a capacity factor of less than 20 per cent (van Niekerk 2010). Its electricity generated is fed directly into the regional distribution network.

According to renewable energy technician (1), the idea for Klipheuwel was initiated in 1994 by South Africa's CSIR whose international business development team was offered turbines by Scottish Power that had previously been deployed in the Orkney and Shetland Islands. However the team quickly came up against the high cost of wind industry logistics given that they would need to rent a crane by the day to transport the turbines to the Scottish mainland while waiting for appropriate weather. It was therefore decided to source the turbines from elsewhere. A project funded by DME, CSIR and the City of Cape Town was then initiated to study the possibility of installing large grid-connected wind turbines in Cape Town. However it soon became apparent that installing wind farms within the Cape Town metropolitan area would be problematic due to the hostile reaction from residents associations. Hence the Klipheuwel site was identified (Smit 2005). According to Eskom (1), individuals within Eskom's Resources and Strategy Group played a key role in pushing for support from senior management (Eskom 1). In 2001 a team from Eskom went to Ireland to look at wind turbines and in 2002 the earthworks began and the shipping took place (Eskom 1).

Figure 6.3: Klipheuwel wind farm[45]

Source: Riaan Smit

While the towers for the Vestas turbines were made locally in the interests of local content requirements (Vestas 1), Wind IPP (2) explained that there were “difficulties in making this happen” though could not explain why. Klipheuwel also highlights some of the problems inherent in importing wind turbine equipment from foreign suppliers. Eskom (2) explained that “when something breaks you need to get spare parts. At one stage we needed a replacement for a hydraulic motor and it took about four weeks to place the order and get it shipped to the site. Then we opened the wooden box to discover that they had sent the wrong motor”.

6.3.3 South African Wind Energy Programme

Parallel to the construction of Darling and Klipheuwel, the South African Wind Energy Programme (SAWEP) was largely pushed by a few dedicated individuals within the DoE with Danish support. It was set up to encourage national on-grid wind development, further to the declaration by the then Minister of Minerals and Energy, Mlambo-Ngcuka of the Darling Wind Farm as a National Demonstration Project in June 2000.

SAWEP is funded by the GEF via UNDP and co-financed by DANCED (GEF 2001), DoE, Saneri and CEF. Implemented by a consultant housed in the DoE, it had a total budget of $12.3 million for phase 1 from February 2008 to March 2010 (SAWEP, no date). Its aim is to “identify and … remove the barriers to large-scale commercial utilisation of wind energy for on-grid power generation in South Africa.” This will be done through “the realisation of an enabling environment for large-scale utilisation of wind power, including regulatory and IPP/ PPA framework, financing mechanisms and the promotion of a project developer industry in parallel with the actual

[45] Riaan Smit personal website: http://mysite.mweb.co.za/residents/rrsmit/site.htm

realisation of a 2x5 MW wind farm" (UNDP/GEF 2001). The final objective is to install and/or prepare the development of 50.2 MW of wind power (UNDP/GEF 2001). Other activities carried out by SAWEP have included the business plan for SAWEA, the Wind Atlas for South Africa (WASA) and the investigation into the development of a wind energy industrial strategy for South Africa (Szewczuk et al 2010).

In brief it can be argued that Darling, Klipheuwel and SAWEP formed the invisible niche-period upon which the RE IPPPP and the emerging wind industry have since built and illustrate how, while significant impetus came from niche and landscape entities in the form of "outsiders" or "fringe actors" (Geels and Schot 2007:400), endorsement from regime institutions and/or individuals within them was fundamental to their success. In the case of Darling and SAWEP it appears that the then Minister of Minerals and Energy was particularly significant, while in Klipheuwel's case the securing of support from Eskom's senior management was imperative. These cases further speak to the question of the timing of selection pressures (see chapter 3) in that as the rest of this chapter explores, it is only because of significant landscape pressures that the industry has continued to develop.

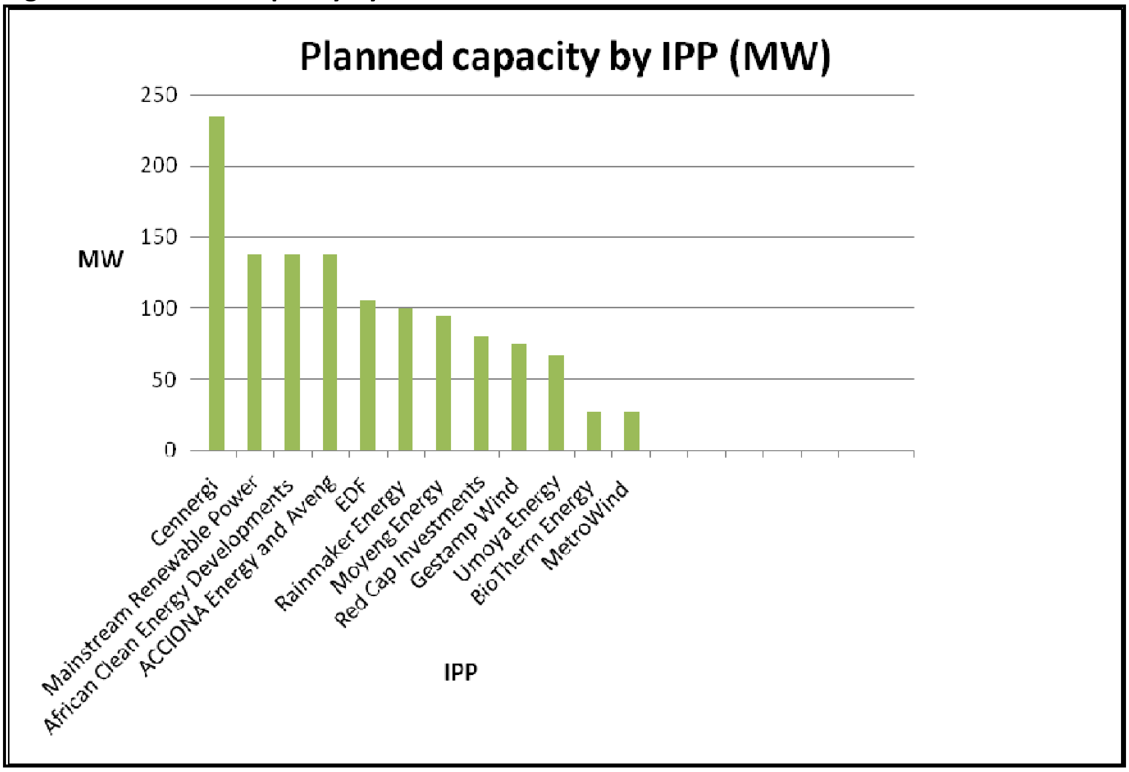
6.4 South Africa's IPPs: "Policy entrepreneurs"

How many of them are doing it for renewables and the sake of South Africa and how many are doing it for their pocket? (Eskom 2)

South Africa's nascent wind industry is predominantly the domain of private developers with access to private national and/or international capital (see table 6.1, figure 6.4). Many potential IPPs consist of a national entity in joint venture with a foreign company, with debt finance provided by South African commercial banks and equity investment by a combination of private companies, development finance institutions and BEE partners. Until recently there were limited details in the public domain of the majority of these stakeholders though this has since become clearer following the approval of the selection of preferred bidders in December 2011 and May 2012.

South Africa's wind energy IPPs and their representative body SAWEA can be referred to as "policy entrepreneurs" (Kingdon 2011) in that they have succeeded in pushing policy discussions in a new direction, witnessed for example by their lobbying role in the RE IPPPP (see chapter 5). Following Kingdon (2011:122) "their defining characteristic, much as in the case of a business entrepreneur, is their willingness to invest their resources- time, energy, reputation, and sometimes money-in the hope of a future return". Not only that but they have been persistent, and lain in wait "for a window to open" (Ibid p181).

Figure 6.4: Planned capacity by IPP



Source: Author's own compilation from publicly available sources as of August 2012.
The generosity of the proposed REFIT tariffs resulted in a 'wind rush' of aspiring developers many with limited experience and even included wine farmers who own large tracts of land but knew little about the wind industry (bilateral donor 1). In light of this a number of national stakeholders involved in renewable energy project development expressed the need to weed out non-eligible players (GTZ 1, Eskom 3, Bank 2, Vestas 1).

It terms of the more credible IPPs, it has been easier for the larger players, some of whom have projects in the pipeline amounting to 1000s of MWs to afford the long wait for the national regulatory framework to accommodate their development. For smaller players waiting is an expensive business and risks financial ruin. As Wind IPP (1) explained in April 2010 "In South Africa the response time is very slow and those of us who do not have deep pockets might loose interest or simply cannot afford to wait". It is also anticipated that smaller players will eventually sell their projects on to the larger players. Bilateral donor (1) concurred that "there will come a point when the smaller project developers will have to sell on and there will be market consolidation. Developers tend to develop the project and move on".

South Africa's wind IPPs have been united under the South African Wind Energy Association (SAWEA), "the leading trade and professional body representing the wind industry in South Africa", with a primary purpose "to promote the sustainable use of wind energy in South Africa" and act as "a central point of contact for information for its members, and as a group promoting wind energy to government, industry, the media and the public"[46]. SAWEA whose members include IPPs, technology manufacturers and wind energy service companies has received funding from Vestas and SAWEP. As a lobby group it galvanised its efforts around its vision paper in May 2010 (SAWEA 2010). In December 2010 Wind IPP (6) stated that "SAWEA allows us to speak with a common voice as we cannot all engage the government separately. That way we have more legitimacy than we would as individual companies". However given the immaturity of the market, the struggle for a very limited amount of MWs in the first round of REFIT, and complexities over access to Eskom's grid, in mid-2010 one member confessed that SAWEA's members were essentially in competition with each other and that there were limits to how much the group could work together.

In early 2012 SAWEA merged with the South African Solar Thermal Industry Association, the recently formed Sustainable Energy Society of Southern Africa and the South African Photovoltaic Industry Association to create an umbrella body called the South African Renewable Energy Council (SAREC). SAREC's aim is to facilitate institutional strengthening and "coordinated" and "unified" dialogue between government and the renewable energy industry (Hopson 2012). The formation of SAWEA and subsequently SAREC, while clearly no match for the Energy Intensive User's Group at present, speaks to the question asked by Byrne et al (2011:56) regarding how niches develop collective identities and interests and the political roles they must play in order to ensure the success of their transition.

Lobbying efforts by South Africa's emerging renewable energy industry have not always been carried out very diplomatically, or been well received by the government. A notable example is that of Irish company Mainstream Renewable Power which has one of the largest renewable energy portfolios in the country with a total of 3000 MW of wind and solar projects at various stages of development. Its 138 MW Jeffrey's Bay wind farm, in a consortium which includes Siemens Energy Africa and Absa Capital (Creamer 2011:*8 April*) was selected as preferred bidder in the first round of the RE IPPPP. In 2009 and 2010 the company lobbied loudly for what it saw as

[46] http://www.sawea.org.za/

appropriate regulatory conditions to allow the entry of wind IPPs into South Africa's electricity market. Notably, in August 2010 its CEO Eddie O'Connor became embroiled in a public dispute with the Energy Minister Dipuo Peters, who rejected with "with contempt" O'Connor's apparent suggestion of wind as a sole source of energy for South Africa. Asking O'Connor to be clear if he was trying to lobby cabinet she stated that "we cannot elevate wind power above or at the expense of other energy sources" (Salgado 2010). A commentary in *Business Report* suggested that "her response may simply reflect an African energy department irritated at being told how to do business by vocal European players in the wind industry. But it did seem to lean on the heavy side, particularly as O'Connor did not tout wind as the single solution" (Business Report 2010).

6.4.1 A new white elite?

Following the point on "vocal European players", a number of civil society and labour representatives interviewed in 2010 expressed fears that the introduction of IPPs would create a private monopoly driven largely by a white elite backed by international energy giants. The nascent industry was also criticised in the press for being predominantly white and male (Salgado 2010), reflected in the make up of SAWEA's board, which in May 2011 consisted almost exclusively of white men, though this has since diversified. More critically, one civil society representative interviewed referred to the industry as consisting largely of "white wind capitalists". This can be related to Lazar's (1987, unpublished, in Fine and Rustomjee 1996:149) reference to 'land capitalists' to describe a small number of powerful farmers in 1960s who controlled a large section of the country's agriculture under apartheid. This view is endorsed by carbon finance consultant's (1) claim that "the real beneficiaries of the emerging wind industry will be white farmers. They are the ones who own the land. There is a historical context that enforces that." The National Union of Metals Workers of South Africa has also expressed concern that the emerging renewable energy sector will be "dominated by a capitalist system" and that workers and communities will be "forced to pay the costs of the sector's expansion" (Algoa FM 2012). At the Union's annual conference in 2012 its president Cedric Gina asked "Do communities stand to benefit or is this another capitalist grab to enrich a few?" He continued, "for whom is the renewable energy being produced? Is it for big corporations who get the electricity at a discount or is it to give access to those who presently do not have access?" (SAPA 2012).

Table 6.1: List of projects selected under RE IPPPP bid windows 1 and 2							
Project name	**Developer**	**Province**	**Planned capacity**	**Technology supplier**	**Details**	**CDM status**	**Bid window**
Gouda Wind	ACCIONA Energy and Aveng	W. Cape	138 MW	ACCIONA Wind Power (Spain)	ACCIONA Energy a 51% stake, Aveng 29%, Broad Based Empowerment company Soul City 10%. ACCIONA Energy and Aveng will build the project through EPC contracts on a 50-50 basis, and carry out their operation and maintenance[47].	Project idea approved by DNA Nov 2010	2
West Coast 1	Moyeng Energy (Pty) Ltd (a partnership of GDF Suez and Investec and supported by Windlab).	W. Cape	95 MW	Vestas (Denmark)		PDD under review June 2012	2
Amakhala Emoyeni	Cennergi (Pty) Ltd (Windlab initiated)	E. Cape	140 MW	Suzlon (India)		PDD under review May 2012	2
Tsitsikamma	Cennergi (Pty) Ltd	E. Cape	95 MW	Vestas			2
Grahamstown	EDF in partnership with Innowind	E. Cape	24 MW	Vestas			2
Grassridge	EDF	E. Cape	61 MW	Vestas			2
Chaba	EDF	E. Cape	21 MW	Vestas			2
Dassiesklip	BioTherm Energy Ltd	W. Cape	27 MW	Sinovel	Equity partner: Denham	PDD under	1

[47] http://www.acciona.com/news/acciona-and-aveng-awarded-two-renewable-energy-projects-in-south-africa-totaling-209-mw

Wind Energy Facility				(China)	Capital	review June 2012	
Van Stadens Wind Farm	MetroWind (Basil Read Energy has a 35% stake)	E. Cape	27 MW	Vestas	30% OMIGSA, 20% AfriCoast SA, 5% BEE Community Trust. R500 million	PDD under review June 2012	1
Hopefield Wind Farm	Umoya Energy	W. Cape	67 MW	Vestas	R1.5 billion investment[48]	Project approved by DNA Feb 2012	1
Noblesfontein	Gestamp Wind in JV with South Africa's SARGE[49] and BEE company Shanduka	N &W. Cape	75 MW	Vestas	Required investment of 120 million Euros (R1.6 billion). Debt, empowerment and carbon credit financing provided by Standard Bank; Arup are lender's advisors; Wind Prospect are sponsor's advisors. BEE: Shanduka Group	PDD under review June 2012	1
Kouga Wind Farm	Red Cap Investments	E. Cape	80 MW	Nordex (Germany)	Standard Bank, IDC, Inspired Evolution Investment Management, Afri-Coast Engineers[50]	PDD under review May 2012	1
Dorper Wind Farm	Rainmaker Energy Projects (Pty) Ltd.	E. Cape	100 MW	Nordex	Equity provided by: Sumitomo Corporation	Project approved by	1

48 http://www.nersa.org.za/Admin/Document/Editor/file/Consultations/Electricity/Presentations/Hopefield%20Wind%20Farm.pdf

49 http://www.nersa.org.za/Admin/Document/Editor/file/Consultations/Electricity/Presentations/Noblesfontein%20(Coria%20(PKF)%20Investments%2028)%20(Pty)%20Ltd.pdf

50 http://www.nersa.org.za/Admin/Document/Editor/file/Consultations/Electricity/Presentations/Red%20Cap%20Kouga%20Wind%20Farm%20(Pty)%20Ltd.pdf

					(60%), DorperWind Development (Pty) Ltd (a Rainmaker Energy Company 15%) BEE Consortium 25%.	DNA, March 2012	
Jeffrey's Bay	Mainstream Renewable Power/ Genesis Eco-Energy	E. Cape	138 MW	Siemens (Germany)	Fully underwritten Senior Debt by Absa Capital. Equity: Globeleq Holdings, Luxembourg Mainstream Renewable Power SARL, Old Mutual Insurance, BEE 20% including Thebe Investment Corporation[51]	Project idea approved by DNA, Oct 2011	1
Cookhouse Wind Farm	African Clean Energy Developments (jointly owned by Macquarie Capital and Old Mutual Investment Group of South Africa (OMIGSA)). Terra Wind Energy-Golden Valley (Pty) Limited	E. Cape	138 MW	Suzlon	Debt: NedBank, Standard Bank, IDC Equity: Globeleq 39%, BEE company 25%	PDD under review June 2012	1

Source: Author's own compilation from publicly available sources as of August 2012. Please verify before further citation

51 http://www.nersa.org.za/Admin/Document/Editor/file/Consultations/Electricity/Presentations/South%20African%20Mainstream%20Renewable%20Power%20Limited%20Jeffreys%20Bay%20(Pty)%20Limited.pdf

Box 6.1: From Exxaro to Cennergi, large coal builds small wind

Exxaro offers a fascinating narrative of a powerful regime incumbent pushing niche-level developments supported by landscape entities such as Vestas, Tata Power and the Clean Development Mechanism (CDM). The sole supplier of coal to Medupi and the second largest coal producer in South Africa Exxaro's carbon footprint makes up one per cent of the country's emissions at approximately 2.7 million tonnes per annum (MoneyWeb 2011). Having established a clean energy forum in 2007, by 2011 it was developing a renewable energy portfolio with a capacity of just under 200 MW (Exxaro 2011). This includes a CSP plant in Lephalale, the 40 MW West Coast/ Tiqua wind farm at Brand-se-Baai, (Savannah Environmental 2011c) and the 100 MW Tsitsikamma Community Wind Farm (TCWF) which was selected in the second bidding round of the RE IPPPP in May 2012.

Now worth $9 billion, Exxaro is the largest black owned company listed on the JSE and is currently 56 per cent BEE controlled. A 'Proudly South African' company[52], it has considerable political reach. As energy analyst (3) stated in May 2010: "they have access to decision-makers that new [renewable energy] developers do not and influencing access within the ruling party, all departments, and at all different levels as well as many personal relationships. Exxaro are hugely influential, are making an effort to collaborate with the government with sustainability and have a different approach than the average capitalist". According to Wind IPP (2) the strong BEE component evident in Exxaro's renewable projects is a clear comparative advantage for the company.

The company explains that its move into renewables was driven by the need to "become carbon neutral" and "thrive in a low carbon economy" (Exxaro 2011) and that it saw an opportunity in the 2003 renewable energy white paper. Concerned about rising costs, increasing scarcity of electricity and the requirements of the power conservation programme to reduce electricity use by 10 per cent, it saw how it could benefit from generating its own electricity. Exxaro's West Coast/ Tiqua Wind Farm is to be constructed on land owned by its Namakwa Sands operation, one of the largest mineral sands operations in the world with titanium as its primary product (Exxaro 2012). According to Renewable energy technician (1): "Exxaro bought out Namakwa

[52] This term is inspired by a 'buy local' campaign launched in 2001 by government, organised business, organised labour and community organisations to boost job creation and pride in South African companies and national products and services. Further information is available at: http://www.proudlysa.co.za/Index.aspx, accessed 16 May 2011

Sands from Anglo American. When they did they bought wind data that CSIR had been collecting for Anglo American which was originally for pollution dispersion at the Brand-se-Baai mine. At this point Exxaro realised that they had good data."

Exxaro is unique within its minerals and energy giant peer group in galvanising its traditional resources to renewable ends, though companies such as Xtrata, Anglo-American, Sasol and Sappi are also developing cogeneration and small coal IPPs, as part of Eskom's medium term power purchase programme (MTPPP) (see 4.6.3). Mining energy expert (1) explained that for Exxaro, a renewable energy business could help mitigate anticipated future trade barriers that a carbon sensitive market may place on the company's coal exports and other South African carbon intensive goods. As the company's executive general manager of business growth Ernst Venter explained, "for every tonne of coal that we want to export, we want to be able to place a green stamp on that - if you can call it that" (in MoneyWeb 2011).

Recorded on *Mining Weekly's* broadcast service[53], the company plans to increase its capital expenditure to R7.1-billion in financial year 2012 as part of its diversification strategy, of which R3-billion on the Grootegeluk expansion to supply coal for Medupi (Chapter 8), R862-million on its coal business, R62-million on mineral sands development and R3.2 billion on sustainable and environmental projects. However it is not clear how much of that latter spend is for renewable energy projects and how much is for co-generation and energy efficiency projects. Therefore despite Exxaro's unique move into renewable energy which appears to form almost half of its capital expenditure for 2012, its core business in coal and minerals still remains fundamental.

Does the company's enthusiastic embrace of renewables represent a shift away from its role as a stakeholder and beneficiary of the MEC or is it seizing an opportunity to mitigate its core activities and thereby reproduce its dominance within the context of shifting regime trends? Mining industry expert (1) explained "Exxaro has worn two hats. It is lobbying for the cheapest possible electricity which comes from coal but is also preparing to get involved in a new energy future. It is hedging its bets".

[53] Available at: http://www.miningweekly.com/article/exxaro-to-step-up-capex-to-r71bn-next-year-2011-08-18

Cennergi

Cennergi was formed in April 2012 when Exxaro formed a 50:50 joint venture energy company with Khopoli Investments, a subsidiary of India's Tata Power Company. Cennergi has a separate board and governance system of which Exxaro is the primary shareholder (Creamer 2012:*4 April*) and is headed by former Exxaro employee Thomas Garner. With ambitious plans for growth in South Africa and the region, it will consider listing on the JSE in 2013. It has five wind and solar projects at a relatively advanced stage (Ibid) and is now leading in terms of wind capacity under the first and second bidding rounds of RE IPPPP, with a total capacity of 235 MW.

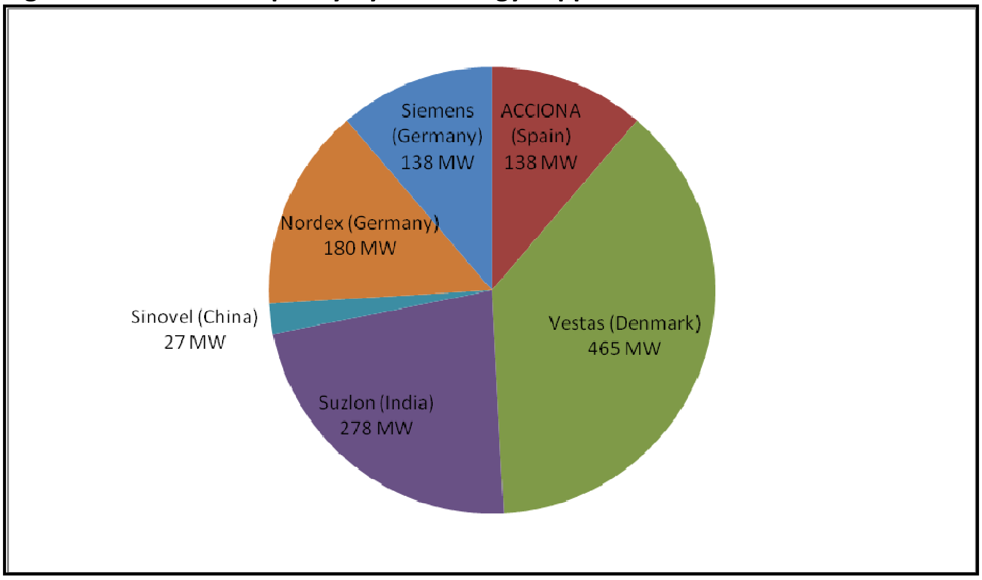
In early 2012, Cennergi formed a partnership with South African IPP Windlab to develop the Windlab-initiated 139 MW Amakhala Emoyeni project near Bedford in the Eastern Cape (Creamer 2012:*23 May*). This forms a further addition to Exxaro's original renewable energy portfolio which was selected under RE IPPPP's second bidding window and is the largest project selected to date. The project has the potential to extend to a total generating capacity of 750 MW (Windlab 2012). Indian company Suzlon will be the preferred technology supplier for this project under an EPC agreement (Suzlon 2012). Suzlon's CEO Silas Zimu said that the project "shows how a South African Black empowered developer (Cennergi) partnered with a South African Black empowered manufacturer (Suzlon) can ensure that the Government's commitments on wind energy are realized." (EvWind 2012.)

Exxaro's CEO Sipho Nkosi explained, "Cennergi has been created by companies from developing nations to serve developing nations. We expect Cennergi to play a key role in the African electricity generation market" (in Mining Weekly 2012). This partnership with Tata Power will add the skills and capabilities necessary to create a world class energy company in this region with enormous growth opportunities" (in ESI-Africa 2012b). Cennergi's creation with support from Indian companies is a further example of the growing role of emerging market economies in South Africa's energy industry (SAPA 2012).

Following Smith and Stirling's assertion (2007:356) that "incumbents who are unable to adapt will suffer declining influence and benefits", it can be argued that as an MEC stakeholder, Exxaro's activities represent a dynamic attempt to reproduce its power and maintain or even increase its influence. The reconfiguration of Exxaro's relationships with a variety of different national and international players relates to Elzen et al's (2004:295) claim that "system innovations are precisely about structural changes in elements and their relationships". As a regime actor, Exxaro is providing material and institutional support to a niche technology with landscape support, despite the fact that the company's overall structure and the regime of which it is a member thus far remains intact. Though it does not appear to have been at the forefront of the industry, it is now making considerable breakthroughs as evidenced by Cennergi's leadership in total awarded wind capacity. Following Geels (2011:25), "Although large incumbent firms will probably not be the initial leaders of sustainability transitions, their involvement might accelerate the breakthrough of environmental innovations if they support these innovations with their complementary assets and resources".

