

The political economy of decarbonisation: Exploring the dynamics of South Africa's electricity sector

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Key points

- Decarbonisation goes far beyond what is technologically or even economically feasible, to encompass a complexity of political, social and economic factors.
- South Africa's coal-dominated electricity sector, a key feature of the country's minerals-energy complex, is in crisis and subject to change. This offers potential opportunities for decarbonisation.
- Despite positive examples of decarbonisation in South Africa's electricity sector, such as a procurement programme for renewable energy, there are structural path dependencies around coal-fired generation and security of supply.
- Decision-making in electricity is highly politicised. Lack of transparency and power struggles in the policy sphere are key challenges to decarbonisation.
- There are battles over which technologies should be prioritised and which institutional arrangements should facilitate them.

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List of acronyms

AMCU	Association of Mine Workers and Construction Union
ANC	African National Congress
BEE	Black Economic Empowerment
BLIPPPP	Baseload Independent Power Producers Procurement Programme
BUSA	Business Unity South Africa
CCGT	Combined Cycle Gas Turbines
CO ₂ -eq	Carbon dioxide equivalents
CoM	Chamber of Mines
COP	Conference of the Parties
COSATU	Congress of South African Trade Unions
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar power
CTL	Coal to Liquids
DDPP	Deep Decarbonisation Pathways Project
DEA	Department of Environmental Affairs
DEPE	Department of Environmental Planning and Energy
DERO	Desired emission reduction outcomes
DME	Department of Minerals and Energy
DMEA	Department of Mineral and Energy Affairs
DMR	Department of Mineral Resources
DoE	Department of Energy
DPE	Department of Public Enterprises
DST	Department of Science and Technology
DTI	Department of Trade and Industry
EDD	Department of Economic Development
EIUG	Energy Intensive Users Group
EJ	Exajoules
ERA	Electricity Regulation Act
ERC	Energy Research Centre
ESCC	Energy Security Cabinet Committee
GCCA	Generation Connection Capacity Assessment
GDP	Gross domestic Product
GHG	Greenhouse Gas
Gt	Gigatonne
GUMP	Gas Utilization Master Plan
GW	Gigawatt
GWhs	Gigawatt hours
IDC	Industrial Development Corporation
IEP	Integrated Energy Plan
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contribution
IPAP	Industrial Policy Action Plan
IPE	Industrial process emissions
IPP	Independent Power Producer
IRP	Integrated Resource Plan
ISMO	Independent system and market operator
kW	Kilowatt
kWh	kilowatt-hour
LTMS	Long-term Mitigation Scenarios
MEC	Minerals-Energy Complex
Mt	Megatonne
Mt-CO ₂ -eq	Million tons of carbon dioxide equivalent
MW	Megawatt
MYPD	Multi-Year Price Determination
NCCRWP	National Climate Change Response White Paper

NDP	National Development Plan
NNEECC	National Nuclear Energy Executive Coordination Committee
NEDLAC	National Economic Development and Labour Council
NER	National Energy Regulator
NERA	National Energy Regulator Act
Nersa	National Energy Regulator South Africa
NGP	New Growth Path
NIRP	National Integrated Resource Plans
NT	National Treasury
NUM	National Union of Mineworkers
NUMSA	National Union of Metalworkers South Africa
OCGT	Open cycle gas turbines
PGMs	Platinum group metals
PPA	Power purchase agreement
PPD	Peak, Plateau and Decline
PPP	Public Private Partnership
PV	Photovoltaics
REIPPPP	Renewable Energy Independent Power Producers' Programme
RECAI	Renewable Energy Country Attractiveness Index
REDS	Regional Electricity Distributors
RFI	Request for information
RFP	Request for proposals
SACP	South African Communist Party
SAIPPA	South African Independent Power Producers' Association
SALGA	South African Local Government Association
SAPVIA	South African Photovoltaic Industry Association
SAREC	South African Renewable Energy Council
SASTECLA	The Southern Africa Solar Thermal and Electricity Association
SATIM	South African Times Energy Model
SAWEA	South African Wind Energy Association
TDP	Transmission Development Plan
TJ/million	Terajoule per million
TWh	Terawatt Hours
UNFCCC	United Nations Framework Convention on Climate Change

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Any errors or inaccuracies in this paper are the sole responsibility of the authors.

Executive summary

South Africa's electricity landscape is undergoing rapid change. The state-owned monopoly utility Eskom, historically dependent on the country's until recently low-cost coal supplies is now in financial and supply-side crisis, subject to growing indebtedness and downgraded to non-investment grade or 'junk' status. South Africa has gone from one of the world's cheapest electricity generators in the early 2000s to a 270% increase in electricity tariffs by 2015, with further increases predicted in the future. Since late 2014 the country has experienced regular load-shedding, a symptom of a larger electricity supply shortage that began in 2007, and which is likely to continue for at least five to ten years. Meanwhile, a successful programme for the procurement of renewable energy from independent power producers (IPPs) has procured 6300 MW since it was introduced in 2011, generating approximately 2% of total electricity at the time of writing in September 2015. Processes are also underway to procure independent power from other sources, including coal, cogeneration and gas, as well an embedded generation programme for rooftop solar photovoltaics (PV). A 9600 MW nuclear fleet is also currently under discussion and shale gas extraction is being explored, both of which are the subject of contested debate.