6.5 Technology supply, a shifting landscape

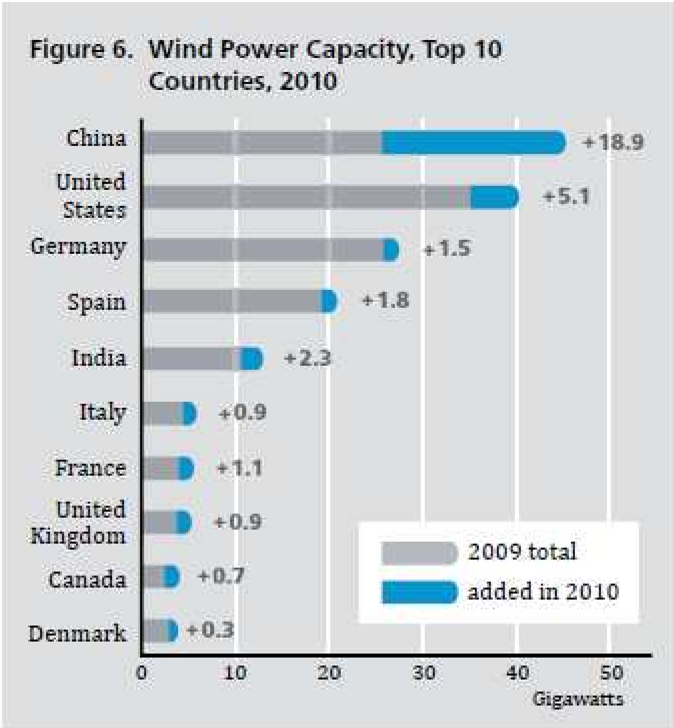
Figure 6.5: Planned capacity by technology supplier



Source: Author's compilation from publicly available sources as of August 2012

Rapidly shifting trends in the international wind market have seen the industry's early leaders: Denmark, Spain, Germany and US, losing ground in terms of manufacturing and installed capacity to the emerging markets of India and China (UNEP/ Bloomberg 2011, see figure 6.6). These dynamics are inevitably playing out in South Africa (Lund 2009, GWEC 2010). In 2010 there were three major wind industry companies with small offices in South Africa: Danish Vestas, Indian Suzlon Energy Ltd and Chinese Goldwind Africa. Vestas has had a representative in the country for about a decade and has now been chosen as preferred supplier for five projects with a total capacity of 465 MW (see figure 6.5). However India's Suzlon is now set to supply almost a quarter of projects approved under the first two bidding rounds of RE IPPPP.

Figure 6.6: Wind power capacity top 10 countries 2010



Source: REN 21 (2011:20)

Suzlon Energy Ltd, India's largest wind turbine manufacturer (GWEC 2010:5) set up an office in late 2010, appointing former managing director of City Power, Johannesburg's municipal electricity distributor, Silus Zimu as its in-country CEO. This has been described as a political appointment due to Zimu's assumed access to power and influence within the ruling party (energy analyst 4). Suzlon, which is tendering to supply equipment for more than 800 MW of wind power (Everready Kestrel 2012:3) was the first technology supplier in South Africa to make public a supply agreement. In May 2011 it agreed to provide 76 turbines for African Clean Energy Development's 135 MW Cookhouse project in the Eastern Cape, the largest wind energy project in the country (Creamer 2011:*25 May*). Suzlon will also supply turbines for Cennergi's 140 MW Amakhala Emoyeni project in the Eastern Cape. Suzlon has since announced the possibility of building a turbine manufacturing plant though this would need to produce about 400 MW worth of equipment each year to remain cost efficient (Alternative Energy Africa 2012b).

Goldwind Africa, whose Chinese parent company Xinjiang Goldwind Science & Technology Co Ltd is one of the largest turbine manufacturers in China and one of the top five in the world (GWEC 2010), was launched in Cape Town in March 2011. In parallel with global trends discussed above, in late 2010 a former Vestas staff member was let go from the company's Johannesburg office in late 2010, only to be recruited by Goldwind's new office in Cape Town just a few month's later (Davenport 2011). However thus far Sinovel is the only Chinese technology supplier selected under the RE IPPPP, for the 27 MW Dassiesklip wind farm.

Other global power and engineering conglomerates some of whom have been heavily involved in the country's coal-fired electricity sector for many years are now contenders in a 'scramble' for access to South Africa's wind energy technology supply, service industry and project development. German company Siemens which has been involved in its electricity sector since 1860 has decided to make the country its wind power hub for Africa and the Middle East. It will supply turbines for Mainstream's 138 MW Jeffrey's Bay wind farm, "with various local manufacturing options under consideration" (Creamer 2011:*24 March*). In 1960s and 1970s South Africa was Siemen's fifth largest subsidiary where it produced electrical components, data systems, telecommunications, power and medical equipment. It also supplied a third of the country's post office and railway signalling equipment and technical assistance for South Africa's nuclear power programme (Makgetla and Seidman 1980:167). German company Nordex which will supply turbines for two projects totalling 180 MW offered a traineeship in wind farm development in Paris for a South African engineer in 2010 (University of Stellenbosch 2010). German renewable energy developer Juwi with an office in Cape Town has also expressed an interest in getting involved in joint ventures (Downing 2012) as part of German intentions more broadly to become involved in South Africa's renewable energy industry.

Spain's Gestamp Steel whose sister company Gestamp Wind will develop the Noblesfontein wind farm in partnership with South Africa's SARGE and BEE company Shanduka, a leading black owned investment holding company established in 2000 by Cyril Ramaphosa, will develop a wind tower manufacturing facility in Cape Town with the aim to supply steel towers to preferred bidder projects selected under phase 1. This will manufacture 200 steel wind towers per year and employ 250 people (Reve 2012).

French company Alstom, a major global supplier of generation and transmission infrastructure with a presence in South Africa for more than 100 years has also announced its intention to supply wind power equipment. In July 2009 Alstom Switchgear introduced a medium-voltage ring main unit for use in distributing power generated by wind turbines (Engineering News 2009). The company whose stated aim is to provide "the cleanest integrated solutions", including carbon capture and storage technology for coal provides 80 per cent of installed turbine generator capacity and 30 per cent of boiler capacity for South Africa's coal-fired power plants (Alstom 2010b). It will supply the turbine island for Medupi which "represents the largest order in the history of Alstom" according to mining industry expert (2).

Turbine suppliers are selective over which IPPs they will supply to, requiring sound wind data and other project parameters before they commit to project involvement (ESI-Africa 2011b). Wind IPP (4) explained "turbines need to comply with certain standards set by the IEC (International Electrotechnical Commission)." The global wind industry currently favours vertically-integrated manufacturing which means that the supply chain of key components is carried out in-house or via long-term contracts with specific companies (Szewczuk et al 2010:23-28). Consequently Wind IPP (5) stated that "currently equipment is being sourced from overseas and engineers will come with it for operation, set up and management." In terms of construction, operation and maintenance foreign expertise will inevitably play a significant role in the wind-energy services industry. A list of global companies that provide "contracting, consulting, O&M, assembling and integration services" includes Hatch Ltd, Garrad Hassan and Mott MacDonald (Szewczuk et al 2010:74). Other companies include British company Wind Prospect, who recently opened an office in Cape Town in order to become "the number one service provider to the African wind market by 2012" (Renewable Energy focus.com 2010) and are advisors to the sponsors in the Noblesfontein wind farm being built by SARGE in joint venture with Spanish Gestamp Renewables.

6.6 Project finance

Norms of international of project finance (Yescombe 2002) coupled with the demands of technology suppliers have a significant determination over the shape of South Africa's renewable energy projects. These are risk averse and demand high and relatively quick returns (Unruh and Carillo-Hermosilla 2006). While there is more international experience of project finance for wind than for solar given international renewable energy trends, South Africa has limited expertise in this area as project finance has been driven by the unbundling of utilities and the privatisation of public sector capital investment (Yescombe 2002, see chapter 4). Though fuel costs for wind energy projects are non-existent, such projects have high upfront capital costs which must be met by the project developer and related debt investment and equity finance, with an estimated total of R120 billion ($16 billion) needed for investment in the 3 725 MW of renewable energy under the RE IPPPP (Bloomberg News 2012a).

Wind IPP (6) described the three main phases of project finance:

i) Setting up the IPP which involves finding an international shareholder and starting the work. This is a high risk phase for finance and involves venture capital and international investors. Most IPPs have a foreign shareholder who enters at this point.

ii) Securing project finance. This stage focuses on building the asset and establishing project finance. The 70/30 per cent debt/equity split is defined at which point commercial banks get involved.

iii) Operational phase. The project is generating and is now minimal risk.

It is anticipated that a number of IPPs may sell their entity at stage 2 or 3, which relates to the discussion on market consolidation (section 6.4).

The key concern expressed by banks considering debt financing was that the project have a government-backed PPA on 'acceptable terms'. This was a sticking point throughout the REFIT/ RE IPPPP consultation process (section 5.3.7). A further requirement was for a grid connection agreement with Eskom (Wind IPP 6). Further elements of project 'bankability' include: EIA status; an agreed equity group; a land ownership or tenure agreement; a 12 month wind resource assessment; proven technical expertise of the developer; turbine suppliers with a track record; agreements for engineering, procurement, construction (EPC) and operation and management (O&M). Significantly the financial model must demonstrate that the project will be able to repay the debt and that the developer has a good credit rating (Bank 2). Bank (2) stated: "There are two basic requirements for project lending. Firstly the project has to make financial sense and generate a required rate of return. Our main concern as lender is to have our debt repaid. Secondly we look at the personal merits of the client, their capacity, expertise, people skills, equity and the likelihood of them appealing to the 'stakeholders', by which we mean the government for example. Lastly we ask to what extent is the developer serious and credible? Not all project developers have proven to be so".

Renewable energy project financing is generally structured on the basis of a 70:30 debt to equity ratio (Mendonça et al 2010:24). South Africa's five main banks Standard Bank, NedBank, ABSA Capital and Investec are the main providers of debt financing whose involvement in the country's emerging renewable energy industry illustrates the evolving role they have played and continue to play in shaping evolving structures in the MEC (Fine and Rustomjee 1996, Magketla and Seidman 1980). Banks may also appoint high level technical advisors from international firms that are paid for by developers, or may play an advisory role to developers themselves, particularly with regards to finding an equity partner, putting together a bid submission to RE IPPPP, negotiations on the PPA and other commercial advice. According to *Bloomberg News* (2012b) Standard Bank funded R8.1 billion for 605 MW of wind and solar projects in the first round of RE IPPPP and R6 billion in the second round for 1454 MW, amounting to about 31 per cent of total MW. Meanwhile Nedbank is partner to 11 of the first round of bidders (Business Report 2012). Investec as both a bank and a wind developer will put up its own debt financing. In the case of large projects, developers may appoint two or three banks to co-finance in light of funding limits. Development finance institutions such as the DBSA may also provide debt financing, such as in the case of Just Energy (see box 6.4). Some banks may also facilitate funding from export credit agencies. Vestas receives support from the Danish Export Credit agency which lowers the cost of capital and makes the investment more attractive to national and international banks (Vestas 1).

A number of interviewees said that it was not competitive for international banks to get involved in debt financing given that the currency risk is high for foreign banks without a Rand balance sheet. In October 2010 Bank (2) explained that as South Africa's exchange rate is floating the Rand has witnessed dramatic fluctuations in recent years. S/he explained "if you want to speculate on currencies you don't do it by lending to a wind farm" and added that continued currency constraints may be a serious deterrent to foreign bank involvement in debt financing. For this reason, Bank (2) explained foreign banks are therefore more likely to be more interested in equity financing if at all.

There is less publicly available information on where equity investment or project sponsors will come from. In December 2010 carbon finance analyst (1) suggested it would include development finance institutions such as IDC and DBSA, European utilities, large international energy companies, BEE groups and the developer itself in various combinations. One example of an equity provider is JSE-listed Aveng, the biggest construction group in South Africa and the largest infrastructure group in Africa by market capitalisation which has a 29 per cent stake in Spanish ACCIONA's Gouda Wind Farm in which BEE company Soul City has a 10 per cent stake (Acciona 2012). Aveng has identified energy as "a core future growth area for the group" and also intends to get involved in the nuclear programme laid out in the IRP 2010 (Creamer 2011:*5 Sept*).

Renewable energy project financing in South Africa is uniquely characterised by the BEE requirement as a precondition to obtaining a generation licence, and BEE partners in turn are likely to turn to DFIs such as the DBSA and the IDC to fund their stake in the project. Developers may negotiate in parallel with equity and debt providers. Legal advisors, often with international expertise, also play a key role in project finance, such as in negotiating over off-take agreements with the buyer of power (Alternative Energy Africa 2012a). There was a sense that banks prefer to fund larger projects given that the transaction costs are more or less the same for a 10 MW project as that of a 100 MW project**.** This conflicts with Eskom Transmission's preference for smaller projects in the first round of REFIT which would ensure that projects are not allocated to one input point and allow the Systems Operator to get used to new technologies. However, given that the Sere Wind Farm is itself 100 MW, Eskom is unable to insist on anything smaller from private generators.

Risk, real and perceived plays a fundamental role in the norms and demands of project finance. As SARi (2010:21) highlights "higher risks require higher returns especially for private investors" which inevitably puts up the cost of capital. Hence it asserts that "domestic institutional, regulatory and public policy measures are crucial in reducing investor risk in order to bring down the necessary REFIT premium." In November 2010 Lawyer (1) explained that some risks hit debt and equity equally and that other risks may have a limited impact on the project and may hit equity first and potentially debt not at all. "In project finance a 'cash flow waterfall' determines the order in which cash is spent from receipts under the PPA e.g O&M; paying the banks; funding reserve accounts; dividends. Return on equity is the last thing in the waterfall. The banks are at or near the top of the waterfall so get affected last" (Lawyer 1). Carbon Finance Consultant (1) explained that risks were related to exchange rates, transport, infrastructure and new industry risk. However s/he implied that the claim of risk was inflated, "it's easy for equity players to say 'you have to pay us, this is new.' But wind isn't that new a technology. If they can make VWs here in South Africa they can put up a wind farm."

6.7 Clean Development Mechanism: Rent seeking or adding value?

South Africa is one of the few countries in sub-Saharan-Africa to have projects registered under the Kyoto Protocol's Clean Development Mechanism (CDM). The majority of these are for industrial processes such as energy efficiency, co-generation and fuel switch, nitrous oxide and methane recovery, often developed by industrial players such as Sasol and Omnia (Reddy 2011:49). The CDM allows developed (Annex 1) countries with binding carbon emission reduction targets under the UNFCCC's Kyoto Protocol to buy credits from developing countries that do not have binding targets and are implementing carbon-reducing projects (cf Newell and Paterson 2010). From this purchase, Annex 1 countries earn certified emission reductions (CERs), in units of tonnes of carbon dioxide equivalent (tCO2e), which they can then use towards their own reduction targets and trade on the international market. CDM conditions state that each project must be 'additional', i.e that it would not have taken place otherwise and that it have both environmental *and* social benefits which may or may not include technology transfer.

However numerous studies demonstrate that the CDM is no mechanism for systems-innovation. Byrne et al (2011:18) find that it tends towards larger projects that are least cost and high return and "exploits static comparative advantages rather than building dynamic capabilities capable of transforming local contexts for development". Other studies question the "additionality" of such projects, and criticise the CDM within the broader context of international carbon markets. They find that it serves to entrench carbon intensive business-as-usual in industrialised countries and has been unable to channel investment to long-term, equitable, low carbon development pathways (Lohmann, 2011, Bond and Erion 2009). CDM projects are limited to developed technologies where there is a relatively easy and profitable generation of CERs, with over 80 per cent of registered projects globally using just five technology types, of which wind is the only 'new renewable', constituting 30 per cent of project capacity by type (Byrne et al 2011:19, 22). In addition the mechanism's narrow conception of technology as hardware assumes that its transfer will automatically be accompanied by "software" such as technical skills, learning rates and tacit knowledge (Ibid).

While the role of the CDM is of emerging significance to project finance in South Africa's renewable electricity industry, in socio-technical transitions terms it is being used opportunistically and in hindsight rather than as part of a systematic national sector strategy towards low carbon innovation. As selected renewable energy IPPs will simultaneously benefit from state subsidies in the form of RE IPPPP and again in the form of CDM CERs, it can be argued that they will effectively be "paid twice".

While DEA (1) stated that "the CDM has not worked well in South Africa so far" and that "project developers and the Designated National Authority (DNA), the national body responsible for the authorization and approval of a project to participate in the CDM, lack capacity[54]", AfDB (1) stated that nonetheless "South Africa has a bigger share of the CDM than other countries. It is a matter of having interest and commitment from the project sponsor and getting the right consultants to write the Project Design Documents (PDD). It requires strong capacity building programmes. The Swedish did training on this in Nairobi with Standard Bank" (AfDB 1). The role of consultants is explored by Gilbertson and Reyes (2009:64) who explain that given the complexity of the CDM's project documentation, it is carried out by specialist consultants, including from the company EcoSecurities, which is simultaneously the largest single purchaser of CDM credits. The role of such intermediaries and "internationally connected carbon entrepreneurs" in the CDM is described by Newell and Paterson (2010:Chapter5) and Reddy (2011:7) who finds that "less than 30 per cent of revenue from carbon trades goes to developing countries. The rest goes to brokers, bankers, investors, and consultants in rich countries, as well as fees and taxes".

Compared to its neighbours, South Africa illustrates Byrne et al's (2011:21) findings that the CDM privileges projects located in countries with sufficient absorptive capacity to host low carbon energy projects. While the CDM has been of little relevance to the country's electricity sector to date, it has rapidly become a consideration for the emerging renewable energy industry. Between January 2010 and June 2012, 45 wind energy projects were listed for prior consideration on the UNFCCC's website, most of which between November 2010 and June 2012[55]. By June 2012, South Africa's DNA had approved ten wind energy projects.

In theory in order for a project to be able to prove that CDM is "additional" the CDM process must be started at the same time. In December 2010 Carbon finance consultant (1) explained that to prove additionality, a project must show its internal project rate of return with and without the CDM and added that without it, "Banks will charge the project developer a higher interest rate". S/he continued that while CDM is no driver of wind energy project finance, it is significant in leverage terms. "You won't get any money up front for your carbon credits, but depending on with whom you sign your emissions reduction purchasing agreement, it will have important implications for the negotiation of debt and equity." Carbon finance consultant (1)

[54] The DNA assesses potential CDM projects to determine whether they will assist the host country in achieving its sustainable development goals and provides a letter of approval to project participants. This letter must confirm that project activity will contribute to sustainable development in the host country. It is then submitted to CDM Executive Board to support the registration of the project. For further information see: http://cdm.unfccc.int/DNA/index.html

[55] http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html?s=140

also suggested that it is likely that companies involved in equity investment in renewable electricity projects will “assume the right of refusal of the project’s carbon credits”. While there are few public examples of this to date, one illustration is Exxaro (see box 6.2) where the technology is provided by Danish Vestas and equity finance by the Danish utility Dong Energy, who will also purchase the project’s CERs.

When interviewed in late 2010 wind energy IPPs indicated that while they were currently registering their projects for CDM a huge degree of market uncertainty remained as to whether or not their projects would qualify, not least because at the time it was unclear whether or not there would be a second commitment period after December 2012. Wind IPP (7) stated “if you don’t start the process now it is not clear whether your project will qualify at a later stage. The longer you leave it the less likely it is that your project will qualify because of the additionality issue. Because of additionality, it is necessary to prove that CDM is making a financial difference. If your project is financially viable without CDM then you cannot apply for it. Also CDM changes the economics of the project, if you don’t have CDM it could make it harder to do anything outside of REFIT”. Wind IPPs also argued that should the then REFIT tariff go down below a certain rate which has since happened, then projects may not be financially viable without the CDM. However wind IPP (2) stated “there is also the question of whether REFIT projects will be eligible under the additionality principle because the REFIT tariff already makes it attractive. Some may argue that the IPPs are the first to market, taking inordinate risks and a huge technological leap, but wind has been proven elsewhere and many people are doing it”.

In October 2010 DTI 2 stated that what the potential wind industry will get out of CDM is very limited and that “it is more a case of cherry on the top”. Carbon finance consultant (1) added “it is just a piece of the market. You will make way more money from the sale of your electricity than your CDM credits”. Bank (1) concurred: “We don’t bank a project on the basis of carbon credits. The project must be viable anyway. It is not a driver. If project developers express an interest in carbon credits we refer them on to our carbon credit division.”

The matter of exporting emissions reductions which are also counted towards national climate change targets is pertinent here. Energy analyst (1) stated: “if all the wind in IRP 2010 gains CDM credits then it won’t count to our national reduction targets as per the LTMS, but to other people’s carbon emissions reductions. Should these things count as reductions for Annex 1 countries or for our national targets? If they count for both it would be double counting.”

From a socio-technical transitions perspective the CDM could be considered an enabling landscape initiative for an emerging niche (Scrase and Smith 2009). However in this case rather than supporting low carbon transformations it is in fact supporting “incremental” or “evasive” innovations (Courvisanos 2012). Innovations which it can be argued would have happened anyway, are already benefitting from subsidies from other sources, and in some cases may benefit MEC stakeholders that have their profits and core activities located in fossil fuels. To sum up, Sawdon (forthcoming 2013) argues that “In terms of … the broader emissions trajectory in developing countries, the CDM has been almost entirely inconsequential. And, to the systematic articulation of political and economic power which determines the pattern of investment in the energy sector, it appears almost completely epiphenomenal”.

Box 6.2: Cennergi’s Tsitsikamma Community Wind Farm
Cennergi’s (formerly Exxaro’s) Tsitsikamma Community Wind Farm consortium which plans to generate up to 100 MW of wind power by 2013 from a R1 billion project in the Eastern Cape (Savannah Environmental 2011b), draws on a diversity of national and international players. Cennergi together with IPP Watt Energy and the Tsitsikamma Development Trust which operates on behalf of the community that owns the land hold a 46 per cent stake. The rest is held by the Danish Industrialisation Fund for Developing countries and Danish IPP, European Energy. Other partners include: the Eastern Cape Community Wind Energy Development Association (ECCWEDA); Danish Vestas which will supply the technology; the Danish Export Credit Fund, which would provide debt credits; the Danish energy utility Dong Energy, which will buy the project’s CDM credits; and Danish wind laboratory Risø, which carried out the wind measurements and mapping (Watt Energy 2011). In late 2010 the Danish Embassy, which played a facilitation role in this project in order to leverage international funding, said “we are hoping this project will be a flagship for COP 17. It has the potential to leverage political clout through its poverty alleviation angle, ownership and economic benefits to the community” (Danish Embassy 1). The land tenure agreement is with the Tsitsikamma Development Trust which manages the land where the project will be constructed. In the post-apartheid era the land was returned to its former owners but there is an agreement whereby white farmers still use it. The land-owning community is very poor and few of its residents have access to electricity. Watt Energy is a black-owned ‘renewable energy project management and facilitation company’ based in Port Elizabeth. Mike Msizi, its CEO was forced off the land under apartheid in 1977. During his exile

he spent time in Denmark where he states, “I was quickly introduced to their biggest passion, drinking beer, followed by their second passion, the wind industry… It was not until the blackouts in 2006 and the introduction of Independent Power Producers into the vocabulary of ordinary South Africans that I remember what I had learned from the people of Denmark” (Msizi 2010). Msizi states that it was as a result of his actions that the first renewable energy desk for the province was set up, Watt Energy (Pty) was established and the interest of the Danish Embassy engaged. Following a visit to Denmark, Watt Energy met with Vestas, Risø and set up by ECCWEDA, now funded by DANIDA, which promotes landowner participation in wind energy. In November 2009, Watt Energy formalised its relationship with Exxaro as its equity partner and Vestas and Dong Energy as technical partners, and financial partners, IFU and EFK. In this instance it seems that not only is Exxaro hedging its bets in energy terms, as discussed above, but also in the context of shifting landscape trends of the international renewable energy market by teaming up with Denmark as a “traditional” player for this project and India as an emerging market player for another in the case of its Amakhala Emoyeni discussed in box 6.1.

6.8 Land grabs?

Securing land rights for renewable energy development can be complex and time consuming given that agricultural land, upon which most wind farms are planned, cannot be subdivided without the consent of the Minister of Agriculture (Deneys Reitz Attorneys 2010). Rezoning permission is also required given the change of land use caused by the wind energy project. In South Africa any land that is not a township or for industrial use constitutes agricultural land, even if is not productive. Waller (2010:38) explains that "the main cause for delay in the permitting process is that an EIA must be undertaken prior to obtaining rezoning permission". In order for a wind energy project to be bankable, the developer must be able to demonstrate robust rights of tenure or "Real Rights", a well-developed legal concept in South Africa (Deneys Reitz Attorneys 2010) which effectively means that developers must either have a long-term lease (over ten years) that has been registered with the deeds office providing uninterrupted access to the project site, or own the land.

While registering a lease or an entire property for a wind farm is relatively straightforward, restricting a long-lease to a certain portion of the property is more complicated. Under Section 3 (d) of the Subdivision of Agricultural Land Act 1970 this counts as a subdivision and approval must be obtained from the Minister of Agriculture. According to Deneys Reitz Attorneys (2010) "… having to obtain Ministerial consent is a process fraught with uncertainty and invariably proves to be time consuming". Therefore securing a lease for state land could involve two or three years of process.

Deneys Reitz Attorneys (2010) favour leasing the site, rather than acquiring full freehold title because the latter would require "having to pay a significant premium for the acquisition of a property once the owner has become aware of its potential in the renewable energy context". Wind IPP (6) added "land issues are complicated. If you want to buy or lease land, the owners could inflate the cost if they know it will be used for renewable energy". Deneys Reitz Attorneys (2010) add that "from the funder's perspective… at the least, the landowner's rights in respect of the areas to be used for renewable energy generation, should be subordinated to those of the developer". Such a statement alludes to a land grab in the case of wind energy development. Concerns were expressed by NGOs and some IPPs over cases where less scrupulous developers are taking advantage of landowners, particularly poorer farmers who may not be aware of the value of their land for renewable energy generation (NGO 2). This relates to concepts of "Green

Grabbing", (Fairhead et al 2012) whereby "appropriations of land for food or fuel" are justified by the apparent environmental credentials of the project in question.

In South Africa there is a considerable degree of uncertainty around land title particularly in the case of private landowners. A wind developer will need to identify the landowner in order for them to sign the consent form for the EIA. There may also be examples where low income communities may have common grazing rights but no formal title as in the case of projects being developed by Just Energy (box 6.4). In South Africa a lot of land is tied up with the state, in communal property associations and various different forms of ownership. Wind IPP (7) explained that addressing these issues from a local economic development perspective is very important, "otherwise the easiest route is to find a single landowner who owns a large piece of land but this will have little impact in terms of maximizing local economic input. It will also depend on the landowner and their willingness to share the benefit beyond themselves".

6.9 Localisation: an emerging industry in an emerging market

"*Over the next twenty years South Africa will need to develop an additional approximately 52 GW of new energy generation capacity to 2030. South Africa has world-class wind and solar resources by any measure that can contribute to a significant element of this capacity. In so doing, it can simultaneously enable development of the industrial capabilities to design and manufacture renewable generation systems, provide jobs, protect and enhance the competitiveness of exports in increasingly carbon-sensitive international markets and contribute to the country's energy security and so the basis for robust and growing economy*" Dr Rob Davies, Minister for Trade and Industry (SARi 2010:3)

'Localisation', used here to refer to the creation of jobs, skills and a domestic manufacturing and service industry for wind, relates to the country's aim to become a manufacturing hub for renewable energy technologies for the Southern Africa region or even the sub-Saharan African continent (DTI 2011:110). While research into its potential was firstly undertaken on behalf of the NGOs Earthlife Africa and WWF Denmark (AGAMA Energy 2003) following the launch of the 2003 renewable energy white paper it is now a stated priority for the government, with job creation and local content a fundamental requirement in the selection criteria for the RE IPPPP. Various national initiatives that aim to generate the conditions for localisation and employment creation in the "green economy" are outlined in a number of government documents, namely the DTI's Industrial Policy Action Plan (IPAP) 2011/12-2013/14, the Economic Development Department's New Growth Path (EDD 2011), and the DoE's IRP 2010. South Africa's green growth has also been embraced by international consulting firms such as Deloitte (2011). In October 2011 the Department of Science and Technology announced its plan to assist the wind energy sector as part of its Technology Localisation Programme.

However there are doubts over the ability of South Africa to establish a critical industrial base for wind energy development. This section explores how while possibilities for localisation have improved since the approval of greater allocations in the RE IPPPP and IRP 2010 and the embrace of green economic imperatives in national industrial strategies, it has been hampered by a late start and continued policy uncertainty.

At the 'Green Economy Summit' in May 2010, President Zuma asserted that South Africa has "no choice but to develop a green economy" (Zuma 2010b). In November 2011 a report by the DBSA, the IDC and Trade and Industrial Policy Strategies (Maia et al 2011) stated that a 'green economy[56]' could potentially create almost five million jobs by 2025, of which approximately 40 000 in solar and wind. The Green Economy Accord signed in November 2011 just before the UNFCCC Conference of the Parties in Durban by representatives of government, business, organised labour and a small number of "community constituents" pledged to create 300,000 new jobs by 2020 (EDD 2011). While Cosatu's general secretary Zwelinzima Vavi welcomed it as a key stepping stone to achieving the objectives of the employment-led New Growth Path (in Ensor 2011), it was received skeptically by a number of NGOs for repackaging "existing initiatives" within a profit making market based paradigm, and was dismissed by the Democratic Left Front (2012) as a new form of "green wash" which justifies the continued commoditisation of nature. From the opposite side, a scathing perspective came from Energy-intensive User (1), interviewed in October 2010: "the green economy is largely hype being thrown up on purpose by the wind and solar lobbies. There are three big lies: renewable technologies are cheaper, you can run a country from wind and solar alone and renewable energy will create jobs".

Not withstanding the potential of solar PV and CSP to create more jobs than wind in South Africa (Maia et al 2011:8), at the time of fieldwork more thought had been put into the localisation of wind in light of the greater commercial viability of the technology. In December 2010 DTI (1) stated that "the more we dig into things, the more it becomes evident that wind currently

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[56] There is no universal definition of the term 'green economy', which is an emerging and dynamic concept. It has been explored by various authors including UNEP et al (2008) and Mendonça, Jacobs and Sovacool (2010). UNEP states: "a green economy (is) one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities." (UNEP 2011)

appears to be the most viable technology with significant scope for localisation… localisation should be one of the fundamental criteria of REFIT". Lewis and Wiser (2007) state that until any country can generate sufficient domestic demand to support local manufacturing, wind power technology will be imported from abroad. Unless there is sufficient and appropriate domestic demand, South Africa may not be able to compete with cheaper imports let alone find a market for export. And without a thriving industry of its own, how can it realistically take the lead for the rest of the continent?

In global terms South Africa is behind the curve in what is a relatively mature and consolidated global wind industry where there are already "significant barriers to entry" with increasingly sophisticated technology and a reluctance amongst leading turbine manufacturers to license their turbine technologies, particularly to developing countries (Lewis and Wiser 2007:1846-7). Meanwhile WTO regulations could pose an obstacle, for instance to the ability of South Africa to tax the import of foreign wind turbines in order to stimulate the development of its own, or even on certain local content requirements.

Localisation could take various forms, including: the assembly of imported parts; manufacture of some components or entire turbines; local technology development through innovation and R&D carried out by a domestic firm often in combination with domestic research organisations; and technology transfer from an overseas firm via a licensing agreement which may or may not include the transfer of technological 'know how'. The three main areas which create direct jobs are: manufacturing of equipment, construction and installation of the project; and operation and maintenance (Lewis and Wiser 2007). A report by CSIR and Risø DTU (Szewczuk et al 2010) researching opportunities in support of the IPAP, recommended that government implement policies that support a large, stable market for wind power, coupled with policies that support local manufacture of turbines and components; the intensification of public funding programmes for innovation; the development of a dedicated model in order to accurately quantify potential job opportunities for a South African industry; and the establishment of a coherent national certification and testing facility.

The final promulgated 'policy-adjusted' version of IRP 2010 states that "a significant amount of wind is built, as this is the cheapest option. Care is taken to ensure a steady and consistent build up in wind capacity in order to stimulate localisation of manufacturing and job creation." (DoE 2011f:24). However while wind capacity in the final version of IRP 2010 comes to 11.8 GW or 13.8 per cent of total capacity by 2030 this signal comes late for the nascent industry. Prior to this a number of national factors provided limited encouragement for the creation of a critical industrial base for wind development including: the absence of appropriate, long-term transmission planning at the national level; the uncertain nature of the RE IPPPP, only finalised in August 2011; and the fact that former drafts of the IRP 2010 had only allowed for 700 MW of wind from 2011-2013 (split by 200 MW, 200 MW and 300 MW) which would not incentivise technology suppliers seeking to invest in a manufacturing and supply industry (see chapter 5).

Lewis and Wiser (2007) explain that the larger the domestic market for wind energy the more success in developing a local technology manufacturing industry, specifically a stable *annual* demand for turbines of a minimum of 150-200 MW per year for at least three years. However for a more "capable and aggressive local industry" a minimum of 500 MW each year is needed (Ibid p1849). In the final IRP 2010, the wind allocation is 300 MW in 2012 and thereafter 400 MW per year between 2013 and 2023, 800 MW in 2024, 1600 MW in 2025, 400 MW in 2026 and 1600 MW in 2027.

Vertically integrated manufacturing means that the supply chain of key components is carried out in-house or via long-term contracts with specific companies. "This captures the whole or main parts of the value chain" and would make it hard for newcomers to the market to integrate and find their strategic comparative advantage (Szewczuk et al 2010:23-28). Component suppliers are largely based in the Europe, the US, Brazil, China, India and South Korea. According to UNEP (2008) China, Denmark and US have thriving industries in turbine, blade, mast and gearbox manufacturing with China in the lead and anticipated to manufacture nearly half of the world's wind turbines. Lewis and Wiser (2007:1844) explain that any local industry will face stiff competition from leading turbine manufacturers which have strong international reputations, decades of experience, financial backing from mega-corporations such as GE and Siemens and an ability to offer multi-year service warranties that reduce investment risk and attract favourable terms.

Box 6.3: Locally made
South Africa has an industry for *small* turbines. Palm Tree Power makes small-scale wind turbines (300 KW and 30 metres in height as compared to 80 metres of a commercial sized turbine) (Szewczuk et al 2010:72). As its turbines are smaller they are more quickly deployed in developing countries for "isolated grid and distribution generation applications in Africa and other developing countries where for various reasons infrastructure might not readily be

suitable". The company receives support from South Africa's IDC but is unlikely to qualify for favourable debt financing from a commercial bank given that it lacks the requisite number of years of operational experience. In addition "small wind turbines will never compete with large wind turbines in terms of efficiency, annual production or even specific cost" (Szewczuk et al 2010:iv). Given the height of the turbines, they operate best on very flat land. Palm Tree Power has a supply agreement with IPP Just Energy for the latter's anticipated 25 MW wind farm in the Northern Cape (box 6.4). Another local wind turbine manufacturer is Cape Town-based Isivunguvungu Wind Energy Converter (Pty.) Ltd (I-WEC) which manufactures "state-of-the-art 2.5MW wind energy turbines and rotor blades in South Africa for the growing local markets", set up in 2009[57]. According to GTZ (1) it now has a licence from a German wind turbine designer. However neither company are supplying to successful projects selected under RE IPPPP.

6.9.1 Lack of optimism

While in late 2010 National Treasury (1) declared "as a nation we can do anything if we put our minds to it and take the challenge", there was a lack of optimism amongst wind energy IPPs about the potential for localisation in light of stiff competition for limited MWs and grid access under the REFIT/RE IPPPP. In November 2010 Wind IPP (2) stated "there has been limited cooperation and sharing of information between IPPs because of competition for REFIT. Otherwise it could have been possible to generate an agreement amongst us over preferred suppliers for instance. However currently everyone is contracting with different suppliers, e.g General Electric, Vestas, Suzlon. This is no way to localise and generate a national industry. Government needs to get involved and mandate this. South Africa already has a boat-making industry which could be turned to making blades locally. However this would need to be done at a very large scale. And the way things are happening it will not be a large market. In addition, South Africa is not cheap to work in." Carbon finance analyst (1) in December 2010 was similarly negative, "they won't make wind turbines here any time soon. Everyone will do their own procurement and get the best deal. You wouldn't mix and match [turbine technologies] because then you would need expertise to maintain two different types of turbine. I bet the turbine people are flocking to the developers and really kissing their asses right now". In October 2010 DTI (2) stated "We do not prescribe technology. Will it emerge that there is a preferred technology amongst IPPs? If there were, local industry would be easier to develop". Following

[57] http://www.i-wec.com/ accessed February 2011

the approval of the RE IPPPP in August 2011, Jason Schäffler of the Renewable Energy Certificate Association, quoted in the *Mail and Guardian* said “Chinese wind turbines will be the least expensive option. Some are okay and some are not" (in Steyn 2011).

In October 2010 bilateral donor (2) alluded to a lack of realism within government on the issue of local renewable technology manufacture saying “some government members consider that SA shouldn’t accept contracts from international firms without them building a plant in the country first…. However SA needs to install some wind first before any large company will consider building a plant”. Similarly in November 2010 Vestas (1) expressed frustration at the DoE’s suggestion that the company set up a factory in the country on the grounds that without “a committed idea of supply, this would not be possible”. S/he added that “in terms of local manufacture it is very expensive to set up a factory and is also unethical to hire people and then let them go” (Vestas 1).

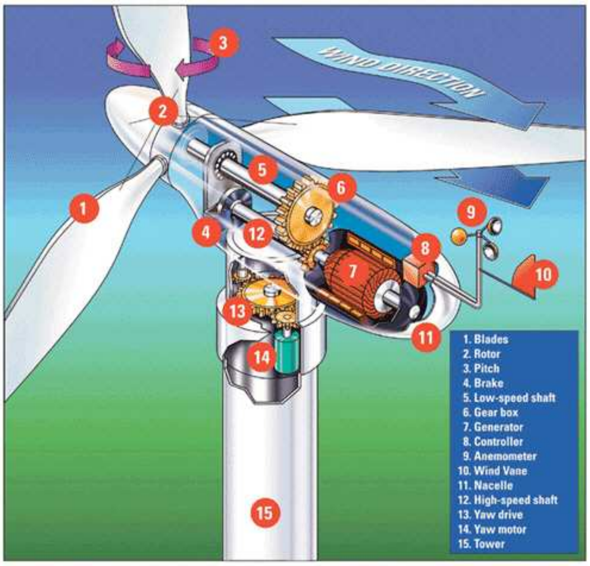
Stellenbosch University Professor Wikus van Niekerk pointed out that localisation of technology must also be accompanied by localisation of skills. Quoted in *BuaNews* he said that South Africa would need to produce nearly 1000 wind energy engineers per year by 2027 in order for a manufacturing industry to succeed. Hence each year alone the country would need to produce 52 engineers for the sector. He concludes, "we are really too late to train engineers for wind energy in South Africa" (Hweshe 2011). On the same point, Mainstream Renewable Power (1) stated: “Human capital in South Africa is limited. Mainstream sends engineers to head office in Dublin, Ireland for training”. Similarly, Vestas (1) stated, “it is not possible to copy an EU model and impose it in Africa. It is important to understand the context, the conditions and key stakeholders first”. This relates to Mokyr’s (1998) discussion on the difficulties of transplanting foreign technology into a country where adapted institutions have not evolved jointly as a result of which, serious incongruities and disruptions could result. Discussions by Byrne et al (2011:29) on the increasing “knowledge embeddedness” of technologies and the requirement for increasingly specialised knowledge for the creation of technical change are also relevant. Similarly Jenkins (2008) finds that technological change in South Africa has resulted in a decrease in demand for semi and unskilled labour in which the majority of the working population are employed.

While experience and innovative design is required for blades[58], control systems, gearboxes, generators and convertors, least cost is a greater priority in the manufacture of steel towers, the nacelle and the spinner for which local manufacturing is preferred (see figure 6.7). While the absence of a technical knowledge base specific to the wind industry may pose a challenge, South Africa's experience in other industries, particularly steel could have a spill over effect that benefits wind technology development (Szewczuk et al 2010). As steel towers are less sophisticated than other components and often the first component to be manufactured in a local market (Lewis and Wiser 2007:1846) this may offer an opportunity for South Africa in light of its potential comparative advantage in its steel manufacture (Eskom Sustainability and Innovation 1).

Project finance (section 6.6) is a further factor, bilateral donor (1) explained: "banks will not want to finance local manufacturers because they are a higher risk. There is a penalty for going local and this could be a big obstruction". Hence given commercial banks' reluctance to take on technical or financial risk and uncertainty, the stronger the track record and credible operational data of the technology supplier selected by the developer, the more agreeable the bank's lending rate is likely to be. To this DTI (2) added "you need standards as without them you cannot certify a turbine and banks will not finance the turbine. Banks want to implement IEC standards. Managing investor's requirements is a balance."

[58] According to Szewczuk et al (2010), the desire for in-house manufacture of blades is declining as large industrial conglomerates gaining market share such as GE wind and Chinese manufacturers are moving towards out-sourcing, while the more 'traditional' groups that tend to in-source such as Vestas are loosing market share.

Figure 6.7: Wind turbine diagram



Source: http://wind-turbine.tripod.com/id13.html

6.9.2 Trade Unions

Unions expressed concern that the introduction of renewable energy was being carried out by profit making interests amidst fears that it would affect job security. COSATU's August 2011 *Policy Framework on Climate Change* (COSATU 2011) states that "capitalist accumulation has been the underlying cause of excessive greenhouse gas emissions, and therefore global warming and climate change", and that "a new low carbon development path is needed which addresses the need for decent jobs and the elimination of unemployment" (COSATU 2011). Interviewed in early 2010, COSATU (1) expressed that the union was opposed to the introduction of private players in renewable energy generation given that "the private sector is motivated by profit making only". S/he also stated South Africa's unions were opposed to imports that threatened job creation, and hoped that any inputs to a wind industry in South Africa would be manufactured in country. Similarly in May 2010, National Union of Mineworkers (1) stated that "central to any decision [with regards to the electricity mix] should be the creation of local jobs". In November 2011, COSATU said it would reject any form of capital accumulation, "even if those forms of capital accumulation are green" (SAPA 2011). Similarly in February 2012 the National Union of Metal Workers of South Africa said it would try to prevent the renewable energy sector from being dominated by a capitalist system and that workers and communities are at risk of being left behind and "being forced to pay the costs of the sector's expansion" (Algoa FM 2012). COSATU (2011: Principle 8) states that a campaign to protect jobs and support workers whose livelihoods will be affected by a "just transition" to a low carbon economy is needed, and that "if we do not do that, then these workers will resist the transition". COSATU's principles for this just transition are echoed in Cock (2011:239) who states that "we also have to ensure that the development of new, green industries does not become an excuse for lowering wages and social benefits. New environmentally-friendly jobs provide an opportunity to redress many of the gender imbalances in employment and skills". Andre Otto of SAWEP endorsed this concern, "the unions (in South Africa) should be concerned. In Denmark the first developers of wind turbines were farmers – then it became big. The question here (in South Africa) is how we bring communities (into the fold). We need to take (the development) to those communities – to see how we can assist them" (in Aboobaker 2012).

6.9.3 Industrial Development Corporation: a shifting mandate?

Following the finalisation of the RE IPPPP in August 2011 *Engineering News* reported that "sustainable investments are set to absorb the largest single share" of the IDC's R102 billion funding plan for the coming years, with R22.4 billion set aside for low interest loans to establish a green energy industry and create jobs for labour-intensive and advanced manufacturing projects including solar, wind and agricultural processing, in alignment with the New Growth Path. This in contrast to R22.1 billion for the institution's more traditional areas. Ebrahim Patel, Economic Development Minister who has supervisory responsibility for the IDC said that the IDC must "lead the 'green industrialisation drive" and help South Africa identify new products and technologies" (Naidoo 2011a). In April 2012 the IDC announced that it may provide up to R10 billion for 12 renewable energy power plant proposals in the government's second bidding round and in 15 in the first round (Martinez 2012). However it is unclear exactly as to how the majority of these 'sustainable investments' are disaggregated and one can ask the extent to which this potential shift in the IDC's portfolio as a traditional MEC stakeholder (section 4.1.3) is discursive.

Box 6.4: Just energy: Land rights, development finance and local technology
An IPP, Just Energy, is a not-for-profit organisation that works to connect low-income communities that have a wind resource and who "may be living on land that offers more of a resource than they are able to exploit" (Just Energy 1) with partner organisations that have financial resources and technical expertise. The ultimate aim is to pass as much ownership as possible to the local community. After it has paid off its debt and covered the operational costs, project revenues will be returned to the communities. While Just Energy's projects will use local skills the main anticipated economic benefit will come from investing the project's income in

revenue generating activities within the communities. The organisation's plans began before the inception of the feed-in tariff and it is now faced with stiff competition for grid that wasn't there at the outset (Just Energy 1). Oxfam is a founding member of the IPP, has a seat on it board and currently funds its operational and core costs. The IPP is also supported by Bank of America (Just Energy 2011). In December 2010 Just Energy had three potential projects of a total combined capacity of about 115 MW.

As part of Just Energy's community benefit approach, landowners are structured into the project's ownership via a community trust or investment vehicle which will hold revenues on the communities' behalf. For instance community ownership of the 65 MW Riverbank Project in the Eastern Cape during wind farm operations is 40 per cent. This means that the community will be the project's principal BEE partner and will also be involved in deciding how the project's revenues will be invested, such as into local business creation or social support projects (Just Energy 1). The project will funded by the DBSA (Just Energy 2011).

In terms of seeking debt funding and equity investment, having the community as a shareholder is considered a 'risk' under project finance norms (section 6.6), especially if the community is to take consensus-based decisions as this is expected to pose increased uncertainty. While development finance institutions such as the DBSA are willing to take a higher degree of risk its rates tend to be unfavourable compared to commercial debt providers (Just Energy 1).

The River Bank Project is located the former Ciskei, a former 'Bantustan' set aside for black people in 'self-governing' territories under apartheid. The land on which the project will be constructed is owned entirely by small holder farmers with the first phase sitting on eleven different portions of land. Land titles have never been legally transferred from one generation to another and until recently there was no process for doing so. Therefore the title may sit with someone from three or four generations back meaning that they, their children and even their grandchildren will be dead. Just Energy (1) explains that getting the title transferred to the current generation can be problematic and complex particularly in the general absence of wills or death certificates. Before the Minister of Agriculture will approve a long-term lease, the land's title must be transferred to the new owners. Given the requirements of project finance, in the face of such legal challenges the IPP still needs to come up with something that banks will be willing to lend against.

Just Energy's 25 MW project in the Western Cape, St Helena Bay, is on land obtained by the community during the post-apartheid restitution process. However it has been hard for the community to make the land, which is dry and unfertile, generate an income so it has slipped further and further into debt. Just Energy (1) explains "when land is obtained as part of the government process, the community does not automatically qualify for a grant to help develop and use it and if it does the grant may not be enough. The land can become a liability due to the cost of taxes and upkeep. Wind development offers a potentially good source of revenue for the community to make the land viable".

The IPP tries to pick turbine manufacturers who can guarantee as much local content as possible in the turbine construction but is still bound by the limits of the market (Just Energy 1). South African turbine manufacturer Palm Tree Power will supply the project in the Northern Cape. This is harder on the project's economics given that the supplier does not have the requisite years of operational experience required by commercial funders. However this project is entirely funded by the IDC and the DBSA "who are willing to take the risk" (Just Energy 1).

6.10 Eskom's Sere wind farm: adding value?

*"The World Bank thought that putting renewable technologies through with Medupi would make them look good, but they were in essence putting two diametrically opposed things together, which sends a bad signal and it back-fired somewhat" (*AfDB 1)

The key interest of the 100 MW Sere Wind Farm for this thesis is that its construction, together with the 100 MW Upington Solar Power Plant was made a condition of the World Bank's loan to South Africa for the 4 800 MW Medupi coal-fired power plant in April 2010 (chapter 8). The project has since attracted what can be argued is a disproportionate amount of concessional finance from international donors and the World Bank-administered Clean Technology Fund (Energy analyst 2). The utility will further benefit from carbon emission reduction credits (CERs) as part of the CDM (see section 6.7). Sere's case illustrates how a niche-level initiative is being used to justify a major investment from the landscape level in the form of World Bank funding for the incumbent coal-fired power plant Medupi. It also demonstrates how while the World Bank and the AfDB as landscape level actors are extending support to both the regime and niche, their support to the former far outweighs their support for the latter. This section examines how while Eskom as a key MEC stakeholder is making limited niche level gestures, its main interest lies in traditional coal-fired and emerging nuclear generation.

Sere forms a fraction the utility's 17 000 MW capital expansion plan (section 4.6.2). It was official 'launched' in December 2011 at COP 17 in Durban and according to Eskom will be fully operational by October 2013 (Naidoo 2011c). In 2009 its estimated total project cost was R3 billion ($4.1 million) (Eskom 2009) though since then total funding requirements have not been disclosed (Naidoo 2011c). The business case for the wind farm was accepted in 2008 and put out to tender, with a public consultation taking place in January 2008 (AfDB 2010:23). However, in the event a tender was never allocated as in the wake of the global financial crisis at the end of 2008, Eskom's management put Sere and various other projects on hold (Eskom 1). As the bulk of the design work had been carried out, including on the transmission line to the site and the substation, halting the work came at a cost as the utility had already put in millions for the work to be done and had to cancel equipment orders for network upgrades (Eskom 1). Eskom now owns the land on which the project will be built which according to the AfDB (2010:3) has been purchased from three farm owners "on a willing buyer-willing seller basis". The project will be connected to the electricity distribution network at the Juno transmission substation (outside Vredendal), in possible competition with Cennergi's West Coast Wind Farm (Box 6.1). The global infrastructure development company Black & Veatch, head-quartered in the US is under contract to develop the project (Eskom 2011:64).

Sere does not qualify to apply for tariffs under RE IPPPP and will not be seeking equity partners, focussing instead on concessionary finance from numerous development finance institutions (DFIs) (ESI-Africa 2010) which has been committed often as a joint package for both Sere and Upington (Sievert 2010, Reuters 2011) as summarised in table 6.2. AFD was the first DFI to agree funding for Sere in 2007, to the tune of €100 million (SA info:2008). In all cases lenders are offered a sovereign guarantee meaning that the loan is backed by the South African government in the event of a default on repayments by Eskom. The project idea for Sere was approved by South Africa's Designated National Authority (DNA) in September 2007 (DNA 2011:13) and for Upington in March 2006 (DNA 2011:9).

Table 6.2: Project finance for Sere Wind Farm	
Lender	Amount
Eskom Holdings, the borrower	$44.5 million
Agence Française de Développement[59]	€100 million
World Bank's International Bank for Reconstruction and Development (IBRD)	$110 million
African Development Bank	$140 million[60]
Other lenders (including EIB and KfW)	$170 million
Clean Technology Fund (via IBRD)	$125 million
Clean Technology Fund (via the African Development Bank)	$50 million

Source: extracted from Climate Investment Funds (2010b)

In April 2010 the World Bank approved a $110 million loan to Sere as part of the Eskom Investment Support Project of which the bulk consists of $3.04 billion for the Medupi coal-fired power plant (World Bank 2010:29). Procurement tenders were re-announced in October 2010 (Eskom Enterprises 2010) and when interviewed in November 2010, Wendy Poulton, Manager of Eskom's Sustainability and Innovation Department confirmed that the project was at a commercial stage. World Bank (1) justified the provision of money for these two projects as part of the Eskom Investment Support Project by saying "there were gains to be made more broadly given that Eskom didn't have enough money for the renewable energy component, which was significant to its LTMS path and to which it had committed in its investment plan. This money would accelerate those projects significantly, despite what the private sector might say". CTF funding for these two projects was agreed later in 2010 as part of the "Eskom Renewables Support Project".

While scarce public finance at concessionary rates for renewable energy development may be welcomed, others question why proportionately speaking, so much of it is being channelled to so few projects (NGO 2). And via a utility that has already received significant public funds in recent years for its core coal-generating activities and whose financial management and commitment to transparency has come under question (see chapter 4). As Zadek (2010:1061) states, "the World Bank's allocation of climate funds to … Eskom was seen by most as an expedient attempt to defuse international anger over the far larger package of financing to

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[59] Amount calculated based on the financing structure provided Climate Investment Funds (2010b:3). As this document does not disaggregate financing between Component 1 -Sere Wind Power Project, and Component 2- the Upington CSP Project, I have split the figures in half in the absence of more detailed public information.

[60] The AfDB announced a combined $270 million for the Sere wind farm and Upington CSP plant, and a further $100 million to go via the World Bank managed Clean Technology Fund (Reuters 2011). For the sake of this report, a 50/50 split has been assumed

support the commissioning in South Africa of the Medupi Power Station". Such heavy subsidy and intervention also raises broader questions about how development assistance in climate change and renewable energy should be channelled (Nakhooda et al 2011).

As chapter 8 explores, one of the justifications of the World Bank loan to Eskom was that it would enable the utility to undertake large scale renewable energy development. Following this logic, the CTF project development objective of Sere and Upington is "to facilitate the accelerated development of large scale renewable energy capacity in support of the long-term carbon mitigation strategy of South Africa" (Climate Investment Funds 2010b)[61]. However the cost, capacity and carbon emissions of Medupi dwarf these tiny renewable concessions into insignificance. As Eskom (2) stated "Eskom has a long way to go. With 90 per cent coal, a 100 MW wind project is a drop in the bucket". AfDB (1) stated that "Eskom and Treasury made it clear that if they took CTF money that it wouldn't jeopardise their position on Medupi. They wanted no conditions. They acted as if they were doing us a favour rather than the other way round". It is also possible that funding was loaded onto these projects so that they could be rushed through in time for the UNFCCC COP 17 in December 2011, when South Africa's low carbon initiatives would come under international scrutiny. In her budget speech to parliament in May 2011 Energy Minister Dipuo Peter said, "we hope to conclude at least 1000 MW of renewable energy transactions by December this year, in time for showcasing as we host COP 17 in Durban" (McKenzie 2011).

Others argue that these projects represent easy pickings for DFIs who are keen to be seen to be boosting their renewable energy lending project portfolios (NGO 3). An alternative suggestion was made by Eskom (3) as to how to use public sources to create more of a level playing field and facilitate access for a greater number of different renewable energy projects. "The World Bank could have given us funding for transmission lines and a substation for the new renewable energy players rather than paying for Sere and Upington. It would have provided cheaper access for everyone else. But DFIs do not like funding transmission costs". Another point illustrated the dominance of the World Bank within the CTF, "within the CTF, the AfDB and other MDBs have

[61] The CTF plan for South Africa was endorsed by the CTF trust fund committee in October 2009 (Climate Investment Funds 2009) and consists of three projects approved in October 2010: "Eskom Renewables Support Project" consisting of the 100 MW Sere wind farm and 100 MW Upington CSP plant of $350 million (Climate Investment Funds 2010b); an energy efficiency programme funded by IFC and AfDB for $15 million (Climate Investment Funds 2010a); and a "sustainable energy generation component" of $85 million, also funded by IFC and AfDB (Climate Investment Funds 2010a) and for Upington about R5 billion or $600 million "excluding contingencies" (Climate Investment Funds 2010b)

been quite marginalised already. If you look at the breakdown it's mostly IBRD and that's no accident" (AfDB 1).