South Africa's coal-dependent electricity sector is responsible for 45% of national emissions (237 Mt CO₂-equivalent in 2010). Coal-fired plants account for 85% of installed capacity and 92% of electricity produced. Therefore decarbonisation in the electricity sector cannot be achieved without reducing the absolute contribution of coal-fired power at the same time as integrating a range of low-carbon energy supply options such as wind, solar photovoltaics (PV), nuclear and concentrating solar power (CSP) and new energy storage technologies. Demand-side management measures such as energy efficiency and increased numbers of installed solar water heaters are also significant options. Further, decarbonisation of the electricity sector has to involve the adaptation and restructuring of network infrastructures and accompanying institutions, markets and policy frameworks that in their current form are supporting a carbon-intensive system of production and consumption. Finally, if decarbonisation is also to incorporate a 'just transition' to a lower-carbon economy, then it must also address questions of economic inequality and welfare and an inclusive and sustainable growth path. In South Africa's case this is particularly challenging. As one of the most unequal countries in the world, the question of access to energy in South Africa is paralleled by its major development challenges. These challenges are linked to a history of racial oppression and inequality, poor access to services such as health and education, high levels of violence and an unemployment rate of around 25% (if discouraged work seekers are excluded) or 37% (when using the broader definition).

Decarbonisation therefore goes far beyond what is technologically or even economically feasible, to encompass a complexity of political, social and economic factors. Choosing pathways that avoid long-term technological 'lock-in' whilst prioritising socio-economic well-being and transparent and democratic policy processes is crucial to the realisation of decarbonisation. With this in mind, this paper provides an in-depth and historical analysis of the key features of South Africa's electricity sector and the stakeholders and beneficiaries operating within it. This includes an exploration of the sector's structure and governance; the success or lack thereof of key policy developments in creating accountable systems of decision-making and facilitating the introduction of renewable energy, particularly since the end of apartheid; and the role of key institutions and individuals in shaping and/or blocking such developments. Such an analysis is essential in order to understand how technologically feasible scenarios of decarbonisation are either blocked or supported by political and economic forces. We find that, while there are positive cases of decarbonisation in South Africa's electricity sector, there are also structural path dependencies in the electricity and energy sector more broadly, around coal-fired generation and security of supply for pre-existing Eskom plants. These path dependencies are compounded by a lack of transparency in decision making on electricity and power struggles in the policy sphere, all of which present key challenges to decarbonisation.

South Africa's electricity sector sits at the heart of the country's highly energy intensive economy. Coal accounts for 65% of the country's total primary energy supply and 92% of

electricity produced. With an economy structured around an evolving system of accumulation known as the minerals-energy complex, South Africa has historically relied on cheap coal and cheap labour for cheap electricity, for the disproportionate benefit of mining and minerals-based export oriented industry, with approximately 40% of the country's electricity consumed by its energy-intensive industrial users.

Such a system is, however, subject to change due to a combination of endogenous and exogenous factors. This includes an electricity crisis and the disintegration of closely knit relationships between actors in Eskom, coal and other mining companies, and the state. The country's mining industry has been beset by strikes and labour unrest while national economic growth is in decline. Increasing electricity prices along with declining prices in international commodity markets have reduced the international competitiveness of many of South Africa's raw and beneficiated products. With changes in international demand for the country's coal, depletion of the country's cheaper coal resources and the end of long-term coal contracts between tied coal mines and Eskom, the era of cheap coal is coming to an end, despite the continued fundamental significance of the resource to the country. At the same time, South Africa is under international pressure to reduce its carbon emissions. In 2009 President Jacob Zuma pledged to reduce carbon emissions by 34% by 2020 and 42% by 2025 below a business-as-usual trajectory. South Africa's Copenhagen pledge has since been codified in the National Climate Change Response White Paper (NCCRWP) and formalised in the international regime through South Africa's Intended Nationally Determined Contribution (INDC).

Eskom was downgraded by Standard & Poor's to a negative credit rating in March 2015 and has experienced ongoing uncertainty in board and executive level governance. It is applying for further tariff hikes from the national energy regulator and there are ongoing discussions over the sale of some of the utility's assets with the aim of attracting external investment, though, given the utility's negative credit rating this is unlikely to be on favourable terms. Delays in the construction of Eskom's new coal plants, Medupi and Kusile, have resulted in substantial cost overruns and the utility has increased its reliance on expensive diesel to power the country's open cycle gas turbines in order to make up the supply side gap.

In the midst of such changes there are various cases of decarbonisation taking place within the country's electricity sector which have been encouraged by a diversity of factors. Some are due to conscious attempts driven by environmental and/or social concerns while others are driven by concerns such as energy security or power sector reform. One evident site of decarbonisation is found in the case of the country's Renewable Energy Independent Power Producers' Programme (REIPPPP). This was launched in 2011 following the inclusion of a carbon constraint in the country's Integrated Resource Plan for electricity (IRP). Since then, the growth of a utility-scale, private sector renewable energy industry has developed its own momentum, supported by financial interests and those with an ideological interest in power sector reform. REIPPPP is internationally celebrated as a successful programme for the procurement of independent power from renewable energy and South Africa is now twelfth in Ernst and Young's latest Renewable Energy Country Attractiveness Index. The prices of these renewable energy technologies have decreased dramatically in the past three years and wind and solar PV are now cost competitive with Eskom's new build coal. But as we explore, in the short-to-medium term such developments are unlikely to replace the important contribution that coal makes to the electricity sector and the economy, including its influence over national decision making. The path dependencies of coal will pose a significant obstacle to any moves to decarbonise as high-carbon development continues to take place alongside a growing contribution from renewable energy. This is in addition to a potential (and highly controversial) nuclear fleet.