Concerns were also expressed that as Eskom has no expertise in the wind industry, building and operating the Sere Wind Farm would pose a technical challenge. An anonymous employee of the utility stated "wind is not Eskom's expertise. We should not be wasting our time on wind as we will be diverting skills away from the things we do best." Bilateral donor (2) stated "Eskom has strong competencies in coal and grid management. They have good engineers. However they have never built a wind farm." It is therefore likely that they will need to appeal to experienced consultants for assistance but the extent to which Eskom may develop its skill set in renewable energy from this project is unclear.

Eskom's dabble with renewable energy does not appear to portray the same level of enthusiasm or potential as that of Exxaro, but rather it can be argued represents a lazy attempt to capitalise on over-enthusiastic multi-lateral and bilateral donor funding which has crowded onto two small projects. As chapter 8 discusses, Sere and Upington have contributed to a legitimising low carbon discourse for World Bank funding for a high-emitting coal-fired power plant. In turn this raises questions over the use of 'climate finance' and the nature of emerging funds such as the CTF that have as their objective the mitigation of climate change and tackling of energy poverty. The case also raises questions over the relationship between multi-lateral institutions and the South African government, whereby the latter seems to hold significant bargaining power when faced with the former under pressure to find suitable clients and seeking to expand their renewable energy portfolios.

6.11 The technical challenge: transmission and the integrated grid

"Unless we get the powers that be to understand how they want to drive the politics, you won't get the infrastructure in" (Eskom 1)

"We can't build infrastructure if there are no development rights allocated. REFIT does not allow for that. Eskom needs to build infrastructure today, but for what and for whom?" (Eskom renewable energy engineer 1)

Following Smith et al's (2005:1493) assertion that the electricity-generating regime "is dominated by rules and practices relating to centralised, large-scale (usually thermal) power technology and high voltage alternating current grid infrastructures", the ability of South Africa's emerging renewable energy generation to integrate into a centralised national transmission grid that is approximately 90 per cent coal-generated poses a challenge that is both technical and political. This is exacerbated by competing claims over baseload power, 'variability' and 'intermittency.' It is unlikely that the amounts of wind and other renewable technologies included in IRP 2010 can be integrated without significant cost and time to adapt and upgrade the transmission and distribution systems. While Gül and Stenzel (2005:43) assert, "the experience with wind power showed that integration was more an economic and political issue than a technical issue", Mokyr (1998:40) qualifies 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".

Trollip and Marquard (2010:6) state that as wind energy develops and is supplemented by biomass, CSP, PV, mini-hydro and other technologies South Africa's centralised grid will inevitably develop into a "fragmented, decentralised infrastructure supported by a plethora of myriad independent power producers". I would argue that this is a long way off. And by the national utility's own admission this is an issue to which little strategic thought has yet been dedicated (Eskom 2010), illustrating what Byrne et al (2011:49) identify as the global dominant framing favoured by engineers, consultants, politicians and industry that only considers electrical energy within the context of the centralised transmission grid. It also relates to claims by Nelson and Winter (1982) and Dosi (1982) that cognitive routines mean that engineers will look in certain directions and not in others. Evolutionary thinking (Freeman and Perez 1988, Moe 2007) which asserts that institutions suitable for an earlier technological paradigm may not be appropriate to support new technologies is also relevant here. Hence the integration of renewable energy would necessitate a fundamental restructuring of the system in both technological and institutional terms (Künneke 2008).

Eskom's Systems Operator, responsible for planning the transmission network, balancing supply and demand and maintaining the stability of the system (section 5.2.3), is central to connecting renewable energy to the grid in South Africa. But as Eskom Transmission Division (1) explained in November 2010, learning new skills to be able to operate the necessary software such as SCADA (System Control and Data Acquisition) which is now standard in Europe and helps to manage fluctuations and match generation with load (customers) would be a challenge for the Systems Operator. Lack of clarity over grid connection capacity for renewable energy in South Africa was perceived as a serious risk by developers in 2010. For example, in October 2010 Vestas (1) stated "to date there are no adequate grid codes for integration in South Africa. Potentially this could be a big hold up". Likewise, in its *Generation connection capacity assessment of the 2012 transmission network,* Eskom (2010a:2) explained, developers will not construct a project without certainty of connection as they will be unable to generate income without it. Road infrastructure is likely to pose a further challenge. As DTI (2) explained "you can't make the wind blow where the roads are".

In December 2010 Eskom renewable energy technician (1) expressed difficulty in anticipating the necessary transmission design requirements given the unpredictability of applications from wind, and other renewable energy developers for grid connections particularly in terms of location and size. S/he described the situation as being like "a sitting dart board with these darts coming in every now and then. The dart board is filling up and up. We are getting five darts in the same place but we can only service one or two in that particular zone". In November 2010 Eskom Transmission Division (1) asserted: "the need to reinforce transmission will cause a delay in the introduction of renewable energy but if projects are within grid transmission capacity there will be no delay".

It is more cost effective to build and plan transmission for the final amount of power from wind and other renewable energy on the grid than to increase and reinforce grid capacity incrementally. An IEA publication asserts that "failure to develop grids concomitantly to intermittent resources such as wind power is likely to threaten system stability" (Gül and Stenzel 2005:30). Eskom Transmission Division (1) concurred: "energy planners and the DoE must decide on the generation mix so that we can deal with transmission accordingly. If we adjust the transmission grid for a certain amount of renewable energy and then have to integrate nuclear in 20 years time we will face a very difficult task." This relates closely to concepts of path dependency and technological lock-in discussed in Chapter 3. As Rip and Kemp (198:339) declare: "irreversibility, once achieved, is what makes a technology hard, difficult to change and a structural factor in itself".

Eskom renewable energy technician (1) also stated "Eskom needs to build infrastructure today, but for what and for whom? We need governance, willingness and political power today to support certain projects in the future. We can choose projects for 400 MW but for 4000 MW you have to think differently and think five years down the line". Until the increased greater certainty provided by IRP 2010 and the RE IPPPP, national policy had failed to allow for a strategic long-term determination of the country's energy mix and align it with its distribution and transmission system. The fact that IRP 2010 is a "working document" still leaves a lack of clarity regarding the generation mix and total capacity by 2030 and beyond.

The need for new transmission lines and substations could seriously delay renewable energy development not least because the necessary EIA approvals can take more than five years. In addition approval from NERSA is required as well as from Treasury in view of the high financial cost. For instance in November 2010 Eskom Transmission Division (1) stated that up to R300 million could be spent on one project. Eskom renewable technician (1) added "if the lead time for infrastructure is five to six years we need to give the development rights now because we won't build infrastructure if there are no developments allocated. But REFIT doesn't allow for that".

Given the significance of dispersed interconnection in minimising 'variability' and smoothing out electricity supply and demand[62] (Archer and Jacobson 2007, Katzenstein et al 2010), geographical placement of projects is also a key factor in the selection of renewable energy IPPs. According to Delucchi and Jacobson (2011:1171), the interconnection of wind over regions "as small as a few hundred kilometres apart can eliminate hours of zero power". However this is likely to exacerbate competition in instances of more than one project aiming to connect at the same substation which can only accommodate a certain amount of MW.

In November 2010 *Engineering News* reported that "proximity to the existing grid" would probably be a key deciding factor for project selection under REFIT phase 1 which at the time was set to contribute 1025MW to the grid by 2013 of which 700 MW of wind (van der Merwe 2010a). Geographical diversification of renewable energy connections would be a decision-making factor as this would reduce system instability as opposed to wind energy projects being

[62]With the exception of Gül and Stenzel (2005) most authors and experts referenced here distinguish between 'variability' and 'intermittency'. Wind (and some other renewables such as solar and wave) is 'variable' because the output from a wind farm varies considerably over time, being determined by numerous factors including seasonal variations and site specific factors e.g sea breezes are more constant than land breezes and wind speed (Rycroft 2011, Sinden 2008). Meanwhile the output from a 'conventional' thermal power plant such as coal or nuclear is considered 'intermittent' as this cannot be assured at all times either. For instance an electricity utility should anticipate a thermal plant being out action for approximately 170 hours a year due to circumstances such as mechanical or electrical failure and about 600 hours for planned maintenance (Milborrow 2009:32). Of note is that when an individual wind turbine is down, only a fraction of electrical generation is affected, but when a large coal-fired power plant is down this will have a significant impact on the grid.Flexible reserve generation, such as closed cycle gas turbines or pumped storage plants in the case of South Africa, is needed in order to manage variability. How much depends on how much wind power and how much flexibility already exists in the system. Other options for managing variability include the use of 'smart' meters so that flexible loads (demand) are moved to times when wind power is high, and storing excess energy at the site of generation in batteries, hydrogen gas, pumped hydroelectric power or a thermal storage medium (Delucchi and Jacobson 2011:1172). However the mainstream roll out of these possibilities is some way off even in countries with high levels of grid penetration.

allocated to one input point (Ibid)[63]. Quoted in the same article Kevin Leask, Eskom's grid planning department chief engineer, told developers that they "should be realistic in the timing of their projects, and it was not a matter of the system operator not being able to take the megawatts, but rather a question of what the cost of integrating those megawatts would be, and how long it would take" (van der Merwe 2010a). Hence the implication that projects requiring transmission reinforcement in order to connect would not qualify. However it was hoped that the gradual introduction of renewables would enable the system operator to gain experience in operating renewable energy generation with minimal risk which could be applied to larger amounts of generation further down the line.

6.11.1 Technical uncertainty

The upper limit of the share that wind and renewable energy can provide in an electricity supply and its associated costs and investments has been explored by various authors (Milborrow 2009, Grubb et al 2008, Delucchi and Jacobson 2011). Though a critical issue for policy makers, there is no consensus or certainty over this and it is a matter of international debate[64]. There is no doubt that the variability of wind could destabilise the electricity grid if no precautions are taken (Gül and Stenzel 2005). However there are very different national and international understandings over how well South Africa's electricity supply system would cope with the integration of renewable energy into the grid. Such a discussion evokes Jasanoff's (2003:160) analysis of competing areas of expertise and claims of science in influencing policy, which reflect the political and material interests of the disputing parties.

The sceptical viewpoint tends to cite a concern that wind cannot provide thermal 'baseload' power[65]. For example, mining industry expert (2) asked "what happens if the wind dies down or the sun goes in? What will be the effect on the system then?" Similarly, in November 2010 South

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[63] Milborrow 2009 demonstrates how increased geographical spread reduces wind fluctuations and has a "smoothing effect". Hence "the more wind-generating capacity that is installed, the more widely it is spread, and sudden changes of wind output across the whole country simply do not occur". He also points out that "while the loss of the largest thermal unit on a power system (1200 MW in the UK but 400 MW in Denmark) is a real risk, it is inconceivable that 400 MW to 1000 MW of dispersed wind generation will disappear instantaneously due to wind variations (Ibid 2009:36). In addition the uncertainty "imposed on a system operator by wind energy is not equal to the uncertainty of the wind generation but to the combined uncertainty of wind, demand and thermal generation" (Ibid 2009:39).

[64] An in-depth consideration of this matter and exhaustive study of the relevant literature is beyond the boundaries of this study. However, it appears that the bulk of the research that exists has been carried out in relation to Europe e.g Germany, Denmark, Spain, UK and Ireland, and North America where wind and other renewables are already present.

[65] "A base-load power station is one that is in theory available 24 hours a day, seven days a week, and operates most of the time at full power" (Diesendorf 2007). Archer and Jacobson (2007) assume that wind can provide a portion of baseload power.

African Independent Power Producer's Association (1) which consists of approximately 15 companies, mainly of coal-fired baseload and co-generation interests stated "We have to stabilise our baseload, which is what we are short of. We are dependent on Medupi and Kusile being commissioned on time. There is no plan B. The only other solutions are the power conservation programme, energy efficiency and demand-side management which take power away from users". The EIUG's December 2010 presentation at the IRP 2010 hearings called for the need "for available, reliable, base-load and internationally competitive power". The provision of baseload power was also a key justification provided by government and the World Bank for the construction of the Medupi and Kusile coal-fired power plants (Hogan 2010, chapter 5).

Renewable producers have refuted arguments that renewable energies are unpredictable and difficult to integrate into the grid, on which point SAWEP (1) stated that "a lot of rubbish has been written about the availability of wind in South Africa". At the June 2010 IRP hearings Umoya Energy said that wind energy penetration levels of around 10 per cent have a limited impact on the grid and that based on experience of European countries such as Denmark, Germany and Spain, penetration of up to 20 per cent is feasible[66] (Umoya 2010). The company cited the 2009 study funded by German GTZ which showed that Eskom's grid in the Western Cape could accommodate almost 3000 MW of Wind Power (section 6.11.2). It asserted that South Africa should be targeting 6000 MW of wind now, with a 2020 target of 16 500 MW and that wind power does not need additional back up "when placed in the correct context, i.e. a small diversified portfolio within the total system" (Umoya Energy 2010).

SAWEA (2010:3) argued that, "national electricity systems can typically achieve up to 15 per cent of wind penetration without any notable grid upgrades" which translates as 6600 MW of geographically dispersed wind capacity. This would be backed up by existing thermal units such as gas fuel turbine stations in the Western and Eastern Cape and hydro as short term reserve requirements which would allow the system operator to balance variations in wind generation. In a 2009 report WWF is confident that South Africa could achieve 15 per cent of renewable energy into the electric grid by 2020, ideally a mix of solar thermal and wind which would benefit "both from the lower cost of wind and the ability of solar thermal plants to contribute to peak demand" (WWF 2009:7). More radically, at the Civil Society Energy Caucus in September 2010

[66] According to Eriksen et al (2005) few countries in Europe have more than 20 per cent wind penetration, Denmark 49 per cent, Germany 22 per cent and Spain 22 per cent.

Killian Hagemann of G7 Renewable Energies stated that South Africa could be 100 per cent renewable by 2050.

6.11.2 Technical studies

A GTZ-funded report "Grid Integration of Wind Energy in the Western Cape" published in 2009, carried out by German company DIgSILENT in cooperation with the Western Cape Department of Environmental Affairs and Development Planning and Eskom, found that up to 2800 MW of wind power could be integrated into the Western Cape grid. This could take place without the need for additional transmission lines or grid stability issues, though upgrades would be needed at the distribution level. This would reduce the Western Cape's dependence on electricity imported from Mmpumulanga in the north east and accordingly alleviate strain on the Cape Transmission Corridor.

Building on GTZ's study, in February 2011 Eskom published its *Generation Connection Capacity Assessment of the 2012 Transmission Network*, in order to address the lack of clarity over connection capacities for new renewable generation at Eskom's main transmission system substations in the Eastern, Western and Northern Cape. The study allows for 'level 1' and 'level 2' connection capacity (table 6.3), the former considering the existing 2012 transmission network infrastructure with no network reinforcement and the latter allowing for limited local transmission network strengthening without extending to the reinforcement of the main power corridors (see figure 1.3). The report states that in order for a project to connect without time constraints, it would need to have a MW output less than the main transmission system (MTS) connection capacity, and "should be able to connect to the transmission network without any addition deep transformation reinforcement required" (Eskom 2011:4). Should "deep reinforcement" be necessary meaning that the project MW output is either the same as or greater than MTS connection capacity, it will imply a time constraint for connection.

Table 6.3: System N-1 Generation Connection Capacities

Area	Level 1	Level 2
Western Cape	2988 MW	4100MW
Eastern Cape	1042 MW	1600MW
Northern Cape	129 MW	1000MW
TOTAL	**4159 MW**	**6700 MW**

Source: Eskom 2010:ii

A similar study will not be carried out for distribution and instead “direct connection to the distribution networks will be considered on a case by case basis” (Eskom 2011:3), and that all distribution networks are supplied by a Main Transmission System substation. However despite this Eskom has limited involvement in the selection process over which the DoE will now have final say (section 5.3).

A Capacity Credit[67] study for wind commissioned by GTZ, Eskom and the DoE and carried out by DIgSILENT and Windlab (GIZ et al 2011) analysed three scenarios of installed wind generation capacity of 2000 MW by 2015; 4 800 MW by 2020 and 10 000 MW by 2020. They found that the capacity credit of wind generation in South Africa will be between 25 per cent and 30 per cent for installed wind generation of up to 10 000 MW and that the latest wind prediction tools will be important. GTZ facilitated a three day workshop in late 2010 and found that despite scepticism from Eskom about the adoption of wind, “by the end of a three day workshop a number of senior directors were in favour. It seems that Eskom has realised that it cannot resist renewable energy anymore, so it is preparing for the inevitable. There has been a paradigm shift” (GTZ 1). This and other findings with regards to the acceptance of renewable energy by the DoE and Eskom (section 5.2.2) relates to Geels and Schot’s (2007:402) claim that socio-technical transitions are not “planned and coordinated from the outset”, but rather become coordinated at some point “though the alignment of visions and activities of different groups”.

6.12 Chapter summary

This chapter finds that competition between transnational giants based in ‘core’ nations, which has long been a feature of South Africa’s industrial development (Makgetla and Seidman 1980, McDonald 2009:38) still applies to its nascent wind industry. While German companies have a long history in South Africa’s coal-based infrastructure sector, Germany and Denmark were

[67] The term ‘capacity credit’ refers to the percentage of installed wind capacity that can displace conventional capacity already on the grid (Milborrow 2009:41). As wind penetration increases the capacity credit of wind will decrease. It can also be referred to as Equivalent Firm Capacity (EFC) (GIZ et al 2011:33).The ‘capacity factor’ tells you how much a wind farm generates on average over a period of time, compared to output at full capacity over the same period. Hence if a wind farm has a capacity factor of 20 per cent this means that for every 1MW installed only 200kW will be generated on average every year. It is not easy to estimate the amount of firm capacity that the integration of wind generation into the grid will add as this is dependent on a number of factors, including: the correlation between wind generation and demand, the nature of conventional power sources and other renewable sources on the grid, the characteristics of the load such as peak periods, the reserve margin and the percentage of the total installed capacity that wind comprises (GIZ et al 2011). Capacity factor also depends on site specific factors such as wind speed, and the type of turbine technology, such as hub heights and rotor diameters. Generally speaking, the newer the turbine technology, the greater the capacity factor largely due to increased hub height and rotor diameter (Delucchi and Jacobson, 2011:1174- footnote). Capacity credit calculations must always consider the whole system (GIZ et al 2011).

instrumental in initiating South Africa’s emerging wind industry. These countries were pioneers of the global wind industry due to strong research and development since 1970s which resulted in established domestic industries (Lund 2009). Other ‘core’ nations in South Africa’s wind industry now include Ireland, Spain and France as well as the emerging markets of India and China. Given the burgeoning domestic industries of India and China they are now seeking export markets, while increasing their involvement in South Africa’s infrastructure development more generally. For example while the renewable portfolio of Exxaro, South Africa’s second largest coal miner was initially established with Danish support, Cennergi as it has since become was established with support from international conglomerate Tata Power. While not apparently one of the initiators of wind as an early niche, Cennergi now leads in terms of generation capacity by IPP. It will it be interesting to see if it retains this lead in future bidding rounds of RE IPPPP. Secondly in terms of technology supply, while ‘traditional’ players Danish Vestas and German Siemens and Nordex still lead in terms of market supply, Indian Suzlon headed in South Africa by the former CEO of one of the country’s largest electric municipalities with strong links to the ruling party is now making a credible challenge. Thus far it is set to supply almost a quarter of approved MWs.

The extent to which national infrastructure is compatible with the introduction of wind and other renewable energy (Scrase and Smith 2009:717) is a serious factor given that minimal changes in grid transmission infrastructure due to costs and regulatory hold ups may fail to facilitate the timely emergence of wind and other renewables to electricity supply. To that end, in its promotion of renewables the Transitions Management (TM) approach finds a centralised electricity system which is a feature of most OECD countries difficult to sustain and instead finds a structure based on distributed and micro-generation more appropriate. However it is unlikely that this will emerge in South Africa any time soon.

To return to the question over the extent to which the introduction of wind, as a recent development in South Africa’s coal-dominated electricity supply sector represents a structural shift in its MEC, it is clear that the technology has started to receive growing support at the level of policy and institutional support from regime actors. However while wind IPPs and those that support them may contribute to the generation of a cleaner electricity supply in South Africa, the construction of these technologies will still fuel a doubling in demand as chapter 5 has explored. As Geels (2011:28) states, “niches gain momentum if expectations become more precise and more broadly accepted, if the alignment of various learning processes results in a stable configuration ('dominant design'), and if networks become larger (especially the participation of powerful actors may convey legitimacy and resources to niche-innovations." While these niche innovations may not rival South Africa's internationalised resource conglomerates, they are nonetheless supported by significant actors at the regime and landscape levels in financial and technological terms, and are beginning to incorporate MEC stakeholders backed by international interests. They also include energy service companies that have to date been focused on coal-generated electricity supply. For this reason we can consider that wind may become a vested interest in its own right (Moe 2007) and in turn become a new form of accumulation that will fail to tackle energy poverty and reinforce historical inequalities. However it is also notable that Eskom's involvement in it is minimal and apparently unenthusiastic. Rather than a wholehearted embrace Eskom is using the construction of wind as a justification for the construction of further coal. On that note, chapters 7 and 8 now turn to developments in the coal industry playing out in parallel to the renewable emergence.

7 Chapter 7: Coal crunch?

"Eskom sits between the interests of the country's coal-miners and its energy-intensive users. Eskom is a vehicle for shifting risk. The coal companies and the EIUGs make the profit and shift the risk onto the state that shifts it onto the public." Energy analyst (2)

Ninety three per cent of South Africa's electricity generation is supplied by coal. While its electricity sector is governed by a public monopoly, approximately 80 per cent of its coal is supplied by five private monopolies, Anglo American Corporation (AAC), BHP Biliton, Xtrata, Exxaro and Sasol. As international conglomerates these companies have significant reach at the landscape level. While Eskom is their biggest customer for coal supply, they in turn are amongst Eskom's biggest customers for electricity. They wield considerable influence over the utility with regards to setting the terms of coal supply agreements. Members of the Energy Intensive User's Group (EIUG) and the Chamber of Mines (section 4.1.4), these coal miners also wield considerable power over electricity policy making as chapter 5 has examined. Here in chapter 7, I analyse recent developments in the country's coal industry and explore the institutional and market dominance in the commodity's mining, supply and usage. This adds to chapter 4's exploration of the MEC and the electricity sector and sets the scene for an analysis of the Medupi coal-fired power plant in chapter 8. It also challenges the extent to which South Africa's coal industry can be considered a well-established subordinate regime within its coal-generated electricity regime. Together with chapter 8, this chapter addresses the key question:

- *How is South Africa's historically entrenched coal industry resisting and adapting to an evolving energy landscape?*

On a methodological point, a contemporary analysis of South Africa's coal industry is challenged by the fact that there is limited literature on this subject with exceptions being critical in-depth contributions by Marquard (2006) and Eberhard (2011). For this reason insights from authors writing in the decade prior to the end of apartheid and its immediate aftermath are significant, including Fine and Rustomjee (1996), Clark (1994), Innes (1984) and Christie (1984). Secondly many of the 'official' facts and figures on supply and demand, and the nature of stakeholder involvement are opaque in nature or deliberately kept secret. Hence much of the evidence here has been compiled from media reports and interview material.

Despite significant shifts in the country's projected electricity mix (chapter 5), coal generated electricity, a central feature of the MEC will still play a major role. The IRP 2010 envisages that coal will supply at least half of South Africa's electricity needs by 2030, to a total capacity 41 071 MW. However in recent years the quality of coal burned by Eskom has been deteriorating at the same time as its costs have increased (Eskom 2010). This has contributed to the 25 per cent year on year increase in electricity prices agreed in 2010 (section 4.6.4) and the costs of running new build coal-fired power plants including Medupi.

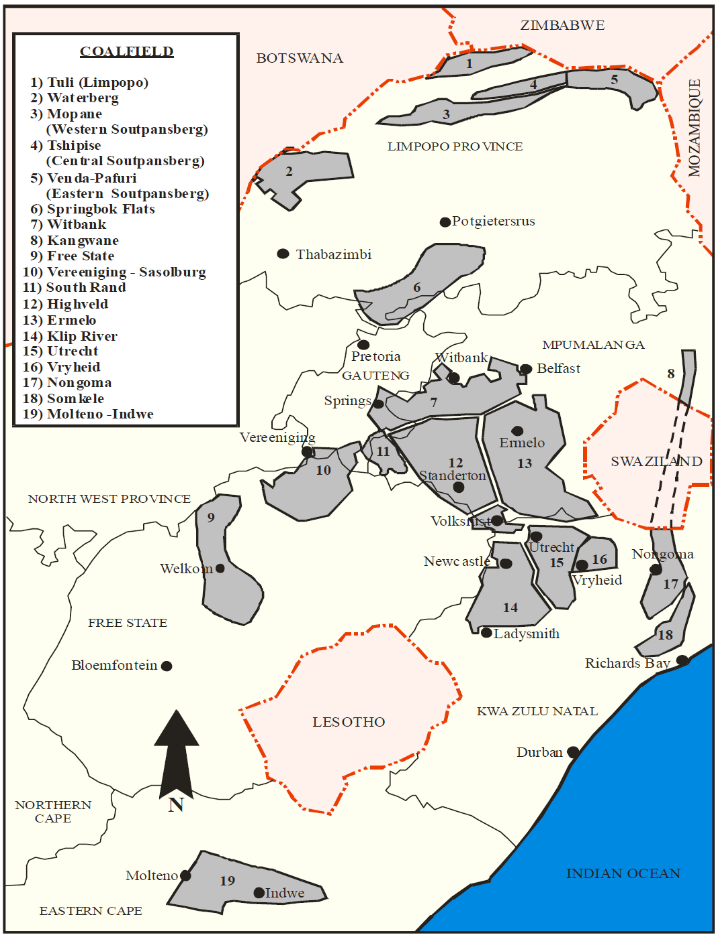
In reference to the title of this chapter, 'coal crunch', the historical low cost of South Africa's abundant resource endowment in coal is now under threat which has resulted in a shift away from long-term favourable contracts between Eskom and private mines. A number of factors have contributed to this, including: the impacts of growing export demands on the domestic market; infrastructural constraints on the internal and international transport of South Africa's coal; the continuation of large-scale economic capital that continues to control the country's coal industry though now coupled with the emergence of small-scale Black Economic Empowerment (BEE) coal companies in the post-apartheid era; the highly secretive nature of coal procurement contracts between Eskom and the mines that supply it; and the lack of bargaining power held by Eskom in relation to these suppliers.

Eskom's 2010 Annual Report lists increasing costs of coal transport, the uncertain long-term supply of coal and its deteriorating quality as "emerging risks" (Eskom 2010:19). Significantly the utility alludes to its own lack of bargaining power in the face of its coal suppliers by describing an "on-going deregulation of the coal mining industry, with a corresponding shift in the power balance away from the national interest to that of the shareholders of the mining companies. This has directly impacted the quantity, quality and cost of coal supplied to Eskom as some miners have deliberately optimised their total business at Eskom's expense (even to the extent of receiving ongoing volume and quality penalties)" (Eskom 2010:96).

7.1 On Coal in South Africa

Global coal consumption has grown faster than any other fuel since 2000, by 4.9 per cent per year with the five largest users, China, USA, India, Japan and Russia accounting for around 72 per cent of total global use (WEC 2010). IEA (2010:207) states that limits to the continued use of coal are defined by the need to limit global carbon emissions rather than scarcity. One third of South Africa's coal is exported despite infrastructure constraints (section 7.5), which is now its third largest commodity export earner after platinum and gold (Eberhard 2011:29). With the world's largest coal export terminal at Richard's Bay north of Durban on the East Coast, its geographical positioning in the Pacific/ Atlantic basin makes it a 'swing producer' (Eberhard 2011) allowing it to export coal to Europe and the East. It ranks fifth as a hard coal exporter behind Australia, Indonesia, Russia and Colombia (Ibid p2).

Figure 7.1: South Africa's coal fields

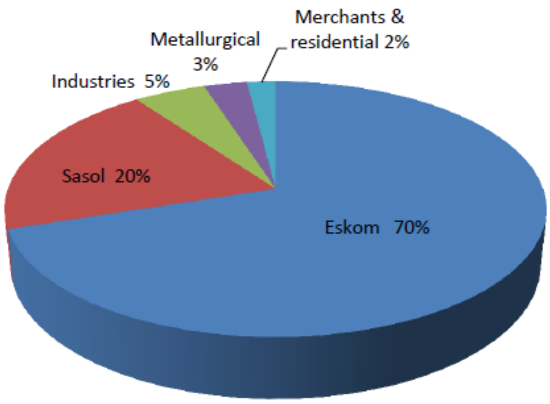


Source: Eberhard (2011:44)

Given that South Africa's coal seams tend to be thick and close to the surface, it has been relatively easy and cheap to extract. Half of the country's production comes from opencast mines and the remainder from underground mines (Eberhard 2011:2). In comparison to coal found elsewhere, South Africa's coal tends to have a low sulphur content but a high ash content, sometimes up to 65 per cent which gives it a lower calorific value (Marquard 2006). For this reason export coals are usually washed in order to keep their ash content below 15 per cent. Ninety six per cent of South Africa's reserves are bituminous, thermal or steam coal, which are used for electricity generation. Metallurgical or 'coking coal', used in the smelting of iron ore for the creation of steel and anthracite account for 2 per cent each. Eskom's coal-fired power stations use conventional pulverised coal technology, which have average thermal efficiencies of 33 per cent, in contrast to global average efficiencies of 35 per cent between 1990 and 2007 (Eberhard 2011:2).

Currently most of South Africa's coal is mined from the Highveld, Witbank and Ermelo coalfields in Mpumalanga province in the north east, where most of Eskom's 13 coal-fired power stations are located (see figure 7.1) with Witbank the most important source. However, these coalfields are now approaching their productive limits (Booyens 2012). According to Marquard (2010) South Africa cannot use more than a quarter of its current coal reserves and still meet its climate targets, yet plans by Exxaro for the massive development of untapped deposits in the Waterberg where coal has higher ash content and lower yields are under way. Exxaro intends to increase rail capacity from the Waterberg to 40 million tonnes a year, of which half for exports and half for Eskom's Mpumalanga power plants (Eberhard 2011:11) including 14.6 tonnes for Medupi (section 8.7). Exxaro is also part of the Transkalahari consortium which aims to develop coal and mineral reserves in South Africa and Botswana and create a rail line through Botswana and Namibia in order to export to Europe (Seccombe 2011b). It intends to increase its coal export allocation at RBCT as well as develop downstream products such as char and market coke (Exxaro 2010). While the Waterberg holds the biggest potential for growth in the steam coal industry (Booyens 2012), it is far from industrial centres, has a limited water supply and an inadequate rail infrastructure leading out of it. Its coal is also harder to access and is found in layers instead of the seams of the Central basin (Naidoo 2011d).

Figure 7.2: Coal use in South Africa excluding exports



Source: Prevost (unpublished 2010, in Eberhard 2011:4)

Source: Prevost (2010), in Eberhard (2011:4)

While there is no up to date picture of the country's coal reserves (Creamer 2012:*1 Feb*), drawing from various sources Eberhard (2011:2) estimates that the country's economically recoverable coal reserves range from between 15 and 55 billion tonnes[68], though a figure of approximately 30 billion is more commonly cited (BP 2011). According to Eskom (2011:2) it burned 122.7 million tonnes of coal and emitted 224.7 million tonnes of CO_2 in 2010. It is estimated that Eskom's coal demand will peak at over 155 million tonnes per annum in 2021 once the Medupi and Kusile power plants are operational (Eberhard 2011:34) and is set to reduce to an estimated 60 million tonnes per year by 2040, when a number of Eskom's power stations will have been decommissioned (ESI-Africa 2011d). However South Africa's coal miners are still keen to pursue coal as a major source of electricity provision (Seccombe 2011a). Domestic prices currently at about R170 or $23 per tonne are amongst the cheapest in the world but these are rising and likely to continue to do so in the coming years (Eberhard 2011:37). Eskom (2011:72) anticipates an additional 15 per cent rise in the coal price in 2012.

7.2 Private monopolies

Despite such a heavy reliance on coal for primary energy, South Africa has no explicit coal policy to match (Marquard 2006, Eberhard 2011) though coal prospecting and mining rights are controlled by the new Department of Mineral Resources (DMR). Coal comes from privately owned mines and has no price controls. The domestic market was deregulated after 1986 following years of extensive lobbying by the coal industry (Eberhard 2011:8), described by Makgetla and Seidman (1980) and (Innes 1984) as 'monopoly capitalism'. Prior to this the domestic coal price was set without reference to international prices given that most domestically consumed coal was considered a different commodity due to its low calorific value.

Despite recent gains by smaller black owned coal producers discussed below, South Africa's coal industry is still dominated by large multinational mining conglomerates that have evolved from the six 'axes of capital' discussed in box 4.1. The five companies account for about eighty per

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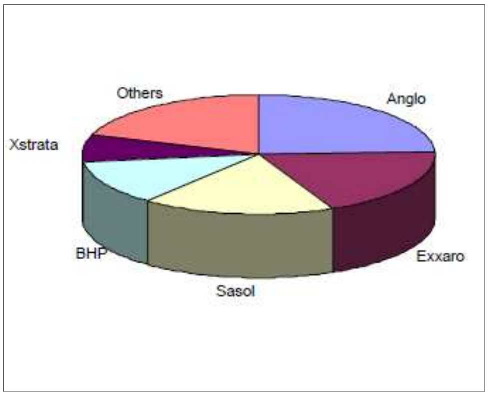
[68] In the first half of the 20th century it was assumed that South Africa's coal deposits were effectively inexhaustible. For instance the 1921 Coal Commission (in Marquard 2006:74) reported that the country held almost 45 billion tonnes of coal, which assuming an annual consumption of 10 million tonnes meant that it would take 5000 years for coal resources to eventually run out. However a Coal Commission report in the 1970s provoked a minor policy crisis when it suggested that South Africa would need to seek alternative energy sources by 1990. This sparked greater research in resource and reserve estimates which by 1980s identified 51,960 million economically recoverable tonnes (Marquard 2006:73-74).

cent of coal production in South Africa (see figure 7.3, Eberhard 2011). While Sasol owns its own coal mines, of which the majority are in the Highveld coal field and supply its Secunda coal-to-liquids (CTL) plant amongst others, the bulk of Eskom's supply has come from long-term contracts with adjacent private mines owned by the other four companies (Ibid). Of the coal consumed domestically, Eskom uses two-thirds and Sasol one fifth (see figure 7.2)

Figure 7.3: Share of production by South African coal producers



Source: Eberhard (2011:3)

South Africa's coal industry is a further example of the economic dominance of large scale corporate capital embedded in the country's mining and industrial history and hence its socio-technical regime. Until the end of apartheid, collieries operated as divisions within gold mining houses, after which the internationalisation of South Africa's coal and other mining industries developed and collieries separated into their own local and overseas marketing operations (Marquard 2006). Companies such as AAC and BHP Billiton then diversified internationally and restructured their South African subsidies into international coal groups (Ibid p82), merging with other mining and minerals conglomerates.

Box 7.1- South Africa's five main coal companies
• **Anglo American Corporation (AAC)**: The country's largest coal producer (Eberhard 2011) where it owns nine thermal coal mines. It is also the world's largest producer of platinum exclusively from its South African operations. In South Africa its operations consist of Anglo American Corporation plc (financial), Anglo American Thermal Coal,

Anglo Gold Ashanti and Anglo American Platinum Corporation Ltd. It has an 85 per cent stake in de Beers, the world's biggest diamond distributor[69] (see also Box 4.1).

- **Exxaro:** With its origins in the steel parastatal Iscor, it is amongst the world's top three producers of mineral sands, the only zinc producer in South Africa and the largest BEE company listed on the JSE. It has operations in South Africa, Australia, Namibia and Chile. It is the sole supplier of coal to the Medupi power plant, with a small renewable energy portfolio (boxes 4.2, 6.1, 6.2).

- **Xtrata**: Xtrata Coal, headquartered in Australia operates five mines in South Africa[70]. With its origins as a Swiss listed mining company in 1926, Xtrata plc was created in 2002 and listed on the London Stock Exchange. Xstrata South Africa is a subsidiary of Xstrata plc and consists of Xstrata Alloys and Xstrata Coal South Africa. Xtrata Alloys, based exclusively in South Africa is the third largest user of power at 1.1 GWh per year (Seccombe 2010). A $90 billion merger agreed in February 2012 between Xtrata and commodity trader Glencore would make it the world's fourth largest mining group by market capitalisation (Financial Times 2012a).

- **BHP Billiton**: Headquartered and listed in UK and Australia with a secondary listing in Johannesburg, BHP Billiton in South Africa was formed out of Gencor in 1997 when it merged with Australia's BHP and absorbed Rand Mines. BHP Billiton's Energy Coal is now one of the world's largest producers and marketers of export thermal coal. In January 2007 South African Ingwe Collieries wholly owned by BHP Billiton changed its name to BHP Billiton Energy Coal South Africa (BECSA) which has three coal mining operations in Mpumalanga Province[71].

- **Sasol:** Created in 1950s as a global pioneer of coal-to-liquids technology using the Fischer-Tropsch process involving synthesising liquid hydrocarbons from coal, Sasol is the world's leading coal to natural gas processing company. Coal-to-liquids was first used industrially in Nazi Germany during the Second World War and then by apartheid South

[69] http://angloamerican.com/about/ataglance
[70] http://www.xstratacoal.com/EN/Pages/default.aspx
[71] http://www.bhpbilliton.com/home/businesses/energycoal/Pages/default.aspx

Africa under international sanctions, with considerable assistance from IDC (Fine and Rustomjee 1996:169). Sasol's first plant in South Africa started in 1955 and has since produced more than 1.5 billion barrels of synthetic liquid fuel (IEA 2010:171) (see also 4.1.4).

Quoting Fine and Rustomjee (1996:9): "the users of electricity within mining are the group producers who own and operate the gold and other mines". This is endorsed by energy analyst (4) who stated that "there are huge interests in the supply of coal and the purchase and sale of electricity. The same people are on the board of directors of the energy-intensive users as they are of large mining companies". These companies are also amongst the country's highest carbon dioxide emitters, with Sasol at 61.2 million tonnes of CO_2 equivalent, BHP Billiton at 3.1 million tonnes of CO_2e and AAC with 2.7 million tonnes of CO_2e (CDP 2011:22).

South Africa's coal development is woven into the country's political and economic history, including divisions between 'Afrikaner' political power and 'English' economic capital until 1950s (see 4.1.1). In the immediate post-war era, access to the domestic market was controlled by the cartel, the Transvaal Coal Owners Association (TCOA) set up in 1908 which represented 'English' mining capital (Fine and Rustomjee 1996).The TCOA were blamed publicly for domestic coal shortages in the country while making excessive profits from exporting their coal (Fine and Rustomjee 1996:158). A similar scenario is now taking place with today's mining and energy conglomerates, as this chapter explores.

Until end WW II, Afrikaner capital was virtually absent in mining and other productive activities that until then were the preserve of English capital (Fine and Rustomjee 1996: chapter 7). However the promotion of Afrikaner finance capital in late 1940s and 1950s by the National Party government with assistance from the IDC coincided with the creation of a range of gold mining related institutions, the central MEC activity of the time. This challenged the control of British commercial banks such as Barclays and Standard Bank over the mobilisation of national finance for industrialisation. By 1950s as the divisions between Afrikaner political power and English economic power began to disintegrate, the TCOA began to admit Afrikaner-owned coal-mines into the cartel (Fine and Rustomjee 1996:158) and in 1960s the interpenetration of large-scale Afrikaner finance into mining took place. This was "supported by the implementation of industrial policy through state-owned corporations in steel, chemicals, fuel and energy" and the consolidation of large-scale capital (Ibid) which enabled the state to implement coordinated industrial policies by 1970s for the first time (Ibid p168).

The incorporation of BEE objectives is a key recent development in the country's coal industry. In addition to the establishment of mining major Exxaro, which will supply the majority of Medupi's coal (chapter 8, box 4.2), BEE deals have also created numerous smaller black-owned companies which are competing for a share in domestic and export coal markets and now collectively control more than 30 per cent of South African coal production (Eberhard 2011:8, 31). According to DPE (Hogan 2010c), "all Eskom's suppliers meet the requirements of the Mining Charter and the BBB-EE Codes". In FY 2008/9 the total value of contracted coal from BEE suppliers to Eskom was approximately R11.3 billion (Hogan 2010c).

There are some notable examples of the inter linkages between the country's mining conglomerates and smaller BEE companies. Optimum Coal[72] is now the country's sixth largest thermal coal producer and the fourth largest exporter of thermal coal (Eberhard 2011:12). It owns two operating mining complexes, both located in the Mpumalanga province. Cyril Ramaphosa, who was involved in the setting up of the BEE Commission in 1998 (section 4.1.6), was recently appointed as nonexecutive director and chairperson of the board (Lazenby 2012). In another example in an almost circular model of interest, Eberhard (2011) explains how BEE company, African Rainbow Minerals (ARM) has a 10 per cent direct interest in Xstrata Coal South Africa (XCSA). ARM also owns 51 per cent of its subsidiary, RM Coal which in turn holds a 20 per cent interest in XCSA. Another example is AAC's 73 per cent stake in Anglo Inyosi Coal who hold Kriel colliery and the new Zibulo multi-product mine.

7.3 From coal crunch to electricity crisis: Eskom's bargaining power

Eskom's lack of bargaining power with its coal suppliers is central to electricity policy-making. Eskom (2010:97) refers to its "limited means to drive consistent pricing and contract terms in negotiations", and to ensure that negotiations are agreed under a reasonable timeframe "since the miners are almost always better off delaying until Eskom has no option but to agree to their terms".

Three quarters of Eskom's coal comes from long-term contracts with so-called 'tied collieries' or mines near to its power stations (Eberhard 2011:38). However, since the start of the supply

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[72] http://www.optimumcoal.com/Optimum-Coal-Fact-Sheet.pdf

shortages in 2000s these have been unable to meet the utility's demand to meet the high burn levels to which it has been subjecting its power stations. Due to its need to source coal from elsewhere in order to meet these supply shortages and to comply with its BEE commitments, Eskom has sought more expensive, short or medium term coal supply contracts with mines located further away from its power stations. These contracts are also affected by the increased costs of road transport and the subsequent damage that this causes to the roads (Njobeni 2010:*13 July*, Creamer 2011:*4 Feb*) such as in the case of the Majuba and Tutuka power stations. Indeed, an element of the World Bank's loan for the "Eskom investment support project" (chapter 8) is for a larger capacity railway line to supply Majuba for which a feasibility study was undertaken in 1990s but never implemented (Eberhard 2011:16).

According to Prinsloo (2011), Eskom buys 29 per cent of its coal on short-to medium term contracts, 24 per cent on fixed price contracts, and 47 per cent on 'cost-plus' contracts, a contractual arrangement where Eskom pays for "all the operating costs to mine the coal plus an annuity return to the mining house" (Eskom 2011:102). In a leaked memo, Olsen (2007) explains how "these mine financing documents assured that the mining houses recovered 100 per cent of their capital investment as well as a healthy return on that investment during and post that recovery".

The secrecy surrounding Eskom's short to medium term coal procurement contracts is clearly illustrated by former minister for Public Enterprises Barbara Hogan's response to questions posed in the National Assembly in February 2010. Responding to questions over how much coal is burned by each power station; how much electricity is generated by each power station; the average coal stock pile per month and per power station; and the detail of coal contracts with individual coal suppliers, she stated that detail "is confidential and its disclosure could be prejudicial to Eskom's commercial negotiations in support of security of supply" (Hogan 2010c). This is a further illustration of Marquard's description of the secrecy in energy policy making as a legacy of the apartheid era.

Eskom's inability to set terms in coal supply contracts has been identified as a strong contributing factor to black outs and load shedding experienced in 2006/8. This in addition to its mismanagement of its coal supplies and inadequate stock piling (Chettiar et al 2009) which has been cited by a number of sources. Marais (2011:348) refers to the 2008 black outs as a "'perfect storm' of coal-supply mishaps, scheduling errors, surging demand and strategic miscalculations"... which brought "an unnerving reminder of the muddled and reactive nature of energy policymaking in South Africa”. He describes “a reliance on low-quality and wet coal (transported in open trucks and carriages in the rainy season) and an unusual coincidence of scheduled power-plant refurbishments and unscheduled repairs, which reduced generating capacity even further. ‘Capacity constraints’ may have contributed to some of the scheduling errors that removed some power stations from the supply grid for maintenance work and shortages of skilled technicians have been cited as a reason why repairs took longer than anticipated” (Ibid p349).

This is endorsed by mining industry expert (2) who concurred that during the blackouts of 2008, Eskom ran out of coal and ended up paying international prices for last minute additional supplies: “This is because the utility’s previous practice of keeping a 21 day coal stock pile in its base load power stations was reduced to 10 days by the then Eskom finance director who now works at Anglo Platinum. At this time there was an increase in electricity demand as part of the pre-recession commodities boom. This coincided with a bout of heavy rain which turned already low stockpiles into sludge. When this was put into the boilers Eskom ran into huge problems and the utility had to turn to the spot market for more supplies. What this meant was that local coal companies were able to charge international prices”. South Africa’s Chamber of Mines also blamed the large load loss on maintenance failures at the utility, as well as a flawed stockpile policy which meant that it was “using the ‘mush’ at the bottom of their coal stockpiles” (Creamer 2011:*4 Feb*). Since the black outs Eskom now attempts to hold stockpiles of 42 days in all its power stations (Eskom 2010:31).

However the most damning report which uncovers some alarming detail is found in a memo, dated 19 July 2007 from Susan Olsen of US international energy consultancy Wingfield to Eskom’s then CEO Jacob Maroga, leaked to the press in September 2009. Writing before the 2008 load shedding took place, her findings included that: Eskom ’s Generation Primary Energy division (GPE) had allowed the mining houses to dictate the terms of long-term coal-supply agreements so that the capital gain and return on investment was heavily skewed in their favour; most of the agreements neither required that the mining houses supply the quality of coal appropriate to the design of Eskom’s power plant in question nor that they fuel the plants at 100 per cent load if so required; that Eskom’s GPE had consistently and historically failed to enforce the minimal requirements of the contracts; and since the end of apartheid under the minimal requirements of the supply agreements, many mines had prioritised coal supply for export in terms of both quality and quantity over coal supply for Eskom.

Olsen also found that while BHP Billiton and AAC put forward “solid” teams of negotiating experts, GPE put forward an ever changing team of staff who had no experience of commercial discussions and would even ask the mining houses to draft the agreement and the associated prices. In sum, she stated that Eskom’s GPE division lacked “experience in and knowledge of the coal industry in general and South Africa in particular and the impact of coal quality on power station performance and reliability... The hard truth is that until very recently, GPE’s staff of mining engineers, geologists and other technicians never had to compete with domestic industrial demand or consider the implications of the international coal market on its ability to secure coal. Unfortunately GPE is unequipped for the challenges”. de Lange (2009) argues that Eskom’s failure or inability to act on the majority of these findings contributed to the blackouts of 2008.

In 2009 Eskom signed a large number of medium term coal supply contracts, which run out in 2018 (ESI-Africa 2011d). The IRP states “Today South Africa is in the very privileged position of having access to coal that is priced well below world-market prices and locked in via long-term contracts. If, however, these contracts expire and are open to renegotiation (especially the older existing contracts), it is uncertain whether the new negotiated price will remain favourable, especially if selling it on the global market would be more attractive” (DoE 2011f:19).

7.4 Export and domestic tensions

“Coal supply in South Africa is dependent on market forces and these are driven by price incentives... Market conditions are changing and growing international demand for coal is putting extreme pressure on world markets for coal supply. The highest bidder gets the best coal and there is great incentive for South African companies to export our best coal rather than to supply domestic needs”. (Fakir 2010a)

As export prices are about three times higher than those offered by Eskom (Seccombe 2012), Eskom now finds itself competing with potentially lucrative profits that can be made from increased demands for the country’s coal exports and related to that, its re-negotiation of many of its contracts with its suppliers**.** Meanwhile there is no export strategy for coal (Creamer 2012:*1 Feb*). In its 2011 Annual Report (2011:24) Eskom states that rising international coal prices “could result in coal being diverted for the export market and Eskom not having access to sufficient coal, and/or to coal of an acceptable quality. This can lead to the increased cost of coal for Eskom and possible coal shortages. In addition, there are efficiency implications for using poorer quality coal as well as associated increases in maintenance.”

Richards Bay Coal Terminal (RBCT) has had a capacity of 91 million tonnes per annum since 2010 (Eberhard 2011:22) and is controlled by the private coal producers who export their coal via the port. The export entitlement of each coal producer is proportionate to the size of the company's share holding in the terminal. Until 2004 less than one per cent of RBCT was owned by black controlled companies, with AAC, BHP Biliton and Xtrata collectively accounting for three-quarters of the terminal's capacity. However, in the latest expansion of the terminal's capacity this balance of power has shifted with one third of export allocations now in the hands of black-owned coal companies (Ibid).

Figure 7.4: Richards Bay Coal Terminal[73]

Source: RBCT

Exported coal has always generated significantly higher revenues than that sold domestically. For instance even in 1948, 7.5 per cent of South Africa's coal was exported but contributed 46 per cent of total coal mining profits (Fine and Rustomjee 1996:157). South Africa's coal export development can be divided into three phases (Marquard 2006): until 1940s between a sixth and one third of all coal production was exported; between 1950 and 1970 this was reduced to about two per cent of production due to state restrictions (Eberhard 2011:6); and from 1970s the mining and production of South Africa's coal increased markedly following new investment in the industry, the introduction of beneficiation technology including Sasol's synthetic fuels, wage increases and the resurgence of the international coal market[74].

[73] Available at: http://www.rbct.co.za/upload/images/gallery_08.JPG, permission of use obtained
[74] Marquard (2006:76) describes how between 1940s and 1970s South Africa's coal industry stagnated due to factors such as the introduction of price controls on the domestic market by the state which failed to recognise depreciation, the electrification of the railways which reduced direct coal use, the decline in

This 1970s resurgence was followed by a massive expansion programme by Eskom (see chapter 4), the construction of RBCT in 1976 and a dedicated rail link from South Africa's most important coal-fields to the port as part of the development of a large export market. Between 1970s and 1980s South Africa's coal industry saw output more than double and quadruple by the end of the century (Eberhard 2011:6). Meanwhile the global oil crisis in mid-1970s increased opportunities for South African coal exports to Europe and the expansion of Sasol's coal-to-liquids industry. Marquard (2006:77) documents how the development of South Africa's coal export market in 1970s lead to coal being the top performer on the JSE by end 1970s, with exports generating 90 per cent of the industry's revenue. More recently Eberhard (2011:15) adds that this has also lead to a deterioration of domestic coal quality as suppliers have reserved higher grades for export. In October 2010 mining industry expert (2) concurred: "coal prices in South Africa are R200/ 250 per tonne, but spot prices on export are $160 (R1108[75]) per tonne. The exported coal is much better quality. South Africa burns very low grade coal."

South Africa's coal exports are dominated by Asia mainly China and India (Esterhuizen 2012a), but also South Korea, Malaysia, Pakistan and Taiwan. This follows Eberhard's (2011:25) prediction that while demand from Europe will decrease demand from emerging market economies, particularly China and India will significantly increase. This is exacerbated by new export markets in India which are now competing with Eskom for a type of low-grade coal known as RB3 which had conventionally only been burned in South Africa (Njobeni 2010:*13 July*, Eskom 2010:96). Eskom's Primary Energy division says this could threaten about 520 million tonnes of domestic supply (ESI Africa 2011d).

The issue of coal industry regulation or lack thereof is raised periodically by stakeholders in government. Most recently, it was the subject of debate at a conference on South Africa's coal road map, being developed by various government and industry bodies including the DMR, Anglo-American Thermal Coal, Sasol, Eskom and BHP Billiton. In February 2010, then minister of Public Enterprises stated "the current regulatory environment may not sufficiently protect South Africa from the international market for steam coal and aggressive interest shown by India and China to secure access to imported coal" (Hogan 2010c). In February 2011 Eskom requested that the DMR introduce greater regulation to control the production, storage and use of coal in South

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exports due to the stagnation of the international coal market and anti-apartheid pressure. He stated that the industry had "a semi-feudal labour-intensive production structure".

[75] At $1=R6.93 at rates of 1 October 2010

Africa (Creamer 2011:*4 Feb*). However while the minister shared Eskom's concern she took no action to address this (Ibid).

The inability of government to act on the issue of coal regulation suggests that like Eskom, it too is beholden to the more powerful interest of the country's coal companies. Evidence to support this view can be found in the response of the chief executive of South Africa's Chamber of Mines Bheki Sibya, who denied the existence of a coal supply or quality crisis and rejected calls for state intervention to curb coal exports in order to meet domestic supply. He said that instead "there is an industry that is willing to work with the relevant government, labour and industry stakeholders to facilitate continued security of primary energy supply, and the continued growth of South Africa's world class coal-mining industry" (Creamer 2011:*4 Feb*). He also denied that the coal-mining industry is supplying poor quality coal for electricity generation and exporting coals that had traditionally been reserved for Eskom.

Such a debacle illustrates strong tensions and power plays within the regime, with South Africa's private coal miners holding the upper hand over the electricity parastatal. Moreover, the lack of government intervention suggests an inability or unwillingness of the DMR and DPE and other government departments to act in the face of powerful interests.

7.5 Infrastructure constraints

"South African coal exporters are constrained by logistics. The Transnet rail infrastructure is inadequate. So there are limits to how much coal we can get onto the rail system. When we negotiate with Eskom for the cost of local coal supply they know that we cannot export. In that sense they are insulated from the dynamics of the international coal price" Coal miner (1)

Despite greater profits to be made from export than the domestic market, South Africa's coal exporters are still challenged by insufficient rail transport and heavily reliant on trucks, which in turn cause costly damage to the roads. While RBCT has an export capacity of 91 million tonnes per annum, the associated rail capacity fails to match this at less than 68 million tonnes per annum (Eberhard 2011:21).The rail parastatal Transnet described by Eberhard as "probably the only integrated rail-ports-pipeline state-owned monopoly in the world" (Ibid) owns the railways from the mines to the port, and is a key obstacle to the development of further rail infrastructure for South Africa's coal exporters. For this reason coal exports have in fact declined in recent years having peaked at 69.2 million tonnes in 2005. As Transnet's ownership and operation of South Africa's ports other than RBCT and petroleum pipelines account for the bulk of its profits it has limited incentive to invest in its coal rail link (Ibid). This is exacerbated by the reluctance and/ or inability of coal exporters to commit to long-term guaranteed usage agreements.