While South Africa has an ambitious national climate change strategy, the ability of climate policy to drive shifts in South Africa's energy system is limited. As we demonstrate, there are quite separate groups of actors in the energy and climate change spheres. Many emerging trends in the energy sector have little to do with climate change mitigation even if they may be associated with low-carbon energy. The country's electricity supply-side crisis and the increasing cost-competitiveness of renewable energy appear to be far greater drivers of change than concerns over climate change. That the IRP and REIPPPP may have had environmental

spin offs is more of a side effect. Further, those actors whom we would consider to be the likely natural allies of the Department of Environmental Affairs – notably environmental groups and the nascent renewables industry – either do not involve themselves in the mitigation policy space or have not developed the sorts of relationships and dependencies that would drive mitigation policy in the face of firm opposition from carbon and energy-intensive firms. Similarly, the poor have largely been excluded from policy processes and inclusion in a more equitable energy system. While electricity connections have increased significantly in the post-apartheid era and the state has introduced a Free Basic Electricity allowance for low-income households, energy policy continues to be geared towards meeting the needs of large industrial customers.

While there appears to be limited collaboration between the architects of environmental policy and the renewable energy industry, it is of note that new coalitions and networks are emerging between conventional and entrenched energy intensive users and more recent renewable energy bodies – for instance, between the energy intensive users group and the South African Wind Energy Association. These growing networks are collaborating on issues such as the ability of renewable energy IPPs to secure wheeling agreements with electricity consumers. Such shifts are taking place independently of national initiatives on climate change mitigation that are being carried out by the Department of Environmental Affairs, largely in isolation from the rest of government. In addition, the unquestioned assumption that coal is the optimal fuel to provide affordable security of supply is on the wane amongst certain consumer groups. The main priority for some factions of business and industry now appears to be for security of supply at an affordable tariff, regardless of the technology choice that generates it. There are also emerging concerns amongst companies that they may be held to account for the carbon that is emitted as a result of their electricity consumption with the implementation of carbon regulation. Renewable energy may, therefore, present an attractive alternative.

There are evident tensions in South Africa between a growing ideological commitment to a liberalised electricity market and an attempt to hold on to a crisis-ridden state-owned utility that some critics have referred to as ‘crumbling and bloated’. However, it is clear that South Africa’s electricity supply-side crisis, which currently sees regular load-shedding across the country, has served as a catalyst for a number of initiatives, some of which are more low-carbon than others. First, it has accelerated independently procured utility-scale renewable energy under REIPPPP. Secondly, there are processes on-going for the procurement of co-generation, gas and baseload coal. Thirdly, rooftop solar PV is rapidly emerging despite the absence of an appropriate regulatory framework, as commercial enterprises and wealthy households seek to buy their independence from an unreliable and increasingly expensive national grid. This is in addition to further measures to facilitate the connection of non-Eskom generation to the grid, including wheeling agreements. Wheeling and embedded generation, both of which have historically faced institutional blockages suddenly appear much more attractive in the context of a supply-side crisis and an inability by Eskom to meet demand for the foreseeable future. In this sense it can be argued that there is opportunity in crisis, which has facilitated moves towards decarbonisation.

A fundamental factor in any analysis of the political economy of decarbonisation is that of decision-making in the electricity sector, which has long been and continues to be highly politicised. It is clear that there is a battle over which technologies should be prioritised in addition to which procurement models and institutional arrangements should facilitate them. Power struggles across government and within the ruling African National Congress (ANC) are evident at the level of national policy making and regulation in the electricity sector as much as they are in other policy sectors. Such power struggles have contributed to the substance of decision-making on policy being subordinated not only to ideological inconsistencies within the ANC and its tripartite alliance with the Congress of South African Trade Unions and the South African Communist Party, but also to factional rivalries. Meanwhile the Presidency is trying to hold on to the closed decision-making system that was an important feature of the country’s minerals-energy complex as illustrated by the battle for nuclear procurement which appears to be driven by the Presidency. This raises the question of the extent to which tensions in policy-making can be resolved, with decarbonisation as the end goal.

Finally, despite the emergence of new forms of generation, particularly renewable energy, uncertainty surrounds the ability of Eskom's transmission and the country's municipalities that control 40% of distribution to accommodate and integrate this. Such an issue may pose a serious obstacle to the realisation of decarbonisation measures. In addition, in a country that has consistently had one of the highest levels of inequality globally, the moves that are taking place towards decarbonisation will not necessarily benefit South Africa's poor and marginalised. While the REIPPPP does contain potentially progressive requirements for community development and economic development, there are concerns over how they are being implemented. In addition, as the country's wealthier consumers seek to buy their own energy security from rooftop solar PV or, less sustainably, diesel generators, low-income users who are connected to the electric grid risk being cut out of a system that they can no longer afford to use, given the country's increasing electricity tariffs.