Inadequacies in the rail transport system also impact the internal distribution of coal. Mining industry expert (2) claimed that “Eskom’s coal procurement policies are not well organised. Some of its supply comes from a series of small BEE companies who deliver in trucks. This boosts Eskom’s BEE figures. For instance, the Majuba coal-fired power plant uses 45 000 tonnes of coal per day which is delivered in 1000-1500 trucks per day. There is a huge problem of quantity and quality. For instance trucks can trip the system by filling the lower part of the truck with water. They are only weighed on the way in, not on the way out”. A similar tale is told by Fine and Rustomjee (1996:157) in the era shortly after the electricity industry was taken over by the state in 1948 (chapter 4) when an absence of sufficient railway trucks and locomotives limited the movement of bulk coal from the mines to urban power stations and urban consumers as well as coal for export.

Olsen (2007) adds to this with the discovery that Eskom’s GPE is unable to “audit and track a ton of coal from any mine from which it is produced to the boiler in which it is fired. Aside from being unable to determine the true cost of electricity at any station’s busbar, GPE cannot on any given day determine how much coal it has received, stockpiled or burned.” She identifies two cases of “missing” coal, 80000 tonnes at Arnot power station and 278000 tonnes at Kriel. The additional costs of road damage caused by coal haulage trucks are significant. In its multi-year price determination application to NERSA 2010/2011 to 2012/13 (section 4.6.4), Eskom asked for R10 billion over five years for road maintenance for coal transportation in Mpumalanga (NERSA 2009e:16).

7.6 Chapter summary

South Africa’s coal industry can be referred to as an example of what Freeman and Louçã (2001:329) describe in relation to the ICT industry as broader global networks of “monopolistic corporate power” in the form of giant multinational corporations. In this case the South African government and Eskom lack the bargaining power to introduce greater regulation and transparency or control pricing in the face of large internationalised mining companies. The chapter also illustrates the difficulty of defining the socio-technical regime as a level of analysis within the MLP. In South Africa’s case, while the electricity utility has had a monopoly over generation and transmission and 60 per cent of distribution, it appears to be subservient to the demands and expertise of coal-related capital. Hence conceptualising South Africa's coal industry as a "subordinate" regime (discussed in section 3.1.1) within its overarching electricity regime is problematic.

Relating to previous discussions, as a JSE-listed public company and the state electricity utility, Eskom is a difficult entity to categorise which relates to its conflicting role as "developer, procurer, negotiator, evaluator etc" (section 5.3.8). While its Systems Operator is involved in mediating between competing fractions for the continuation of capital accumulation as in the case of the IRP, as a utility it is struggling to maintain its own monopoly power over electricity generation, transmission and distribution. And despite the ISMO bill, for the time being it is still the single buyer of power. In this sense it can be considered both a state entity and a fraction of capital. Moreover, the pressures to which Eskom is subject from the coal mining industry in addition to the others factors identified in this thesis may yet serve to destabilise it further financially and politically in the long-term. It is paradoxical that the companies which have benefitted from its cheap tariffs are members of the same conglomerates that supply it with coal and whose actions it can be argued are contributing to its long-term destabilisation. This returns to the statement by energy analyst (2) at the start of this chapter that Eskom is a vehicle for shifting risk between the country's coal miners and its energy-intensive users. It can be argued that this is a key reason why Eskom finds itself in its current financial crisis. One response by Eskom to this instability has been to increase electricity tariffs (section 4.6.4) and seek finance from multi-lateral development banks construction of further coal-fired generation capacity. The latter is now discussed in chapter 8.

8 Chapter 8: The Medupi coal-fired power plant and the discourse of clean coal.

8.1 Introduction

Africa's largest coal-fired power plant Medupi, in Limpopo province will be the first base load coal plant to be built in over 20 years in South Africa, and the first to use supercritical coal technology. With a total installed capacity of 4 800 MW, Medupi is amongst the top ten largest coal-fired power plants in the world. It will consume approximately 17 million tonnes of coal per annum, is set to increase South Africa's energy sector's emissions by 9.2 per cent (AfDB 2009c:12) and will emit an estimated almost 30 million tonnes of CO_2 per year (AfDB 2009c:12) over its 50 year lifespan. The largest single investment that Eskom has made to date (Rafey and Sovacool 2011:1141) government approval for its construction was granted in 2006 which began in May 2008 (AfDB 2009c:iv). In April 2010 a World Bank loan of $3.04 billion was approved for the project amidst great national and international controversy as the main component of the Eskom Investment Support Project. Initially to have been completed in 2012, the final version of the country's IRP (Chapter 5) schedules it to come online in 2013 (DoE 2011f) though other reports say that the project is now two years behind (Kumwenda 2010).

The case of Medupi highlights competing priorities playing out within South Africa and elsewhere over energy security for economic growth, the requirements of climate change mitigation, access to energy for the poor and environmental sustainability. In a remarkable narrative, key arguments in support of the World Bank's loan led to the plant being labelled 'clean' coal. This was linked to claims that it will contribute to a national low carbon transition on the basis of: its use of super-critical coal technology; and conditions of the World Bank's loan for the retrofitting of Flue Gas Desulphurisation (FGD) technology, the parallel construction of two 100 MW renewable energy projects, energy efficiency measures, and that Medupi be made 'Carbon Capture and Storage (CCS) ready'.

Medupi illustrates how language is used to protect the practices of the socio-technical regime in question. This chapter firstly examines how regime incumbents have employed discourse in order to maintain material power over the country's natural resources and associated political power. This draws on Newell's (2009:427) question of who has power "to define what is and what is not clean and sustainable development". It follows Hajer's (1995:44) description of discourse as "a specific ensemble of ideas, concepts, and categorizations that are produced, reproduced and transformed in a particular set of practices and through which meaning is given to physical and social realities". The creation and use of competing and contested discourses by various networks and coalitions (Hajer and Versteeg 2005a) relating to the negotiation and eventual approval in April 2010 of the World Bank's loan illustrates attempts by entrenched regime interests and MEC stakeholders to redefine coal as a 'clean' technology that will support the interests of the energy poor, and counter arguments that respond to such claims. This has created two quite different realities.

This case study relates to contested uses of 'clean energy' which in the absence of internationally agreed standards or accepted definitions of what this should constitute is a relative rather than absolute concept. Within South Africa the term is simultaneously used by the coal, nuclear, gas, hydro-electric and renewables industry. Furthermore the chapter considers how Medupi may benefit from carbon emission reduction credits under the UNFCCC's Clean Development Mechanism (CDM) on the basis of its 'clean coal' technologies. This sees the CDM operating as a "landscape pressure" that serves to support regime interests rather than innovations at the level of the niche.

The chapter then examines how a loan from the African Development Bank (AfDB) approved just months before that of the World Bank, largely escaped public scrutiny despite considerable deviations from its lending and procurement rules. Lastly the chapter explores how the World Bank's loan has become embroiled in broader national issues of corruption in Black Economic Empowerment (BEE) deals and alleged profiteering by the South African ruling party's investment arm.

This Chapter responds to the following questions introduced in Chapter 1:

- *To what extent do recent developments in South Africa's electricity generation sector constitute a low carbon transition in its minerals-energy complex?*

and

- *How is the historically entrenched coal industry resisting and adapting to an evolving energy landscape?*

This is assisted by the following sub questions:

- *Who and what were the key drivers and forces of influence for and against the World Bank's agreement to fund the project: at the level of the regime, landscape and niche?*
- *How has the use of discourse shaped perceptions of the Medupi coal-fired power plant and decision-making over its finance?*

A methodological consideration discussed in chapter 2, is that due to the sensitive and secretive nature of South Africa's coal industry and the Medupi coal-fired power plant as well as confidentiality agreements between government and the World Bank regarding the institution's loan to the project, access to stakeholders involved in these fields was much more limited than those involved in the nascent wind industry and the policy arena. As mining industry expert (1) explained "with regards to Medupi there is a great deal of secrecy surrounding it and people are unwilling or fearful of talking about it. It is a black box". With the exception of an interview with a former representative of the African Development Bank (AfDB 1) which provided key insights, this chapter has relied heavily on internal memos from development finance institutions, grey literature including publications by industry and civil society, and government documents and speeches. Academic literature on Medupi is also limited given that the controversy surrounding its construction and the World Bank loan has emerged relatively recently with exceptions being Rafey and Sovacool (2011) and Sovacool and Rafey (2011).

The framing of climate change mitigation and its financing, a key theme in this thesis is central to this chapter. Firstly finance from the AfDB and World Bank for Medupi provides a poignant illustration of support from landscape level actors for regime interests in the MEC under the guise of sustainable low carbon development. Secondly as discussed in chapter 3 it challenges concepts of the landscape as 'exogenous' and illustrates how landscape actors become intrinsically bound up with national processes including in this case, matters of corruption.

Multilateral support for South Africa's MEC is nothing new. While Medupi is the largest World Bank loan to date, loans for similar projects were made in the past. There are parallels between the construction of Medupi and Kusile and of three new power stations in 1960s in order to meet the demand of the country's twelve gold mines being developed by Orange Free State Goldfields (Fine and Rustomjee 1996:155). The power stations were built on the coal fields so as to remove the need to transport large amounts of coal from mine to power station. The World

Bank loaned the Union Government $30 million in 1950 and $30 million in 1954 for the power plants, and $20 million in 1950 and $30 million in 1954 for railway infrastructure (Fine and Rustomjee 1996:158). In both cases past and present, blackouts and power shortages were used as an argument to justify the construction of more generation capacity. The NGOs groundWork and Earthlife Africa (groundWork 2010 et al) endorsed by numerous national and international organisations have referred to these as “apartheid empowering loans” for which only white people and heavy industries received electricity “but for which the entire society paid” and has called on the World Bank to offer reparations. Finally while in the case of Medupi, South Africa is currently competing with India, China and elsewhere for parts and equipment for power station construction, in 1950s it was the Korean war that “mopped up supplies of imported power generation equipment” (Fine and Rustomjee 1996:158).

8.2 World Bank loan: For and against, a summary

In November 2009 Medupi was granted a loan of €1.86 billion (about $2.63 billion) from the AfDB which was co-financed with €1.22 billion from European Export Credit Agencies (AfDB 2009c). Just five months later in April 2010, the World Bank’s IBRD approved a $3.04 billion loan as part of the $3.75 billion “Eskom Investment Support Project”. The World Bank’s investment in Medupi, its largest ever in South Africa, was formally requested by government in February 2009. According to Friends of the Earth International, the loan constituted half of the World Bank’s total fossil fuel funding for 2010 (FoE 2011).This was made with an interest rate of 0.5 per cent to be paid off over a period of 28.5 years. The Eskom Investment Support Project consists of three components:

- $3,040 million for the financing of the Medupi coal-fired power plant using supercritical technology, including construction contracts and associated transmission lines
- $260 million for the Sere Wind Farm and Upington CSP plant, co-financed with CTF and other DFI financing (see Chapter 6); and
- $440 million for “low carbon energy efficiency components” including the Majuba Rail Project (financed by IBRD alone) (World Bank 2010a:ii).

Support for and opposition to the World Bank’s loan for Medupi on environmental, social, political and economic grounds was sharply polarised. Rafey and Sovacool (2011) describe the discursive justifications in support of the project as “economic development, environmental sustainability, and energy security” and against it as “maldevelopment or secrecy, environmental degradation or energy poverty" (Ibid p1142). They also refer to the rhetoric of "inevitability" (Ibid p1145) pervasive throughout arguments in support of the project which posits that the consequence of not building Medupi would be "so dire as to be unacceptable and unimaginable". This unites concerns over growth, sustainability and energy security into an "unstoppable bureaucratic momentum" and is compounded by the fact that physically, the plant is already under construction and hence the outcome of the debate predetermined.

8.3 For...

Within South Africa the World Bank's loan was supported most publicly by its Ministers of Energy and Public Enterprises and Eskom. They argued that the plant, and hence the loan was essential for the country's energy security and economic growth (Zadek 2010:1063) given that the country had no immediate alternatives to coal in order to meet its pressing electricity demands. Without the World Bank loan argued Ministers of Energy and Public Enterprises Dipuo Peters (2010a) and Barbara Hogan (2010a), a return to the blackouts of 2008 would be inevitable, with a concomitant impact on the country's economy. Without the power from Medupi and Kusile said Hogan, South Africa could "say goodbye to the economy and the country" (PMG 2010). Medupi was also deemed essential for the South Africa region given the centrality to South Africa's role in the Southern Africa Power Pool. The minister of energy stated: "Without Medupi being completed, the consequences for our sub-region will be dire as a result of the shortages that will ensue" (Peters 2010a).

A second argument, which refers to Medupi using "cleaner coal 'supercritical' technology" (World Bank Group 2010a:5) was that the Bank's involvement would facilitate the development of South Africa's low carbon strategy as enshrined in its LTMS and endorsed by Cabinet in 2008 (Peters 2010a, Hogan 2010a, Gordhan 2010). This is also justified by the plant's use of flue gas desulphurisation (FGD), the fact that Medupi and all future coal fired power projects be made 'CCS-ready', and other elements of the Eskom Investment Support Project, namely the Sere wind farm and Upington concentrated solar power plant and the 'energy efficiency' elements of the loan. In light of this the utility'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. The funding is well aligned to jump-start progress on South Africa's commitment to a lower carbon footprint" (Eskom 2010c).

The World Bank's emphasis on the low carbon element of the loan was also significant, as reflected in its stated outcomes: "increased reliable power generation; increased renewable energy supply; and reduction in carbon intensity" (World Bank 2010a:28). The Bank also stated that its loan was in line with its 2010 'Development and Climate Change, A Strategic Framework for the World Bank Group' (DCCSF) (Ibid p24). An expert panel report in February 2010 concluded that the project was consistent with DCCSF criteria and that as a "transition strategy" it was essential and must be coupled to "a longer-term strategic shift to an economy based upon a low carbon energy supply" supported by the Bank (in Ibid p25). Moreover the loan document stated that without Medupi, "South Africa would not be able to embark on the aggressive implementation of its low carbon initiatives such as investments in renewable energy, energy efficiency and shift in transport modes without this project" (Ibid p22). Lastly the Bank asserted that its engagement with the country as enshrined in its Country Partnership Strategy "also creates opportunities for sustained engagement on the 'greening' of South Africa's energy sector consistent with the government's low carbon energy strategy and IRP" (Ibid p23).

In addition the Bank placed strong emphasis on how it anticipated the project would reduce unemployment, tackle poverty, deepen regional integration, increase energy access and prevent civil unrest and social inequalities, and justified its role as a 'lender of last resort' (Ibid p22). When interviewed, a senior World Bank official based in Pretoria (World Bank 1) qualified reasons for the institution's decision to finance Medupi, implying that there was no alternative. He stated: "we needed to make sure there were no cleaner alternatives… So we looked regionally in the Southern Africa Power Pool, Zambia, Mozambique, and at the Inga dam in the Democratic Republic of Congo. We concluded that the only solution was the Inga 3 dam, but this is far from financial close, and is also 3000 km away from South Africa. There was no way it could be done in the time frame. We also looked at natural gas, but there is limited natural gas within the borders and this is not clean either. We also looked at other technologies such as ultra super critical coal technology and the possibilities of South Africa using it. In light of South Africa being a semi-arid country this would have needed to be dry-cooled."

8.3.1 Against…

Not only did the loan meet with intense opposition from national and international civil society but also South Africa's main opposition party the Democratic Alliance. Notably, arguments against the loan were reflected in a global statement endorsed by over 150 environment, development, human rights and conservation NGOs, community based organisations, academic institutions and trade unions from over 30 countries (groundWork et al 2010). In brief, concerns included: the plant's enormous contribution to the country's greenhouse gas emissions;

concerns over the impact of coal-fired development on local communities and the environment, including acid mine drainage; potential economic impacts of loan repayment; doubts over claims that the project would increase employment; corruption issues relating to the ANC's investment arm's involvement in a contract for the supply of boilers; and the use of scarce multilateral development funding for conventional technologies which could instead be used to promote the widespread uptake of renewable energy technologies (Hallowes 2009, Earthlife 2010a).

Even high-profile US senators Patrick Leahy, John Kerry and Barney Frank joined in the calls of international concern as expressed in a letter to World Bank President, Robert Zoellick (Schneider 2010). Collectively such public pressure may have added to internal opposition from within the World Bank board which resulted in the US, UK, Netherlands and Italy abstaining from the board's vote on the loan (Njobeni 2010:*9 April*)[76]. This attracted accusations of hypocrisy from developing countries particularly in light of the UK's coal-led industrial development and the fact that approximately half of the US's current source of energy is supplied by coal. Indeed some weeks prior to the vote South Africa's then Minister of Public Enterprises Barbara Hogan implied that the US may be feeling on the defensive in light of its stance over Kyoto and that it was under pressure from Copenhagen and hence abstaining was the most neutral route available to it (PMG 2010).

While civil society, national and international played a significant role in opposing and raising awareness of the Medupi coal-fired power plant and the World Bank's role in funding it, South Africa's government questioned the legitimacy of those involved in campaigning against the loan. Finance Minister Pravin Gordhan was reported in *Engineering News* as saying "that it was regrettable that some NGOs, particularly in developed countries, together with a 'very small group of NGOs in South Africa' were placing 'environmental concerns, which could not be immediately addressed, above the economic needs of South Africa'" (Creamer 2010:*1 April*).

8.4 Low carbon: adaptive discourse

At a WWF South Africa and National Business Initiative in November 2011, Water and Environment Minister Edna Molewa said that because South Africa recognised its vast untapped

[76] The study is aware that coal has played a heavy role in the industrial history of the countries who abstained. The USA for instance is home to about 600 coal-fired power plants which provide approximately half of its energy supply. Though this study focuses specifically on South Africa, it does not ignore the urgent need for rich countries to act on their own green house responsibilities under the Kyoto Protocol

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 2011e). The claim that the loan for Medupi would contribute to South Africa’s low carbon growth was wholly rejected by its opponents who pointed out that regardless of any renewable energy component it would almost double the power sector’s emissions by 2018 (groundWork 2009).

8.4.1 Flue Gas Desulphurisation, dry-cooled and water scarcity

“The only reason why Medupi has been retrofitted [with FGD] is because of Copenhagen. It was never part of the financials of this project. There is no local lobby on it. The visible NGOs pit coal against renewables, but there has not been an internal lobby of let’s make sure coal is clean” Wind IPP (1).

As part of Bank conditions for the loan Eskom must have a programme in place to install FGD equipment in each of Medupi’s six units by 30 June 2013 (World Bank 2010a:45). This must be retrofitted as it was not included in the project’s original design. Such a technology will remove sulphur dioxide from the exhaust flue gases of the power plant and according to the World Bank (Ibid p42), would make the plant consistent with World Bank environment health and safety guidelines for new thermal power plants and South Africa’s proposed standards for new plants. The first unit must be in operation by 2018 and all six by end 2021 (Ibid p.iv).

However the feasibility of this technology’s installation is questionable in light of the implications for additional water use that FGD requires in such a water scarce country. Water for the first three units of Medupi has been allocated from the Mokolo Dam reservoir by the Department of Water Affairs (now Department of Water and Environmental Affairs). The other three will come from the Crocodile West Water Transfer Scheme for which phase 1 is to be completed in 2012 and phase two in 2015 (AfDB 2009a:3). Due to the limited availability of water in the Lephalale area Medupi will be dry-cooled, replacing the Matimba power station as the largest dry cooled power station in the world.

The AfDB (2009a:3) points out that “the water requirement will increase three fold (from 4 million cubic metres to 12 million cubic metres per annum) due to requirement of FGD, bottom Ash Dump, etc. Therefore, Eskom will decide to install FGD if the availability of additional water is confirmed from the upcoming Crocodile West Water Transfer Scheme to be completed in 2015. Meantime, Eskom is constructing the power plant with FGD readiness". The World Bank's project appraisal document also states as a moderate risk that "sufficient amount of water might not be available in time for the commissioning of the last three units or the FGD equipment" (World Bank 2010a:42). Similarly, when interviewed in October 2010 World Bank (1) clarified that "it was later decided that the condition for installation [of FGD] would be only the availability of a sufficient amount of water".

According to the AfDB (2009a:5) dry cooled technology uses less than 0.12 litres of water per kWh as compared to 1.0 litres per kWh used by wet-cooling. That said the operation of Medupi's six units will still need six million cubic metres of water per year (World Bank 2010a:38) and additional investments in the Mokolo River system from where the water will be sourced.

8.4.2 Renewable scale up

Finance from both the World Bank's Eskom Investment Support Project and Clean Technology Fund (CTF) for the Upington Concentrated Solar Power plant and the Sere Wind Farm (section 6.10) have been used to justify how the loan will assist South Africa to realise its national mitigation strategy endorsed by Cabinet in 2008. These two projects 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. According to the World Bank (2010:6) "the solar power project associated with this loan would be the biggest grid-connected solar thermal power project in any developing country, the biggest ever solar thermal project with storage, and the biggest ever central receiver-type solar power project". However, collectively these projects which have been used in part to justify such a gargantuan investment constitute a mere 24th of Medupi's total generating capacity. Financing of $ 260 million for these projects which constitutes less than 7 per cent of the total loan was referred to as a "renewable energy fig leaf" by groundWork and Earthlife Africa (2009).

8.4.3 Energy efficiency measures: Majuba rail

The construction of the Majuba Rail Project was put forward as a low carbon element of the loan in that it will replace road transportation of coal to the Majuba power station (section 7.5). Its construction is expected to eliminate accidents and damage to roads caused by coal trucks, and reduce "annual CO_2 emissions by approximately 250 000 tons" (World Bank 2010a:32). However groundWork and Earthlife Africa dismissed this claim outright, claiming "it is simply a cheaper transport option and a poor greenwashing attempt by the World Bank. Neither the pollution from the trucks nor the pollution from the railway line would be created if the coal plant were not built, so it is not an efficiency saving as compared to a viable alternative scenario". According to mining industry expert (2), interviewed in November 2010 the Majuba rail project should have been built in 2003/2004. "Eskom had the money and the plans at the time but they decided that R2 billion was too expensive. Now they have to spend that much on fixing the roads that are being destroyed by the coal trucks".

Also of note is that according to AfDB (1), "the Majuba Rail was to be part of the CTF and was included in the first draft. The World Bank team put it together using technical arguments to allege that it would reduce GHG emissions, improve scalability, could be transferred and used in other parts of the world. However a number of people objected very strongly. A CTF loan shouldn't be for normal business". Such a claim is illustrative of debates taking place within the World Bank regarding how climate finance should be used, and what can be defined as 'clean technology'.

8.4.4 'Clean coal': super-critical and 'CCS-ready'

"The way forward for the coal industry is to clean coal to such an extent that it would be impossible to say that it emits carbon dioxide." Prevost (in Naidoo 2011d)

While Medupi's use of 'super-critical' technology is essential to its credibility and the World Bank loan there is no exact agreed definition of what this term means. According to the IEA (2010), coal-fired power plants that are called thus have higher efficiencies because they operate at high temperatures, up to 600°C in the case of 'ultra super-critical', with steam pressures greater than 221 bar. The efficiencies of these power plants range from 42 per cent to 47 per cent while 'sub-critical' power plants are at around 35 per cent (IEA 2010). However according to the Stockholm Environment Institute, "even at ultra super-critical efficiency levels, coal plants produce twice the emissions per kilowatt hour of a new natural gas plant" (SEI 2011:6).

Various claims have been made about how this technology will reduce Medupi's carbon emissions. Interviewed in November 2010, mining industry expert (1) said that "with super-critical coal the burn is 2 to 3 per cent more efficient. Given the volume of coal that Medupi will burn, about 18 million tonnes [per year], this percentage can have a significant impact". The AfDB (2009c:2) claimed that super-critical technology would mean that "the efficiency of the power plant will be 40% compared to 34% of the sub-critical technology". The World Bank (2010a:49) said that "if Medupi were replaced by a sub-critical plant, this would increase the

GHG emissions by 7.4 percent annually, and the net GHG emission increase would be 2.51 million tons of CO_2 per year, or a lifetime increase of 75.15 million tons CO_2". However while super-critical technology may improve the efficiency of the coal burn, it cannot detract from the fact that Medupi will still emit 30 tonnes of carbon dioxide per year (AfDB 2009c:12) throughout its lifespan. Moreover the fact that Medupi was designed to be built with this technology, undermines claims by the Banks that their loans would reduce the carbon intensity of the power plant.

"Medupi and Kusile are 'CCS ready'. But what this means in reality is that a patch of land next to the power plant is set aside. There has been no consideration of the suitability of this site"
bilateral donor (4)

While Medupi was not designed with CCS in mind, it has now been deemed 'CCS-ready' as a result of World Bank loan requirements. However when interviewed in October 2010 World Bank (1) conceded that "there is a question around what 'CCS ready' means... the World Bank has offered assistance [for CCS]. Medupi was not designed with CCS in mind, unlike Kusile. Maybe in the future Medupi can be redesigned. There is a CCS trust fund in the World Bank which will provide the above mentioned technical assistance. We are discussing capacity building and regulatory frameworks and other technical support to realise the first carbon dioxide injection".

CCS allows for the sequestration of CO_2 from any point source such as gas power generation, industrial processes, refineries, cement making and chemicals manufacturing. However CCS from power generation has yet to be demonstrated at a commercial level. Liu and Liang (2011:3107) describe it as "the only technology available to mitigate GHG emissions from large-scale fossil fuel usage" and as "a bridge between our coal-based energy present and a low carbon energy future". But in the developed world CCS as a way to tackle climate change "now appears to be serious politics, but not yet serious business" (Ibid p3109). This relates to Fairhead et al's (2012) finding that technology expectations "march ahead of technological realities, but provide the basis for raising funding, and the assertion of value (cf Nightingale and Martin 2004)."

In the IEA's 2010 'BLUE map scenario', CCS accounts for only 19 per cent of total electricity generation in 2050 (IEA 2010:119). According to Liu and Liang (2011:3108) the costs of the technology are at present "prohibitively high", at approximately \$150 per tonne of avoided CO_2 on a 2008 basis for "first of a kind" plants or 10 cents per KWh higher than for conventional plants. However with additional learning, costs come down to between $35 and $70 per tonne of avoided CO_2 or 2-5 cents per kWh more than current costs on a 2008 basis (Ibid p3109). Torvanger and Meadowcroft (2011:305) assert that the technological and cost challenges of CCS are most acute for capture, while political challenges are greatest for storage.

South Africa is keen to develop its CCS potential, having joined the Carbon Sequestration Leadership Forum in 2003. In March 2009 the South African Centre for CCS was set up under the South African National Energy Research Institute (SANERI) a subsidiary of the Central Energy Fund (Pty) Ltd, South Africa's state energy company. This represents a mix of bilateral donors, and national and international coal and energy companies. The Centre is funded by the UK's Department for Energy and Climate Change, the Norwegian government, Sasol and Eskom all of whom have a seat on the Centre's board (bilateral donor 4). Other participants include Agence Française de Développement (AFD), Anglo Coal, Alstom, PetroSA, Total, and Xstrata Coal[77]. It can be assumed that the involvement of donor countries and energy companies in South Africa's Centre for CCS means that they have an implicit interest in the continued development of South Africa's coal-based regime given that most CCS-related research takes place in developed countries whose companies own most of the related patents (Liu and Liang 2011:3108). In particular, the wide-scale deployment of CCS is a stated priority for the EU, Norway and UK (Ibid 2011:3110).

In September 2010 the Centre launched its CCS Atlas for the geological storage of CO_2 which according to Minister of Energy shows that theoretically South Africa has approximately 150 giga tonnes of storage capacity of which the majority is situated offshore in the Mesozoic basins. However given the distance from the source of the emissions in Mpumalanga province this would have significant cost implications. A test injection site is scheduled for 2016, with aims for a demonstration site by 2020 and commercial operation by 2025. Of emissions that could be sequestered, approximately 65 per cent would be from electricity generation amounting to 161 million tonnes (Surridge no date) and the remaining from Sasol's synthetic fuel plants. However according to experts speaking at the Fossil Fuel Foundation conference on "clean coal to clean energy" in Johannesburg in November 2011 (Naidoo 2011b) the potential of CCS in South Africa as elsewhere is far from clear, due to the slow development of the technology and limited storage.

[77] http://www.sacccs.org.za/about-us/

The theme of competition between different technology choices is relevant here. In addition to the uncertainties, Meadowcroft (2011:72) cautions that the long-term consequences of CCS deployment may be to "encourage deeper 'lock-in' into a fossil-reliant development trajectory". Indeed, "money spent on CCS is money not spent on other alternatives. Yet governments are being asked today to finance large-scale demonstration projects that appear essential if the technology is to be ready for roll out in 2020 and beyond". Similarly, Scrase and Smith (2009:716) point out that CCS and nuclear are relatively compatible with existing regimes as they "promise to cut emissions without disrupting too many alignments and linkages in the existing socio-technical regime".

8.4.5 Energy security, poverty alleviation and economic growth

"The objective of the Project is to enable the Borrower to enhance its power supply and energy security in an efficient and sustainable manner so as to support both economic growth objectives and the long-term carbon mitigation strategy of the Guarantor" (IBRD & Eskom Holdings 2010:6).

The World Bank (2010a), the AfDB (2009c) and the South African government argued that the loan for Medupi would help to alleviate poverty by preventing electricity shortfalls which would in turn cut supply to industry and result in increased unemployment, heightened social inequalities and the risk of civil instability. For example the World Bank (2010a:22) argued that the electricity shortfalls would "lead to slowdown in growth, cause significant job losses and severely impact the poor" and that the absence of Medupi would undo significant gains in electricity expansion and undermine South Africa's goal of universal access for electrification. In the spirit of trickle down growth at a media briefing in March 2010, Energy Minister Dipuo Peters (2010a) argued that "without the World Bank loan, South Africa will not be able to meet its power needs and this will hinder the kind of economic growth that will be able to break the back of energy poverty and consequently create new employment opportunities". On approval of the loan, Eskom's acting chairman stated "the World Bank loan significantly contributes to the provision of baseload power. Improved energy security will advance South Africa's development agenda for economic growth and human upliftment in South Africa and the region" (Eskom 2010c).

However, many of the loan's opponents claimed the exact opposite, saying that Medupi would mainly benefit energy-intensive users who consume at least 40 per cent of the country's electricity and until the recent tariff hikes, had benefitted from some of the cheapest electricity prices in the world (groundWork et al 2010). This in contrast to the majority of the country's poor who consume only 5 per cent (groundWork 2009). In addition as many of these companies are headquartered abroad, it was argued that profits would leave the country rather than benefit the national economy and would contribute to South Africa's balance of payments deficit. A further argument was that many of these companies were benefitting from preferential tariff agreements, or "special pricing agreements" that were negotiated during the apartheid era (groundWork and Earthlife Africa 2010), though many of these were re-negotiated in 2010. Tristen Taylor of Earthlife Africa said that "with massive disconnections looming due to a doubling of electricity tariffs, a million jobs lost last year, and an effective 40 per cent unemployment rate, one would think that poverty eradication would be foremost in the World Bank and South African government's mind. None of Medupi's output will be for the poor, but will be used to service multinational firms" (in BIC 2010).

Opponents also argued that instead of increasing access, the costs of the loan would add to the rising costs of electricity following the three year on year tariff hikes approved by NERSA in early 2010. This would see a "typical township household" facing a "2009-2012 monthly price rise from R360 ($48) to R1000 ($130)" (groundWork et al 2010) and result in disconnections for those unable to pay and increased electricity theft. In essence it was argued that by giving this loan, the World Bank was endorsing the perpetuation of energy poverty and inequitable distribution of power along racial lines as it had done under apartheid when the Bank financed "power plant construction that provided electricity to large, exploitative corporations and rich white South African, which impoverished black people, for whom there were no electricity connections. Black people were part of the economy that in its entirety had to repay the Bank loans" (groundWork and Earthlife Africa 2010). Hence "the World Bank is repeating one of the world's most tragic episodes: apartheid empowerment of corporations and whites, and impoverishment of black South Africans" (Ibid). This relates to the discourse of "maldevelopment" described by Rafey and Sovacool (2011:1148).

Finally in terms of environmental and health costs, poor people living in the vicinity of the plant and its related coal mining developments will suffer the consequences of polluted water, air and land including mercury residues (groundWork 2009). As AfDB (1) described, "in the shadows of Medupi from the adjoining plant Matimba, there is thick, black acrid smoke coming out. In Matimba there is heaps of coal and equipment etc lying there. For those who live there it is awful. This is why NGOs and local communities complain. Thousands of trucks full of coal from the mine to the power plant pass by".

8.5 Project costs: economic, environmental and social

Initially expected to cost $7.8 billion (Sovacool and Rafey 2011:94) by 2010 estimates of total project construction were at just over $12 billion (World Bank 2010a:29) which has since risen to $17.87 (Creamer Media 2011). Various reasons have been put forward for such an unpredicted increase in the project's running costs including threats to the country's abundant low cost coal (chapter 7) and because Eskom must wait in line for many of the power plants' parts which will be supplied by foreign contractors, in addition to some of the expertise. As DTI (2) explained, while "Medupi condenser tanks are made locally, all the high pressure stuff is imported, such as boilers, motors, pumps". Delays to Medupi's construction will increase costs (de Bruyn 2010), in part due to the need to renegotiate the off-take agreement with Exxaro, discussed below. Also, as mining industry expert (2) explained, "there is a huge risk involved in large- scale construction. There are also penalties and standing time to pay for and so many unforeseen costs. At peak construction there will be 6000 to 7000 people on site and this is not easy to control".

Claims over the cost of different technologies were also forefront in debates over the World Bank's loan with its proponents strongly advocating coal as the cheapest option. For example the World Bank stated that "both wind and solar are much more expensive than coal; the African consumer should not be expected to pay the additional Research and Development costs to bring down the price of these technologies... The country has pressing energy needs that cannot be met with renewable in the short term" (World Bank Group 2010b:3). Similarly the South African government emphasised that without the loan South Africa's consumers would pay more for their electricity as Eskom would have to seek finance from commercial sources rather than that provided by the World Bank at low interest rates (Hogan 2010a). Prior to the loan's approval, then World Bank president Robert Zoellick responding to a letter from US lawmakers (section 8.2.2) who had written to him challenging the loan, declared that coal was still "the least cost, most viable and technically feasible option for meeting the base load power needs required by Africa's largest economy" (in Schneider 2010).

However the World Bank seems to contradict itself in Medupi's project appraisal document when it estimates that South Africa could install an equivalent wind capacity of 15 310 MW (at a 27 per cent average load factor) for an estimated $20 billion (World Bank 2010a:48-49) a figure not that much higher than the current cost of Medupi. Even mining industry expert (1) stated in an interview that "the levelised cost of electricity for Medupi is R1 per KwH. Medupi is therefore no cheaper than wind, and coal is higher risk because of the carbon emissions".

Regardless of whether or not coal would be the cheapest fuel, different private sector representatives argued that IPPs of coal, co-generation and renewables could generate the same levels of electricity as Medupi but at a much lower cost, due in part to Eskom's contracting strategy which involved "38 contracts and several subcontractors" and led to a "messy project management strategy" which added to delays (de Bruyn 2010). Thomas Garner from Exxaro Resources also argued that electricity generated from Medupi was likely to cost more than that which could be generated from IPPs (de Bruyn 2010). In October 2010, Mick Davis, the CEO of Xtrata was also reported in *Business Day* as saying that that "Eskom spent about [R]3000/KWh to install new capacity, while the private sector could do it for about half the price and more quickly, using smaller modular plants" (in Seccombe 2010).

It was also argued that because the loan was in US dollars it would add to South Africa's foreign debt levels. The joint civil society statement (groundWork et al 2010) claimed: "the financial danger of a World Bank loan is that the SA currency will crash (as it has five times since 1996), hence making repayment much more expensive (since the loans are not repaid in rand but in dollars)". Even the AfDB (2009c:9) noted that while "the analysis has revealed the economic benefits of the project as robust" it would remain "susceptible to increases in the fuel cost and exchange rate appreciation".

Critics also emphasised that the high external costs of coal, such as environmental pollution, the impact of coal-related emissions on health, the environment and climate change, had not been adequately factored into costs, if at all (WRI 2010, groundWork and Earthlife Africa 2010). This includes the issue of acid mine drainage which "results when water comes into contact with the exposed ore body of the coal mines leaving water high in dissolved metals and sulphates" (groundWork 2009:4). This has received increased attention in recent years given the country's vast plans for coal mine development (Liefferink 2009).

8.6 Medupi and the Clean Development Mechanism

As indicated in an interview in November 2010 with Eskom Sustainability and Innovation (2) and reported in the *New York Times*, Eskom was considering applying for CDM credits for Medupi on the basis of emission reductions from its super-critical technology (Friedman 2010). This was heavily criticised by environmental justice campaigners on various grounds, one being that Eskom would essentially be "paid twice": by World Bank finance and with carbon credits for the construction of a coal-fired power plant (Ibid). Moreover in terms of "additionality", Medupi would have been built with super-critical coal technology regardless. As mining industry expert

(1) conceded, “CDM is meant to make you carry out a project you wouldn’t have done otherwise. In a sense it is gaming the system”. Possible CDM accreditation for Medupi is an example of a landscape pressure which should ostensibly provide support for low carbon niches (Scrase and Smith 2009:715) but which is in fact supporting the regime. This relates to findings by Gilbertson and Reyes (2009:57) that “the CDM is subsidising the lock-in of fossil fuel dependence through providing incentives for coal-fired power stations in the South”.

‘Supercritical’ coal-fired power plants were made eligible for CDM credits in April 2007 under methodology ACM0013 (SEI 2011). As of October 2011 there were 45 coal projects in this pipeline, all in India and China of which six had been registered. However in July 2012 the CDM board suspended the methodology. While Medupi may no longer be able to apply for CDM credits on the basis of its super-critical technology, it may still qualify on the basis of being ‘CCS-ready’, given that at the UNFCCC conference in Durban in December 2011, the UNFCCC agreed to make CCS eligible for CDM projects, though as yet none have been approved.

In South Africa’s *Activities and Plans for Carbon Capture and Storage,* A.D Surridge (no date: 3) stated “to incentivise Non-Annex 1 Parties to undertake carbon capture and storage projects, then the technology needs to be recognised by the Clean Development Mechanism as a legitimate method of earning carbon credits”. “There is a big debate over CDM and CCS. There are environmental benefits to making CCS viable. However, once you start integrating it into the CDM you won’t be able to go back. There are questions around whether it should be getting supported from public funds”.

8.7 Alleged corruption: ANC’s investment arm and Hitachi power

In the run up to the World Bank’s decision over the loan there was controversy regarding the 25 per cent stake held by the ANC’s investment arm Chancellor House in Hitachi Power Africa which in consortium with Hitachi Power Europe was awarded the R35.3 billion boiler supply contract for Medupi (Mail and Guardian 2010). The scandal lay in the fact that this deal would enrich the ANC as a political party who would benefit financially from the World Bank’s loan. Secondly the Chairperson of Eskom’s board Valli Moosa was at the same time a member of the ANC’s National Executive Committee[78] and its National Finance Committee (Jolobe 2010:211) which is responsible for the party’s fund-raising. Despite having chaired the meeting at which Eskom’s

[78] Rule 12 of the ANC constitution provides that the NEC “*is the highest organ of the ANC between National Conferences and has the authority to lead the organisation, subject to the provisions of this Constitution”*

board agreed to award the Medupi boiler contract to the Hitachi Consortium in October 2007 (Public Protector South Africa 2009:21), he failed to disclose this conflict of interest.

This controversy relates to increasing public outrage over the profiteering of political parties from business interests and the failure of BEE to thus far play a meaningful role in transforming South Africa's economy. Hitachi Power Africa was formed in 2005 in response to Eskom's new build programme and is 30 per cent black owned with 25 per cent belonging to Chancellor House Holdings (Robinson and Brümmer 2006:19). That Chancellor House's creation in 2003 took place under the initiative of former ANC treasurer general Mendi Msimang, a close confidant of Thabo Mbeki (Jolobe 2010:207) in itself raised questions about the merging of political and business interests (Cargill 2011:6). Jolobe (2010:208) states that "ultimately Mendi Msimang is the boss of Chancellor House, and through him the Mbeki faction in the ANC is in firm control over its vast financial resources". According to a 2006 report by South African think-tank, the Institute for Security Studies, Chancellor House is widely regarded as a source of funding for the ANC. The authors go so far as to call it a "corporate front used by the ANC to seek profit on its behalf" (Robinson and Brümmer 2006:17) and that its investments are often dependent on the government's discretion such as the award of state tenders and mineral rights.

In March 2006 a tender was put out for Medupi's turbine and boiler works. Tenders were submitted to Eskom by the Hitachi Consortium described above, and a consortium of Alstom S&E and Steinmüller Africa. Though the Alstom-Steinmüller consortium initially won the tender, they later withdrew due to Eskom's "technical and commercial conditions". Subsequently in October 2007 Eskom awarded a R35.3 billion contract to the Hitachi consortium for the construction of Medupi's six boilers. Then on 8 February 2008 a *Mail and Guardian* article (Brümmer and Sole 2008) published details of the alleged conflict of interest discussed above. Hitachi subsequently subcontracted construction of the boilers to South African engineering firm Murray and Roberts.

In March 2008 Helen Zille, the Leader of South Africa's main opposition party the Democratic Alliance (DA) and the Executive Mayor of Cape Town lodged a complaint with South Africa's Office of the Public Protector over the ANC's involvement in corrupt business deals, including that of Chancellor House and Medupi. The subsequent report of the investigation carried out by the Public Protector published in February 2009 into allegations of improper conduct by the former Chairperson of Eskom's board of directors, Valli Moosa found that his actions did involve a conflict of interest and he had acted improperly. The report further recommended that the Minister of Public Enterprises develop legislation to regulate the conducting of business between government entities and political parties. Yet the Public Protector appeared to neutralise his own findings when he also found that the contract “was not in any way affected by Mr Moosa’s improper conduct” and that “the awarding of the contract by Eskom to an entity in which the ruling party has an interest was not unlawful” (Public Protector South Africa 2009:5). An explanation for this volte-face is provided by Jolobe (2010:211) who states that the Public Protector is not empowered to investigate the conduct, affairs and relationship of private entities, and political parties, like businesses, are private institutions. This is an unfortunate circumstance as the conflict of interest, and potential for political corruption, arose from the personal (party political interest) of Moosa”.

Prior to the approval of the loan the DA together with the Independent Democrats reportedly called for the World Bank to make the loan conditional on the ANC divesting itself from its stake in the Hitachi consortium on that basis that the World Bank loan would “inadvertently be funding a massive conflict of interest where the ruling party is able to benefit handsomely from a government tender” (Rose 2010). The DA went as far as to lobby the US and UK, who are key stakeholder governments on the World Bank’s board not to support the loan and submitted a proposal to parliament for a ban on political parties tendering and contracting with general government.

Prior to the loan’s approval Eskom and the South African government argued that the World Bank money would not go directly for the Hitachi contract given that funding for this had already been secured (in PMG 2010). Reports in the press then indicated that pressure was applied to the ANC behind the scenes (Rose 2010) and shortly after the loan was approved, ANC Treasurer stated that Chancellor House would sell its stake in Hitachi Power. However this ran contrary to statements by the ANC’s secretary general who had said that the party would only do so if the rules on political funding were changed for all parties.

This controversy, which relates closely to the theme of maldevelopment explored by Rafey and Sovacool (2011) was accompanied by accusations of World Bank complicity in national corruption. The case also illustrates how development finance, as a landscape level actor cannot be divorced from the regime that it supports and relates to the point made in chapter 3 which challenges the definition of landscape level developments as exogenous. Instead it finds that they are instead closely intertwined with regime and niche-level processes.

8.8 Exxaro: expanding Grootgeluk

Coal for Medupi will be supplied by Exxaro under a contract to supply 14.6 million tonnes of coal per year for 40 years for which the company is expanding the capacity of its open cast Grootgeluk mine in Waterberg at a capital cost of R9 billion (Creamer 2009:*11 Dec*). This is due to come on line in 2012. In 2008 Exxaro supplied 36.3 million tonnes of coal to Eskom and 3.3 million tonnes for export (Eberhard 2011). Exxaro which also has mines in the Witbank field is the only large operator in the Waterberg region where Grootgeluk's expansion is central to its planned coal developments. Grootgeluk, originally set up by the state for Iscor's steel plants "has the largest coal beneficiation complex where 7 600 tonnes per hour of run-of-mine coal is upgraded in six different plants", currently supplying 15.3 million tonnes a year on a long-term, low-priced contract to Eskom's 3990 MW Matimba power station via a 7km conveyor belt (Eberhard 2011:11). Once its expansion is complete "Grootgeluk will be the largest coal operation in the world, producing some 33 million tonnes per annum of power station, coking and steam coal" (Exxaro 2010a).

While the commercial terms of the coal supply and off take agreement between Exxaro and Eskom are not public, carbon finance consultant (1) stated "the coal deal for Medupi with Exxaro and Eskom- was not fixed cost". Mining industry expert (1) stated "Grootegeluk isn't a tied colliery, so the cost of coal supply for Medupi is on commercial terms. In this case there is room for fluctuations in the international coal price". However the agreement was apparently suspended in 2009 when Eskom requested a review of the commercial terms which resulted in Exxaro temporarily suspending its coal expansion project until a "definitive agreement" was signed on 26 March 2010 (Exxaro 2010b). Exxaro's ability to do this provides a further illustration of Eskom's lack of bargaining power discussed in chapter 7 in the face of coal mining giants. It is understood that Eskom holds a 'take or pay' contract with Exxaro, which means that the delays to Medupi's completion will have cost implications for the utility. This has resulted in "discussions" between both parties over the contractual obligations of the coal supply contract (Creamer 2011:*23 Nov*).

8.9 "Unscathed": the African Development Bank loan

"There was not much sleep lost in AfDB over this project, unlike in the World Bank... Moreover the AfDB could be more lenient as they agreed to fund the project before the World Bank. In the event the World Bank ended up having to do all the work and criticised the AfDB for getting through the process relatively unscathed. The AfDB loan had a carte blanche on procurement and

were not required to pay all that much attention to environmental and social issues. AfDB made some enemies in [Washington] DC over Medupi" AfDB (1)

While the World Bank's loan to Medupi was mired in controversy, the AfDB's loan agreed in November 2009 just five months earlier largely escaped public scrutiny, with limited attention paid to the environmental, social, political and procurement issues over which the World Bank received so much criticism. The AfDB loan for approximately Euro 1.86 billion backed by a sovereign guarantee from the government of South Africa (AfDB 2009c:iv) was for the supply and installation of six boilers and turbo-generators, to be co-financed with Export Credit Agencies Hermes of Germany and COFACE of France (AfDB 2009c:2) who contributed Euro 1.22 billion between them (AfDB 2009c:iv). Medupi's boiler and turbine contracts were identified for funding shortly after South Africa's Minister of Finance formerly requested assistance from the AfDB for Eskom's CAPEX programme (see chapter 5) in May 2009.

One of the suggested drivers of the AfDB's approval of the loan was that its then Vice President Mandla Gantsho was South African and the former CEO of the Development Bank of South Africa (DBSA)[79]. Given that South Africa is one of the most powerful countries within the AfDB[80] this meant that "there was political interest too" according to one insider (AfDB 1). Another possible driver was that while the AfDB had a strong relationship with South Africa's private sector through credit lines to Standard Bank for example, it did not with the public sector, "so with Medupi there was an interest in capturing a new client. It looks good on the Bank's books" (AfDB 1).

From within South Africa it has been suggested that the greatest pressure for the loan came from Eskom and that similar tensions between Eskom and the government to those identified in chapter 5 were apparent (AfDB 1). According AfDB (1) "the government couldn't care less. The Treasury didn't give clear answers about the sovereign guarantee for example. There were big questions about whether the loan would be given to the South African Treasury or Eskom. The Treasury didn't want to take the loan as it would affect their credit rating. But Eskom would only take it if the loan had a sovereign guarantee. There were key tensions between Treasury and Eskom on this matter" (AfDB 1). In addition the DoE gave little intellectual input to negotiations

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[79] http://www.treasury.gov.za/comm_media/press/2006/2006031001.pdf

[80] See: http://www.bicusa.org/en/Institution.Structure.1.aspx for further a detailed explanation of AfDB's voting and governance structure

on the project's financing. Instead, "the AfDB talked mainly with Treasury, Department of Environmental Affairs and Eskom" (AfDB 1).

As with the World Bank loan, according to AfDB (1) "the greatest noise about carbon emissions was made by UK, US and Germany but they looked like hypocrites in light of their track records. We knew the US would abstain but obviously that wouldn't stop the project". The US abstained from the vote (Berger 2010) as did the UK, which votes in a block with Germany, the Netherlands and Portugal[81]. While written questions about Medupi were presented by the US, German and Norwegian chairs, AfDB (1) explained that "there was the usual camaraderie from Africans within the World Bank. The British and US ED would not be listened to and in the interests of political correctness they tend not to speak up so much. The German executive director reportedly said 'I am not in a position to make too much noise, this is Africa'".

The US's key concerns outlined in a statement by its chair related to shortcomings of the environmental impact assessment (EIA), the fact that the loan would provide retroactive funding for the procurement contracts and the inadequacy of efforts to mitigate the impact of CO_2 and SO_2 emissions. It stated that the EIA should have assessed the Crocodile West Transfer Water Scheme and the expansion of the Grootegeluk coal mine which will supply the power plant with water and coal respectively (U.S Chair 2009) (section 8.7). Moreover given the proximity of the proposed Kusile coal fired power plant to Medupi the chair asked for an assessment of the cumulative impacts of both plants. The US Chair also asserted that "we think the AfDB and its shareholders would have been better served by ensuring that the timing of this project coincided with that of the World Bank board consideration. This would have allowed a more coordinated and effective response by the two MDBs and their Boards to the climate-related concerns raised by this project, which at 26 million tons of CO_2 per year, will rank as one of the largest sources of carbon emissions in the world" (U.S Chair 2009:3).

A key concern over procurement was raised. As project construction begun one and a half years prior to the request for the loan, the boiler and turbine generator contracts were awarded in 2007 (AfDB 2009a:6), making the AfDB's retroactive involvement at this stage unconventional. The boiler contract was awarded to Hitachi Power Africa for R20 billion (AfDB 2009c:15) (section 8.6) and the turbine contract to Alstom S&E for R13 billion, signed in September-October 2007

[81] There are 18 executive directors on the AfDB's board, 12 for the countries in the region and six non-regional members of which only Canada and the US have their own chairs.

(AfDB 2009c:15). Consequently AfDB contracted Crown Agents Consultants (AfDB 2009a:6) to conduct an independent review of Eskom's procurement and contracting procedures. The review which could not be sourced for this research but was referenced in an AfDB aide-mémoire claimed that Eskom's procurement procedures were "consistent with AfDB's principles of economy, efficiency, transparency and equal opportunity. Notwithstanding the fact that some of these deviations were judged to be significant, the review showed that there is no risk associated with the procurement aspects of the proposed financing, especially considering that the design and construction phase is already well advanced" (AfDB 2009a:6). Despite this, the AfDB requested various safeguards including the amendment of the contracts for the turbine and boiler to give the AfDB the right to audit all financed contracts, and the submission of the contracts' prices "to satisfy the Bank that the boiler and turbine contract prices for Medupi were a fair reflection of open market rates" (AfDB 2009a:6). It is notable that the review seemingly failed to consider the public storm that had taken place surrounding the awarding of the contract to Hitachi Power Africa (section 8.6).

However the US disagreed with the independent review, referring to "multiple important inconsistencies with AfDB Procurement Rules". It found that "the non-compliance with the Bank's Procurement Rules on advance contracting and retroactive financing should have prohibited AfDB financing of this project. The adverse impact of these violations of the international competitive bidding provisions of the Rules is demonstrated by the fact that there was only one 'compliant' bidder each for the very large-value contracts for boilers and turbines. It is probable that the various irregularities discouraged bidders (and it is possible that other potential bidders were not even aware of this tender, which was issued by invitation), and we will never know if Eskom received the best deal possible, as would have been the case if the AfDB's Procurement Rules had been followed" (US Chair 2009:2).

A further complication in relation to the AfDB's loan for Medupi related to a separate twenty year "non-sovereign corporate loan" of $500 million, disbursed to Eskom in January 2009 under the AfDB's private sector lending window (AfDB 2009c:8). Under the terms of this loan the AfDB treated Eskom as a private entity which meant that there was no government guarantee. Its Vice-President Mandla Gantsho reportedly justified this decision by saying "Eskom is without a doubt the most credit-worthy utility in Africa, with its investment credit ratings" (van der Merwe 2008). Questions were raised by the Nordic desk of the AfDB in relation to how this loan was spent, over which conflicting claims have been made by Eskom and AfDB. The AfDB's November

2009 (2009c:8) proposal document claims that “Eskom used the loan proceeds towards implementing Medupi and Kusile”. However Eskom, reported in the 2009 document *Questions from Nordic desk on Eskom’s Medupi Power Project*, stated that “no specific project was singled out for funding from the ADB [AfDB] private sector loan” and added that “another project that benefitted from the AfDB funds was Ingula pump storage” and that the funds for Medupi “did not include the boiler and turbine contracts” (Nordic Desk 2009:3).

Meanwhile AfDB (1) explained: “because the loan was a line of credit, it was private sector and just went into Eskom’s general pot so it was not tied to anything. With lines of credit there is much less requirement for accounting for expenditure. However, when it came to a further request from Eskom for Medupi, the AfDB private sector representative who had approved this line of credit started asking questions about where the money had gone to. Eskom said that ‘all money is fungible’, therefore we can’t tell you where it went. It didn’t go to any specific project.”

When compared to the World Bank, the AfDB’s loan evaded the radar of national and international scrutiny, and criticism of its loan has mostly been retroactive (Bank Information Centre and Heinrich Böll Stiftung 2011). Moreover as this section has discussed, there were significant inconsistencies relating to the nature of its procurement contracts linked to the Chancellor House scandal discussed above. Reasons as to why this appeared to go unnoticed in the public domain are unclear, though one could speculate that the World Bank received greater national and international attention in light of the size of its loan, and because of the significant clash between its high profile rhetorical commitment to climate change and status as a self-declared environment bank, and its carbon heavy energy lending portfolio. Moreover as the largest and oldest multi-lateral development bank, the World Bank’s activities receive greater focus from international civil society with a long-standing tradition of activism and lobbying by groups such as US-based Bank Information Centre and UK-based Bretton Woods Project within wider international networks.