Such developments evoke the question of whether we are witnessing a fundamental change in the country's electricity sector.

1. Introduction

South Africa's electricity landscape is undergoing rapid change. The state-owned monopoly utility, Eskom, historically dependent on the country's until recently low-cost coal supplies is in financial and supply-side crisis, subject to growing indebtedness and downgraded to non-investment grade or 'junk' status (Fin24, 9 March 2015). South Africa has gone from one of the world's cheapest electricity generators in the early 2000s to a 270% increase in electricity tariffs by 2015, with further increases predicted. Since late 2014 the country has experienced regular load-shedding which is likely to continue for at least five years to a decade. Meanwhile, a successful programme for the procurement of renewable energy from independent power producers (IPPs) has procured 6300 MW since it was introduced in 2011, generating approximately 2% of total electricity at the time of writing in September 2015 (CSIR, 2015). Processes are also underway to procure independent power from other sources, including coal, cogeneration and gas, as well as an embedded generation programme for rooftop solar PV. A 9.6 GW nuclear fleet is also currently under discussion and shale gas extraction is being explored. Both are the subject of contested debate.

At the heart of South Africa's highly energy-intensive economy is its electricity sector, which is responsible for around 45% of the country's emissions: 237 Mt CO₂-eq in 2010 (DEA, 2014). Coal-fired power plants account for 85% of installed capacity and 92% of electricity produced (IEA, 2014). Decarbonisation in the electricity sector therefore cannot be achieved without reducing the absolute contribution of coal-fired power at the same time as integrating renewable energy sources such as wind, solar photovoltaics (PV) and concentrating solar power (CSP), and new energy storage technologies. Energy efficiency and demand-side management measures such as the increase of solar water-heaters, new technologies, and behaviours are also significant. Decarbonisation of the electricity sector must also involve the adaptation and restructuring of network infrastructures and accompanying institutions, market and policy frameworks that currently support a carbon-intensive system of production and consumption (Winkler, 2007; Unruh, 2000 & 2002; Winkler & Marquard, 2009).

There are other facets of decarbonisation that go beyond technical developments. If decarbonisation is also to incorporate a 'just transition' (Swilling and Annecke 2012) to a lower carbon economy, then it must also incorporate questions of economic inequality and welfare, as well as inclusive, transparent and democratic processes. A just transition must therefore account for issues such as access to energy for the poor, the role of labour and the social consequences of energy exploitation and infrastructure development, regardless of whether it is high or low carbon (COSATU 2012, Newell and Mulvaney 2013). Specifically, Swilling and Annecke (2012) assert that a just transition must tackle global socio-economic inequalities in terms of consumption and access to power, and cannot be achieved through a mode of production that depends on resource depletion and environmental degradation. Such a transition will require 'deep structural changes' with a system of governance that includes restoration, reconstruction and redistributive justice.

Ensuring that pathways to decarbonisation do not intensify or replicate the historical inequalities of South Africa's current growth path is particularly challenging. As one of the most unequal countries in the world, access to energy in South Africa is paralleled by its major development challenges. This is linked to a history of racial oppression and inequality, poor access to services such as health and education, high levels of violence and an unemployment rate of around 25% (if discouraged work seekers are excluded) or 37% (when using the broader definition). In 2011 45.5% of the population, approximately 23 million people were classified as 'poor', while 20.2% of the population, approximately 10.2 million were classified as living in extreme poverty. Beyond that, women, children and youth experience higher levels of poverty, which remains highly racialised (54% of black South Africans live in poverty) (StatsSA, 2014).

Decarbonisation therefore goes far beyond what is technologically or even economically feasible, to encompass a complexity of political, social and economic factors. Choosing pathways that avoid long-term technological lock-in (Unruh 2002), whilst prioritising socio-economic well-being is crucial to the realisation of decarbonisation. With this in mind this paper

provides an in depth and historical analysis of the key features of South Africa's electricity sector and the stakeholders and beneficiaries operating within it.

An analysis of electricity policy must be context-specific, understood via an exploration that includes political, economic and social complexities, institutional architecture, infrastructural and industrial development, comparative technological advantage, historical legacies and geophysical factors (Rip & Kemp, 1998). In the case of South Africa this includes its large coal resource, its racially differentiated access to electricity as a legacy of apartheid, its centralised transmission grid structure, and high demand from industrial users. As we demonstrate, South Africa's electricity sector is a site of complex governance arrangements, compounded by path-dependency of techno-social systems, political and economic interests and uncertainty in the adoption of new technologies.

Our analysis includes an exploration of the sector's structure and governance; the success or lack thereof of key policy and regulatory developments in creating accountable systems of decision making and facilitating the introduction of renewable energy, particularly since the end of apartheid; the role of institutions and actors in shaping and/or blocking developments in recent decades; and the way in which new technologies, policies and institutional arrangements are supported or opposed and by which actors. In doing this, we illustrate some of the networks and power dynamics at play, and the tensions or conflicts that exist between different actors and coalitions within the economy and their potential influence over the transition process. Such an analysis is essential in order to understand competing agendas within industry, government, finance, labour and civil society and the dynamics of complex and long-term political, social, economic and technological change processes. This further highlights 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 multilateral finance, private international investment and bilateral interests. Significantly it helps us to understand how technologically feasible scenarios of decarbonisation are either blocked or supported by political and economic forces. We find that while there are positive examples of decarbonisation in South Africa's electricity sector there are also structural path dependencies in the electricity sector, and energy sector more broadly, around coal-fired generation and security of supply for existing Eskom plants. We further identify the lack of transparency in decision making on electricity and power struggles in the policy sphere as a key challenge.

A key finding is that there has not been an emergence of powerful – or even coordinated – pro-mitigation coalitions despite international commitments and domestic policy on climate change. Those groups that we would expect to be pro-mitigation are fragmented and dispersed, whereas coalitions concerned with maintaining the status quo are well organised and have used the discourse of growth, employment and competitiveness to hinder the implementation of mitigation policy. This has been exacerbated by the country's fragile economic position.

Decarbonisation of the electricity sector will require a significant scaling up of low-carbon infrastructure, particularly in the 2020s as coal-fired power plants begin to retire. As it stands, South Africa's electricity sector is coal-dominated, with a small but significant renewable energy programme and the possibility of a large state-funded nuclear programme. Current conflicts taking place in the sector will determine whether the renewable programme remains on the periphery of a centrally planned and procured hybrid power market, and whether further power sector reform takes place and alters the control Eskom has over generation and transmission. These struggles over the electricity market are beyond mitigation policy but will potentially have important implications for decarbonisation.

This research draws from 26 semi-structured key informant interviews undertaken in May and June 2015, including members of the renewable energy industry, the coal sector, finance, Eskom, the National Energy Regulator of South Africa (Nersa) and government departments. Given the politically and/or commercially sensitive nature of the subject matter, we have not listed the names or institutional affiliation of the interviewees, nor do we cite them by name. We have also undertaken extensive content analysis of grey literature pertaining to the energy and related sectors, including government documents, national policies, and industry reports; and a systematic consultation of relevant media, including sources such as *Business Day*, *Engineering*

News, Financial Times and *ESI-Africa*. The paper is also enriched by the authors' combined long-standing and in-depth expertise and insights into South Africa's energy sector and climate policy and political economy analysis. Informal discussions with contacts in the energy policy sphere have also helped inform some of the findings of this paper, though for obvious reasons they cannot be cited here.

The researchers also undertook participant observation at various seminars and conferences involving members of the energy industry, national and local government, civil society and academia including: the Green Economy Workshop, run by the National Business Initiative, the Fossil Fuel Foundation's Electricity Conference and Junior Miners Conference, McCloskey and CoalTrans coal conferences, the DEA's National Climate Change Conference (held in November 2014) and National Climate Change Co-ordinating Committee meetings, as well as National Treasury's Carbon tax stakeholder workshops. Participation at these conferences is highly illustrative of discursive dynamics between industry, government and finance and recent developments in the energy sector. Our methodology is enriched and informed by theories of policy processes, and literature on the challenges of researching power and policy e.g. Dryzek (2005), Keeley and Scoones (2003), Kingdon (1995), which has enabled us to unpack some of the drivers and barriers to the decarbonisation of South Africa's electricity supply. However this paper is primarily a rich empirical study on emerging trends in the South African electricity sector, and how these do or do not contribute to a long-term transition to a lower-carbon economy with reduced levels of poverty and inequality.

This research is primarily aimed at policy-makers, academics and industry practitioners who are concerned with, and seek understanding of, the nature of decision-making in South Africa's electricity sector or who wish to make comparisons with other national contexts. This paper assumes some knowledge on the part of the reader on a technical level of the nature of electricity transmission, generation and distribution as well as a certain level of familiarity with the nature of politics and policy-making South Africa. The paper does not claim to offer straightforward policy recommendations, or what Büscher (2009: 5) would refer to as a 'policy fix' approach, but rather aims to expose the complexities of how the electricity sector, and subsequently its potential for decarbonisation, are embedded within a broader political economy. Given the breadth of the issue, the text is not exhaustive and we accept that there will inevitably be some empirical gaps. On that point, while this study focuses on the electricity sector we acknowledge the contribution that other sectors such as transport and coal-to-liquids make to the country's carbon emissions. While they are not dealt with in depth here, we highlight them as areas for further research.