8.10 Climate and development finance: trends in the landscape

The involvement of the World Bank and AfDB in the Medupi coal-fired power plant has fuelled long-standing criticism of multi-lateral development bank lending for fossil fuel projects on the grounds that this should be channeled to renewable technologies that are less able to attract concessional finance (WRI 2008, WWF 2008). It is also the subject of significant discussion at conferences of investors and industry on energy development and finance in Africa, and the focus of a debate taking place within the World Bank (Jones et al 2011). For example the World

Bank's draft energy strategy leaked to the public in April 2011 included a ban on lending for new coal-fired power plants in any World Bank recipient country that qualifies for loans from the International Bank for Reconstruction and Development (IBRD).Though this ban does not include countries that benefit from loans from the International Development Association (IDA) (the World Bank's lending arm for low income countries) or efficiency improvements for existing coal plants in middle income countries, it can still be argued that it is representative of shifts taking place at the landscape level with regards to project-lending for energy.

A more radical argument put forward by a number of international social and environmental justice movements including Friends of the Earth International, Climate Justice Now! and the South Asia-Pacific Movement on Debt and Development is that the World Bank as an institution cannot be trusted to provide climate finance of any kind. This is firstly because of its promotion of an unsustainable economic development model in the form of structural adjustment programmes that have had devastating social and environmental impacts in developing countries; the lack of democracy in the make up of its decision-making board; its track record in financing projects and policies that contribute to climate change; and its current involvement in profiteering from carbon finance mechanisms (Platform et al 2004, BWP et al 2010, FoE-International 2011). Its lending activities will therefore contribute to high carbon lock-in in developing countries. Such criticisms have more recently been extended to the World Bank's role in the CTF (section 6.10) and its appointment as interim trustee of the Green Climate Fund (FoE-International 2011).

8.11 Chapter summary

"Actors benefiting from the status quo tend to lend their agency to defending and extending regimes through incremental innovations" (Scrase and Smith 2009:710)

This chapter has highlighted how discourse and technological modifications have been used by regime interests as "incremental innovations" (Scrase and Smith 2009) in order to perpetuate their material and political power and maintain the use of coal as dominant mode of electricity generation. In doing so I have analysed debates and conflicting claims over: the costs and technical potential of different types of electricity generation; the ability of certain types of coal-specific technology to reduce greenhouse gas emissions; evolving uses of the terms 'clean' energy and 'low carbon'; the developmental impact of coal including the extent to which Medupi will alleviate energy poverty or perpetuate distribution of electricity along apartheid structures;

and the economic, environmental, political and human costs and benefits of exploiting South Africa's natural resource endowment.

In considering the use of discourse to preserve the regime (and the ensuing counter discourse from the niche, itself supported by landscape level entities) this chapter has explored how the term 'clean coal' and associated low carbon expressions have become a "legitimising discourse" (Keeley and Scoones 2003:23, Dryzek 2005). This has been used by the World Bank, AfDB, government and the coal industry to justify multi-lateral funding for the project and South Africa's continued exploitation of its abundant coal reserves. This illustrates how discourse is being used to meet the requirements of low carbon development and climate change mitigation as well as support the continued dominance of entrenched incumbents and the reproduction of certain practices and configurations within the socio-technical regime. The re-conceptualisation of coal as 'clean' and related arguments that Medupi will contribute to poverty alleviation and economic growth can be regarded as the creation of a 'transnational policy discourse' (Hajer and Versteeg 2005a:343). In promoting the loan to Medupi as a low carbon transformational initiative that reduces energy poverty, regime interests supported by landscape level actors seek to align themselves albeit only discursively with the demands of climate change mitigation. As Dryzek (1997:8) explains, "powerful actors who see their interests threatened by established or emerging discourses, will try to override developments at the level of discourse. This does not necessarily mean that they will simply resist environmental values. Indeed a more effective strategy for recalcitrant actors will be to cloak themselves in the language of environmentalism". Technological modifications in the form of super-critical and dry-cooled technology, FGD and CCS represent attempts by incumbents to reproduce the existing socio-technical system by the development of supportive infrastructures (Smith and Stirling 2007:355). These can be described as 'incremental innovations' (Geels and Schot 2007:409), in that they make limited changes to overall regime structures and are short term in impact. Following Freeman and Perez (1998:46), these modifications do not result from deliberate research and development activity but rather improvements suggested by engineers and minor improvements in efficiency and quality. Returning to concepts of technological lock-in (chapter 3), it is because of this that system changes tend to be incremental not radical (Dosi 1982, Markard et al 2012). Following Dryzek (2005:173), the use of such technological fixes can be referred to an example of techno-corporatist ecological modernisation".

Support from the World Bank, the AfDB and other international institutions for Medupi can be considered “reinforcing landscape developments”, following Geels and Schot (2007:406). This is because the project’s use of clean energy discourse and technological modifications has served to stabilise the regime rather than initiating a low carbon transition. Similarly it has served to sustain the economic “order” (Lewis and Mosse 2006:3). In addition while carbon trading mechanisms such as the CDM should provide a “landscape pressure” (Scrase and Smith 2009:715), open a space for low carbon niches and make carbon-intensive practices less profitable, in this instance the opposite is true given that Medupi is incentivised by potential carbon emission reductions credits.

9 Chapter 9: Conclusion: a shifting regime?

9.1 Introduction

This thesis provides the first detailed empirical analysis of measures to introduce renewable energy generation into South Africa's electricity sector. At the same time it has undertaken a novel attempt to link a socio-technical transitions framework with a political economy perspective informed by South Africa's MEC, itself uniquely characterised by the country's apartheid legacy. This is one response to calls in the socio-technical transitions literature to consider matters of politics and political economy. Applying this framework to South Africa fills a second critical gap in the literature. A third unique contribution has been to incorporate renewable energy and climate change mitigation as emerging features of South Africa's MEC. This analysis has included technical features that are inherently bound up with questions of policy and governance thereby responding to a problem that is at once technological, economic, political, social and environmental.

The questions guiding this thesis were:

i. *To what extent do recent developments in South Africa's electricity generation sector constitute a low carbon transition in its minerals-energy complex?* and

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

As a summary of the findings of this thesis, chapter 4 undertook a historical explanation of the MEC, and contextualised the country's electricity sector, the central focus of the research and the main construct of the socio-technical regime as embedded within it. It concluded that the coal industry and the renewable energy industry have exploited the latest supply-side crisis in order to further their interests. Chapter 5 explored the development of two key policy processes in electricity. In socio-technical transitions terms, this saw the renewable energy industry as an emerging niche win a level of support from the state, thereby gaining ground within the regime. At the same time, further coal construction was also approved. This chapter also highlighted the relational nature of state power in light of the conflicts that were identified between various government institutions. Chapter 6 focused on the wind industry as one emerging niche within the renewable energy industry. It found that it was initiated by outliers within the regime with strong support from landscape actors such as bilateral donors, technology companies and private and international finance. However since then traditional MEC actors namely Exxaro/Cennergi have become dominant in its development with the support of emerging market companies such as India's Suzlon and Tata Power. Chapter 7 placed South Africa's coal industry in context. It explored how internal and external pressures on the country's coal supply and the highly unequal relationship between Eskom and its five major private coal suppliers that means that cheap electricity based on cheap coal supplies is becoming untenable. Chapter 8 explored the case of the Medupi coal-fired power plant. This demonstrated firstly that large-scale coal is still very much the order of the day, but also that key narratives relating to the World Bank's loan led to the plant being described as "clean coal". A discursive analysis shows how these narratives have been used to uphold the established commitments and the entrenched power of the coal-generated electricity regime.

The overarching conclusions of this thesis are firstly that recent changes in South Africa's electricity sector are indicative of the MEC's evolution rather than its decline. Complexities and uncertainties aside, this endorses previous findings that the spirit of the MEC is very much alive (Fine 2008) and 'business-as-usual'(McDonald 2009) is still the case. Thus far it seems that the shifts taking place in the electricity generation sector are more a reconfiguration of agency than a fundamental structural change given that coal-based, energy-intensive vested interests continue to dominate at the level of supply and demand. Secondly in theoretical terms, while the MLP can be a useful heuristic for analysing socio-technical change, a key shortcoming is its failure to recognise and explore explicitly the relationship between economic and political power in determining structural change. Integrating perspectives from political economy is one way to tackle this.

9.2 Empirical reflections

With regards to question i) this thesis has found that so-called 'niche innovations' and emerging players in renewable energy have gained ground at the level of policy and project development for energy generation and grid access. Though no match for incumbent MEC stakeholders, renewable energy IPPs have acquired a certain level of access within the regime in terms of grid access, policy influence and project development. In addition a number of MEC incumbents are gradually adapting to emerging renewable energy niches whilst maintaining a stronghold over their core interests. Moreover it appears that Eskom's monopoly stronghold over electricity generation and transmission, a key feature of the MEC to date, is now under challenge. This challenge sees groups of private players in renewable energy backed by private finance entering the market, in addition to small-scale coal and co-generation projects built by energy conglomerates. All this constitutes important new dimensions in the MEC.

However despite the emergence of new players and evolving configurations of institutions and technologies, the MEC is still a key driver of policy decisions in electricity, still represents an integral relationship between the state and private capital and a "core set of activities around mining and energy" (Fine 2008:1). Despite potentially dramatic changes to its generation mix, the "uniquely electricity intensive" nature (Fine and Rustomjee 1996:8) of South Africa's economic growth strategy has not changed. Renewable energy developments are paralleled by large-scale coal-fired development backed by large volumes of public finance, and the likely introduction of nuclear power. Significantly the proposed changes in electricity apply to the generation mix but not to consumption as the demand side remains fundamentally unchallenged. The IRP 2010's trajectory is based on a doubling of industrial output of mining and minerals-beneficiation by 2030 with a concomitant expansion of electricity generation. For this reason 'niche' innovations in South Africa's renewable electricity generation cannot be considered 'radical' (Geels 2011). In addition it seems that for now, the centralised grid system to which they will connect remains largely undisturbed. This aligns with Goldthau and Sovacool's (2012:235) conclusion that "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".

Despite the introduction of the RE IPPPP and an increased allocation of renewables in the IRP 2010 the question remains as to whether renewable energy is sufficiently protected from "prevailing power structures, priorities and interests in existing markets" (Leach et al 2010:29). Commitment to 'localisation' of the wind industry which is a key national concern in light of high unemployment rates and the strong influencing role of organised labour, is now integrated in government policy, though has not yet been implemented. Furthermore coupled with competition from the import of wind technologies manufactured in China and India, there are fears that South Africa may have 'missed the boat'. The way the wind industry is emerging may not encourage the development of national small and medium enterprises, facilitate a local industry and supply chain and national skills development. And unless South Africa's renewable energy policies are backed up by appropriate state-led industrial policy to support them their long-term success may be compromised.

A further consideration is whether South Africa's socio-technical transition is just, in addition to low carbon. The extent to which new renewable energy may bring about socio-economic benefits is as yet unclear given that the requirements to achieve this under the RE IPPPP are viewed as a constraint by many IPPs. Following Moe (2010:1732) it is possible that some renewable energy IPPs may themselves become vested interests in parallel to traditionally entrenched incumbents. This may happen through the creation of an entrepreneurial elite supported by financial and technological institutions and elite capture of the industry by emerging BEE entities that link powerful political leaders with financial interests.

Coal is still set to play a major role in the country's energy mix. Large internationalised energy conglomerates are still highly influential over South Africa's energy policy as they are its economic policy. As Medupi illustrates, coal-generated interests are adapting to renewable energy development and climate change mitigation requirements through the use of clean energy discourse, with considerable support from multi-lateral agencies. Medupi is an example of a "mega-project" characteristic of the promotion of the MEC (Fine and Rustomjee 1996:252). However there is a move away from the cheap abundant coal-based trajectory on which the country's industrial policy has been predicated to date. Electricity costs are soaring and demand for South African coal exports are increasing. While continued coal development is central to the country's IRP, cheap coal and hence cheap electricity is no longer sustainable. As the cost of coal goes up, the relative cost of renewable energy development comes down and coal supply contracts in South Africa become less lucrative, the national carbon tax is implemented and potential tariff barriers are placed on South Africa's carbon intensive exports, a diversification away from the country's traditional coal base may be inevitable. This is an area for future research. The role that nuclear, owned and managed by government but implemented by foreign consortiums likely from France and China, may play in this is also still uncertain.

The emergence of renewable energy and coal IPPs may be an indication that South Africa's energy-intensive users are no longer able "to have their interests met by the state" (Fine 2008). This aligns with McDonald's (2009:20) finding, discussed in chapter 3 that the traditional MEC model of “big state negotiating with big capital is changing” in favour of a “fragmented and rescaled state negotiating with more globally dispersed capital, in many different sectors with new technical demands”. On that point, Eskom’s structure is already under threat from rising coal costs, electricity supply issues, rising tariffs and a financial crisis. How Eskom’s monopoly control will evolve now that its involvement in the renewable energy procurement process has been removed by the DoE, and as a bill for an Independent Systems and Marketing Office is introduced requires further consideration. The question is whether this a break with the past which will lead to the eventual dismantling of the utility’s control over national electricity generation and transmission as privately generated power comes on stream. Or whether it is a further crisis in a sequence of many.

The unique nature of South Africa’s electricity sector as compared to other BRIC countries as well its neighbours in sub-Saharan Africa, is also significant here, contributing to debates over the ‘ideal’ model for an electricity sector and the failed attempts at electricity liberalisation imposed by structural adjustment programmes elsewhere. Despite the introduction of IPPs and a feed-in tariff in Kenya and developments in the Middle East and North Africa as part of the ‘Desertec’ project, there is little grid-based renewable energy development in the Southern Africa region. How South Africa’s renewable energy industry configures itself is therefore crucial to the way this may take place in neighbouring countries in the near future.

Decision-making in the electricity sector is not just about governance and political economy. As I have explored, significant technical uncertainties such as grid capacity and transmission upgrade requirements are likely to play a huge part in this. Technical barriers such as the ability of a centralised electric grid designed and built for an almost exclusive dependence on low grade coal to incorporate variable renewable energies are also intertwined with complex political factors. This comes back to Hudson’s (2011:1) point of the need for political economy to “engage more closely with the stuff that things are made of.” Technological uncertainties and their exploitation by vested interests have also played a key role in national level decision-making where institutional capacity and expertise amongst those formally tasked with policy making on energy is weak. However there has been an obvious change in the DoE’s rhetoric during 2010 which is now more sympathetic towards renewable energy.

In South Africa, donor aid as a landscape institution has been far greater for coal-fired power plants than renewable energy generation. This is consistent with international trends whereby fossil fuels still receive more subsidies than renewable energy (IEA 2012). The thesis has also shown that project based approaches to climate finance tend to neglect the importance of a broader systems-based approach including issues such as power sector regulations, investment and financing conditions, the need for skills transfer as much as technology transfer, grid infrastructure and technical capacity (Weischer et al 2011:11). While the CDM is playing a growing role in South Africa's electricity sector, this thesis reinforces other findings that rather than building up "dynamic capabilities" (Byrne et al 2011:18) it instead "exploits static comparative advantages". In sum it fails to play a meaningful role as an instrument of socio-technical transformation. The norms of project finance and attitude to risk are also highly determining of the nature of private sector renewable energy development. This supports Söderbaum and Taylor's (2001:685) findings that energy development often takes place within "a profit seeking and 'bankable' framework" which allows limited space for tackling the broader social and ecological implications.

Despite the small and dedicated internal drive for the introduction of renewable industries in South Africa, technical assistance from foreign donors namely Denmark and Germany has been very influential at both a project and policy level. This is consistent with the assertion that niche innovations are often carried out by "small networks of dedicated actors, often outsiders" (Geels and Schot 2007:400). Finally as the financial strength of multi-lateral actors seems to be waning in the face of powerful emerging market actors, the growing economic and political influence of India and China in South Africa's coal, nuclear and renewable energy sector is a further factor to monitor.

9.3 Theoretical reflections

With regards to question ii), in fusing a socio-technical transitions framework with political economy perspectives, I have uncovered compatibilities and clashes. It must firstly be noted that while academic themes of study are forever evolving and multi-faceted, political economy is long-established, whereas socio-technical transitions and in particular the MLP is still emerging and I would argue based on a comprehensive analysis of the literature, still under definition despite its conceptual heritage[82] in evolutionary economics. Importantly the term 'transitions' is

[82] Thank you to Noel Longhurst for this term

fundamental to both approaches. In political economy terms in South Africa's case it is used in relation to the country's post-apartheid economic, political and social transition and the on-going struggle to uphold principles of justice and democracy (Michie and Padayachie 1997). The socio-technical transitions literature meanwhile is concerned with the nature of low carbon transitions in response to climate change mitigation and environmental sustainability. In both cases the term implies deep structural changes, returning to the assertion discussed in chapter 3 that a technological transition cannot be divorced from the broader system in which it is embedded.

Broadly speaking a number of 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 structural changes in relationships in order to bring about transitions; and both underline the importance of a historical approach. With regard to the latter Elzen et al (2004:291) argue that "historical case studies of transition management may partly serve as empirical tests but this raises the problem of generalizability. Do lessons from one domain also hold for other domains?" This can be related to Milonakis and Fine's (2009:46) discussion over the relationship between historical specificity and theoretical generality. Arguing that economic theory can co-exist with historical content, they ask, "is there always a trade off between theory and history, must theory always be universal and general?"(Ibid p46). A further parallel is the uncertain and unpredictable nature of technological development. This can be related 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". However whereas the MEC's theoretical approach is highly cognisant of and explicit about the influence of powerful economic networks and actors over the state in impeding transitions, the socio-technical transitions approach stops short of doing this.

In political economy terms, this thesis has analysed conflict between fractions of capital competing for access in South Africa's electricity sector which in socio-technical terms can be related to the coal-generated 'regime' resisting incursions by the renewable energy 'niche'. Despite its initial resistance to renewable energy, the South African government has succeeded in moderating conflict between these fractions by allowing for growth in the former and the introduction of the latter, thus perpetuating "the dominant mode of production" (Jessop 1990:27). I have analysed the influence of these competing fractions over policy-making in the electricity sector, their competition for access to the national electric grid and as beneficiaries of preferential tariffs and/or state subsidies for their own development. The coal industry, itself part of powerful national and international resource conglomerates is still vastly superior in economic strength to the renewable energy industry and hence continues to dominate in economic and electricity policy making. Nevertheless I would conclude that it is analytically simplistic to pit the coal-regime against the renewable energy niche as two neatly opposed economic interests. As I have shown, while competition between them is clear, the situation is far from dichotomous and an interdependence of networks and institutions between these two loosely defined sites is beginning to emerge with Exxaro being a key example. Power is located in networks as much as within institutions and access to the grid is shifting as different fractions of capital jostle for access.

Following the MLP model it can be argued that stakeholders involved in the emerging wind industry and the development of national renewable energy policy have moved from the 'niche' to the 'regime'. This can be related to Smith et al's (2005:1492) argument that "the power to affect regime change depends on regime membership" and their call for "coalitions of prime movers", in addition to sufficient technical, financial and political power to bring about regime change (Ibid). The question is whether in South Africa these prime movers, operating in public and private sector networks and coalitions such as SAWEA, SAWEP, bilateral donors, government departments and the regulator are powerful enough to have influence over structures in which groups such as the EIUG and the Chamber of Mines are entrenched. A further question that has not been examined in great depth here and that merits future attention is how the nuclear industry will configure itself in relation to coal and renewables and with whom it will inevitably have to compete for financial and political resources and access to the grid. This discussion can be linked to Fine's (2009:42) call for an understanding of the major issues of political and economic power in understanding South Africa's reality and "formulating policy responses". The strong influence that conglomerates have over policy means that "any chances for success depend upon their commitment, voluntary, coerced and/or transformed, to social and economic restructuring at home" (Ibid).

However the extent to which on-going changes in South Africa's electricity generation sector can be considered a 'regime shift' also relates to theoretical ambiguities inherent in describing the levels of analysis of the MLP in that "what looks like a regime shift at one level may be viewed merely as an incremental change in inputs for a wider regime" (Berkhout et al 2004:54). Indeed we have found that the regime is not monolithic and is riddled with conflicts and power struggles. A central example of this is the bargaining power that the country's coal industry has over the utility in setting the terms of coal supply agreements. In addition there are divisions between and within government departments, ministries, the regulator and Eskom. There has also been competition between IPPs for RE IPPPP tariffs as well as cross-overs of interests within the landscape, regime, and niche levels by national and foreign companies, bilateral and multi-lateral institutions and banks. These include Exxaro, Alstom, General Electric, the IDC and the World Bank. Furthermore landscape actors and developments have both served to reinforce and destabilise the regime depending on the circumstance. Rather than exogenous, the landscape can often be intrinsically intertwined with the niche and regime and as this thesis has shown, vested interests resisting structural change are not only powerful at the national level, but part of a complex web of international institutions with links to global trends of financialisation.

In this sense, I would argue that one area where these two perspectives clash is between the MLP's adoption of hierarchical levels of analysis and the MEC's focus on networks of power within and over South Africa's electricity sector. This comes back to criticisms of the MLP as a framework (section 3.1.1) for its assumptions of hierarchical structure which I have found inadequate to capture the fluidity of networks. Employing approaches which challenge the notion of layered hierarchical structures implicit in the MLP's concept would allow greater scope for the analysis of highly dynamic networking processes and shifting coalitions which go far beyond the nation state (Leach et al 2010:75). For example, Bulkeley (2005:876) finds that common assumptions of spatial and scalar configurations of environmental governance that see decisions as "cascaded from international to national and then local scales" fails to recognise "hybrid governing arrangements which operate in network terms" and the linkages between "practices and politics taking place at a multitude of sites and scales of governance". This can be related to Freund's (2010:18) definition of the MEC as "linkages and agencies tied together through very well-developed institutional and financial structures". McDonald's (2009:20) finding that the traditional MEC model of "big state negotiating with big capital is changing" in favour of a “fragmented and rescaled state negotiating with more globally dispersed capital, in many different sectors with new technical demands” is also relevant here. The MLP’s inventor, Geel’s (2011) has since suggested ‘flat ontologies’ may be a more appropriate dynamic conceptualisation for it. I would concur with this particularly when applying Freund’s (2010) concept of an architecture that explores links and networks of power between the financial sector, private sector, parastatals, government and the IDC or indeed Marquard’s (2006:71) description of a complex of overlapping policy networks.

Lastly as a framework the MLP can accommodate a variety of different theoretical and conceptual approaches in order to analyse complex empirical realities over multiple scales and a long time frame. This could make a fundamental contribution to theoretical understandings and future transitions (Elzen et al 2004). Yet this risks any analysis being reduced to an argument that is largely descriptive in nature. As one critic put it “the weaknesses of the MLP are also its strengths. On one hand it is compatible with a variety of theoretical approaches such as political economy, actor-network theory, or principal-agent theory. But for this reason it totally fails to adopt a theoretical or methodological position. It is anything goes[83]”.

9.4 Suggestions for further research

It is hoped that this thesis has made a timely contribution to development studies by considering some of the political, economic, social and technological complexities inherent in the implementation of climate change mitigation in an MIC. Inevitably, this thesis has raised a number of possible strands for further research, academic and other. Most concretely these include: i) greater consideration of the international political economy of coal into which South Africa’s five main private coal suppliers have significant reach. This in light of increasing global demands for the country’s supply, its discursive reconfiguration as a ‘clean’ technology as well as the application of Sasol’s coal-to-liquids technology elsewhere, including Norway, Indonesia and India; ii) a comparison of the development of South Africa’s renewables industry with similar developments in other countries on the African continent, notably Kenya or Egypt which also have embryonic wind industries; iii) a comparison of South Africa’s renewable energy industry with the established industries in India and China that have saturated their domestic markets and seeking to expand are likely to have a strong influence in South Africa; iv) an analysis of the fast emerging solar industry in South Africa, as another emerging niche and which will both

[83] Anon, International Conference on Sustainability Transitions, Copenhagen, 29 August 2012

compete and cooperate with the wind industry; v) the development of the nuclear industry in South Africa as another potential provider of baseload power; vi) the role of established global energy companies such as Siemens, General Electric and Vestas involved in renewable energy development within international trends of financialisation; and vii) an ethnography of investors, lawyers, engineers and project developers involved in energy development in LMICs. Finally, while the MEC is unique for its social, political and economic characteristics determined by apartheid, studying how this concept could be considered in the context of other national or regional scenarios would be a worthwhile undertaking. This could be tackled for example, in relation to Australia and Chile which share South Africa's coal-based abundance and a dominant mining sector in which many of the same companies are involved. It could also be considered in the context of the Southern Africa Power Pool in which South Africa is dominant.

9.5 Final conclusion

My analysis presents findings which inform understandings of the political economy of South Africa's electricity sector. Returning to the notion that policy analysis is as much to do with advocacy "as with understanding", and that "intellectual cogitation" must be linked with "social interaction" if the analysis is to have an impact (Wildavsky 1979:17), I have explored some of the fundamental challenges to bringing about an equitable low carbon transition in South Africa's electricity sector. I hope that my thesis will make a contribution to those involved in overcoming some of these challenges. I am aware that situating the electricity sector within the country's MEC, itself embedded within broader national and international networks of power, risks generating a sense of disempowerment and paralysis of action when faced with the complexity of this reality. However if one conceptualises the MEC as relationships of power and key networks in the country's political economy (Freund 2010), opportunities for change may arise in the ability of numerous actors, national and international, to challenge the status quo and intervene at various different entry points. As previously discussed, in governance terms the challenge to do this depends on the nature and extent of the linkages within the broader socio-technical system that would need to be broken and reconfigured (Rip and Kemp 1998:341). There are a number of examples of where valid challenges to these linkages are taking place. These include: campaigns for greater transparency and accountability within South Africa's national decision-making processes, including the electricity sector, such as South Africa's Right to Know Campaign[84]; national campaigns on Acid Mine Drainage that result from the country's

[84] http://www.idasa.org/our_work/programme/right_to_know_campaign/

mining activities; continued research into the potential for the localisation of renewable energy manufacturing; scrutiny over the role of development finance institutions in their funding of energy; and research and advocacy on international financial regulation and capital controls such as that being carried out by the Tax Justice Network[85]. Outwith the focus of the centralised electricity grid, appropriately implemented, decentralised renewable energy provision also offer practical solutions (Practical Action 2012). Other suggestions could include careful monitoring to ensure that the socio-economic benefits enshrined in the RE IPPPP are genuinely realised and are linked with efforts to tackle historical marginalisation beyond BEE, which has often resulted in the creation of a black elite rather than redistributive economic justice.

Lastly awareness of tensions between environmental and social ideals at both a practical and theoretical level is also important. This firstly implies integrating considerations of ecological limits into a political economy approach without this being rejected as the prioritisation of 'green' considerations at the expense of the needs of the majority population. Similarly a comprehensive integration of issues such as global and national inequality, the role of labour and access to and control over resources into environmental perspectives is needed. With all this in mind, as South Africa grapples with its low carbon commitments and the demands of its own government, industry, banks and civil society it confronts a delicate balancing act of social, economic, political and environmental concerns. A socio-technical transition for South Africa, and indeed anywhere else, will require intervention at various points in the political and economic system in order to mobilise an industry that places sustainable development, energy poverty and climate change at its core.

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