The paper starts with a brief outline of the results of the Deep Decarbonisation Pathways Project (DDPP) in Section 2, a scenario analysis accompanying this this research. We then explore the country's minerals-energy complex as a key description of its historical core based around mining and minerals-beneficiation. Such an exploration sets the scene for analysis of, firstly, the crucial and dominant role that Eskom has played in the economy, and, secondly, of some of the dynamics of the coal industry and its relationship to the electricity sector. Section 4 explores Eskom's financial crisis including some of the long-term and path-dependent factors that have led up to it. We also raise the question as to what this crisis might mean for the future of Eskom as a vertically-integrated monopoly utility going forward. This is followed in Section 5 by a discussion of the way in which electricity is governed in South Africa and in particular some of the key developments in policy and regulation that have attempted to remove energy policy and planning from opaque processes previously dominated by Eskom and the former Department of Minerals and Energy. Such a consideration is continued in Section 6 that is dedicated to South Africa's integrated resource plan (IRP) for electricity. We analyse how that, despite the IRP's various failings and the significant role that coal will continue to play in the next 20 years, it still represents a step forward as the first and relatively transparent process involving public consultation for energy planning – although this has since been undermined by the latest draft of the plan having been abandoned by government. Section 7 discusses the REIPPPP as perhaps the most successful supply-side intervention for decarbonisation in South Africa to date. The section provides a brief examination of the programme and considers some of the political, economic and technological factors that may threaten its sustainability going forward. The

examination of REIPPPP is followed in Section 8 by a discussion of how embedded generation and roof top PV is being developed by wealthy and commercial consumers in response to recent load-shedding, despite the absence of an appropriate regulatory framework. Section 9 discusses how other moves to introduce privately generated power are emerging, namely coal, cogeneration, gas and embedded generation solar PV. Section 10 then discusses some of the technical constraints and realities of any decarbonisation of South Africa's electricity sector and the implications that this has for the transmission grid. Section 11 covers wheeling, and Section 12 is dedicated to nuclear. Significantly for this research, while nuclear is arguably 'low-carbon' and therefore could be considered as contributing to decarbonisation, there are serious doubts with regards to its effect on the public good and the public purse. Section 13 discusses the nature of South Africa's commitments to climate change mitigation and underlines the disconnect that exists between climate policy and energy policy. This is followed in Section 14 by a consideration of the carbon tax as a potentially positive move for decarbonisation. Section 15 concludes.

2. Rationale for this research

This research is intended to accompany the technical work undertaken by Altieri et al (2015) *Pathways to deep decarbonisation in South Africa*. The authors used a partially linked energy model (ERC's SATIM) and economy-wide computable general equilibrium model (E-sage) to unpack the technical complexities of meeting development objectives (reductions in poverty, measured as a lowering of unemployment and a shift upwards in the number of residents living above the poverty line) and mitigation objectives (a 14 Gt CO₂-eq carbon constraint to 2050) in South Africa. Using South Africa's mitigation policy as a guide to set a constraint of 14Gt CO₂-eq cumulative emissions over the period 2015-2050 but allowing the energy model to optimise within that, they found that it is possible to meet the mitigation target primarily through decarbonising electricity supply to 2050.¹ The study then compared two economic pathways: the first decreased unemployment by increasing growth in lower carbon, higher labour-absorbing sectors (the Economic Structure scenario). The second scenario (termed High Skills) looked at the impact of injecting a considerably higher skilled population into the economy, thereby changing the labour force.

In light of the country's high levels of poverty and inequality, the economic analysis is particularly crucial for South Africa. South Africa is one of the most unequal countries in the world, with a Gini co-efficient of 0,69 in 2011 (using income data) (StatsSA, 2014). In 2011, the richest 20% of the population accounted for over 61% of consumption, whereas the poorest 20% accounted for only 4.3%. It is therefore essential that any path to decarbonisation does not replicate the historical inequalities of South Africa's current growth path (Moe, 2010). As seen in Figure 1, South Africa is a global outlier in terms of the emissions-intensity of the economy and per capita emissions.

¹ The cumulative constraint spans the period 2015 to 2050. It includes energy sector emissions and also some non-energy sector emissions, including fugitive emissions from coal and gas extraction, gas transportation, and production of liquid fuels from coal. It excludes process emissions from industrial processes and other non-energy sector emissions (e.g., AFOLU) (Altieri et al, 2015).

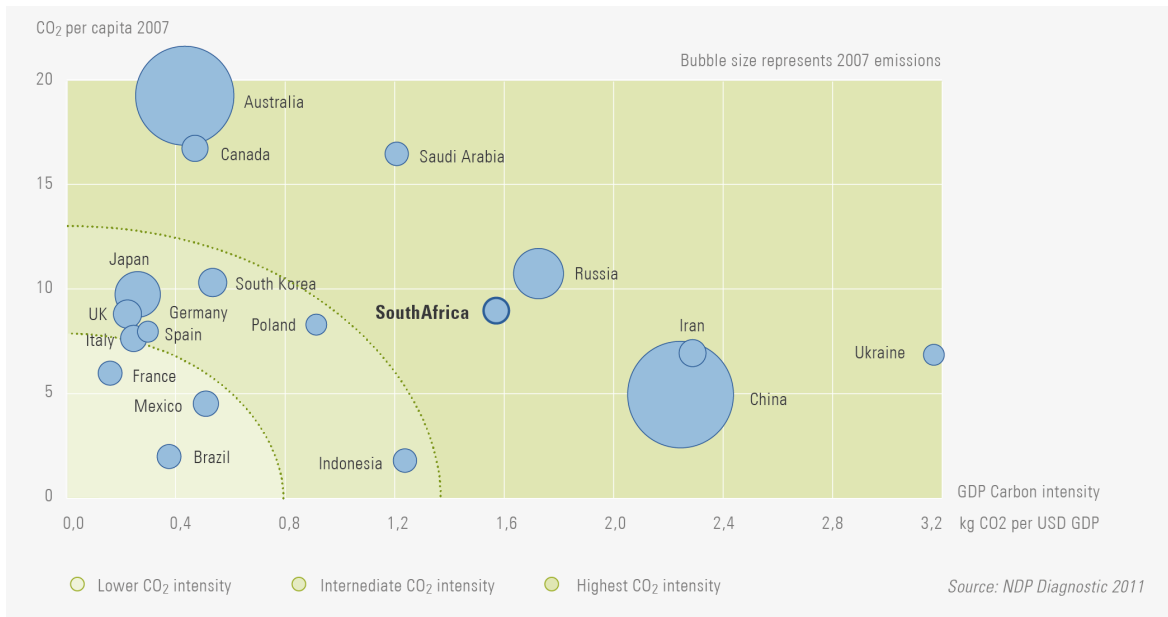
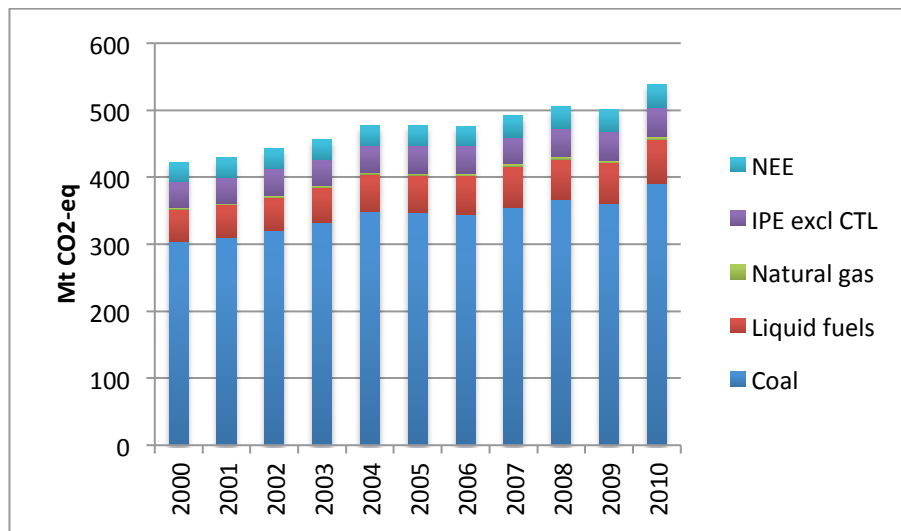


Figure 1: Emissions intensity per capita

(Altieri et al, 2015)

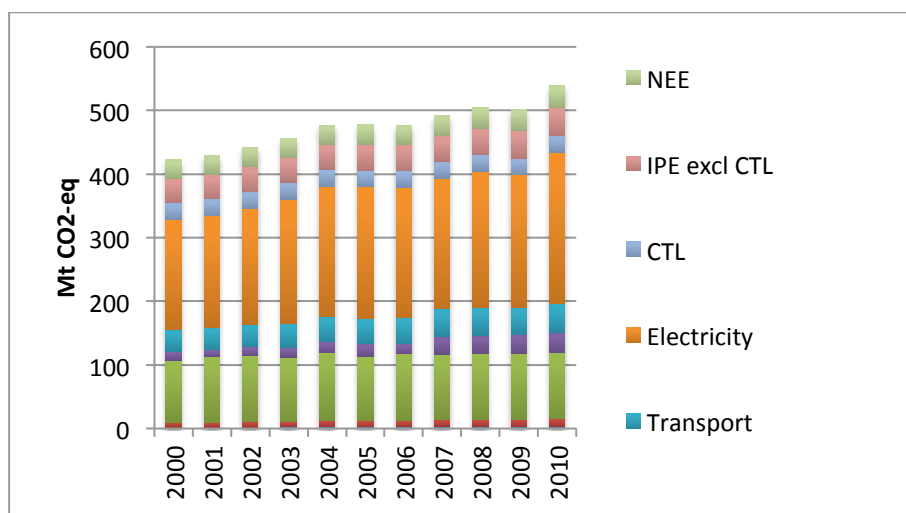
South Africa's emissions intensity results from the structure of the energy sector and economy. Energy supply and demand are thus key determining factors in the realisation or impediment of decarbonisation. Energy emissions accounted for 78% of South Africa's total emissions in 2010: 428 Mt out of total emissions of 518 Mt CO₂-eq (DEA, 2014). Of this, combustion of coal is the largest source by fuel type (Figure 2), and the production of electricity the largest source by sector (Figure 3).



(NEE: non-energy emissions; IPE: Industrial process emissions; CTL: coal to liquid)

Figure 2: Emissions by fuel type 2000–2010

(Marquard, et al, 2011)



(NEE: non-energy emissions; IPE: Industrial process emissions; CTL: coal to liquid)

Figure 3: Emissions sources and trends from 2000 to 2010
(Marquard, Trollip & Winkler, 2011)

As can be seen in Table 1, the carbon constraint imposed in the energy model used in Altieri et al (2015) can be met primarily through a reduction in coal-fired electricity by 2050 and the retirement of carbon-intensive liquid fuels production (coal-to-liquid) by 2040. In short, under either scenario, be it a structural change to the economy or a considerably more effective educational/skills policy (i.e a change in the composition of the workforce), the energy sector emissions are reduced by reducing the contribution of coal. Since coal is a key energy commodity in South Africa, and an important economic sector, this is one of the most profound changes in the indicative pathways to decarbonisation outlined by Alteri et al (2015). For this reason, we dedicate significant exploration to the entrenched nature of the country's coal industry, its contribution to the electricity sector and its international linkages, particularly in Section 3.2.

Table 1: Key metrics for the Economic Structure (Scenario 1) and High Skills (Scenario 2) scenarios in 2010 and in 2050
(Altieri et al, 2015)

Indicator	Units	2010	Economic Structure 2050 Scenario 1	High Skills 2050 Scenario 2
Population	Millions	51.5	62.3	62.3
GDP per capita	Real US\$ 2005/person	4 825	12 973	12 294
Unemployment	%	24	12	18
Population in low income bracket	%	50	18	17
Persons per Vehicle	Person/vehicle	10.2	5.6	5.7
Final Energy Consumption	EJ	2.48	4.75	4.58
Annual GHG Emissions	Mt CO ₂ -eq	398	241	242
Per capita total GHG emissions	Tons CO ₂ -eq/cap	7.7	3.9	3.9
Energy Intensity of GDP	TJ/Million US\$ 2005	10.0	5.9	6.0
Levelised cost of electricity	US\$/kWh	0.056	0.110	0.106

<i>Electricity generation</i>				
Coal	%	91.8	0	0
Natural gas	%	0.2	5.7	6.1
Nuclear	%	5.5	0	0
Hydro	%	2.1	1.6	1.7
Wind on-shore	%	0	15.8	16.6
Solar PV	%	0	13.0	13.0
Solar thermal	%	0	62.5	61.2
Biomass	%	0	1.3	1.4

Long-term scenario planning as in Altieri et al (2015) is able to highlight only a few possible decarbonisation pathways of potentially many. However, the specificity and longevity of electricity assets means that decisions made now on technology choices will have a long-term effect on the structure of the electricity system, the associated level of emissions and the costs of any future transition. Thus, while the modelling highlights that a transition to a lower-carbon and more inclusive economy is possible, the current dynamics of the electricity sector explored in this paper may either indicate a continuation of current path dependencies or the beginnings of a shift away from it. Thus the key questions become: What are the drivers of, and barriers to, long-term decarbonisation that are playing out in the short term? What decisions being made in the present will assist or hinder transition to a new pathway that is at once low-carbon and good for development? And how do the actions of different actors impact the institutional lock-in that may limit the transition? With such questions in mind we now begin with an analysis of the country's minerals-energy complex.

3. Context: the shifting minerals-energy complex

South Africa's political economy has historically been characterised by the minerals-energy complex (MEC).² This refers to an evolving system of accumulation based on cheap coal used for the generation of cheap electricity which, coupled with cheap labour, provides input into export-oriented mining and minerals beneficiation (Fine & Rustomjee, 1996). The interlinkages within and between the energy, mining and minerals beneficiation sectors mirror an interconnected industrial elite that comprises private capital and state actors, and a particular historical dynamic of 'conflict and coordination'. We draw on the concept because it defines a starting point for understanding the nature of South Africa's energy- and carbon-intensive economy. It is also a useful framework for understanding some of the key trends in the country's economic and political history, as well as a tool to understand environmental and social injustice in South Africa, including the effects of continued coal development on local communities (Peek & Taylor, 2014; Hallowes, 2014).

The South African economy has historically been, and remains geared towards, an economic pathway that is premised on capital-and energy-intensity in the productive sectors (Altieri et al, 2015), thus reducing the labour-intensity of growth. Structural changes to the economy and the workforce are thus important for increasing labour-intensive growth and economic welfare as well as reducing the environmental impacts from carbon-intensive, capital-intensive mineral extractive sectors (Winkler & Marquard, 2009; SBT, 2007; Altieri et al, 2015; Black & Roberts, 2009). This has been recognised in policy documents across various ministries, including the National Planning Commissions' National Development Plan (NDP) and in various iterations of the Department of Trade and Industry's (DTI) Industrial Policy Action Plan (IPAP). To date, however, the implementation of these policies has not significantly altered the energy,

² We acknowledge that the concept has not gained wide currency amongst some mainstream economists in South Africa (see Seekings & Nattrass, 2006; Morris & Martin, 2014), but consider the concept useful for understanding path dependencies in the energy system

emissions or employment intensity of the South African economy, and indeed minerals-based industrialisation remains a key pillar of the DTI's strategy.

South Africa has a formalised national system of innovation and policy which falls under the auspices of the Department of Science and Technology (DST, 2013). The DST conducts an annual survey according to OECD methodologies and standards and according to the 2012/2013 survey gross domestic expenditure on research and development (R&D) amounted to R23.871 billion at current Rand value in 2012/13. This was some 0.76% of GDP which is well below countries such as Brazil and China which are above 1% and well below the OECD average of some 2.4% (DST, 2013). The South African government is the largest funder of innovation through its science councils, which have significant capacity that could very plausibly be re-directed towards decarbonisation and sustainability areas, and related research budgets for higher education. While there have been policy decisions to support the green economy, renewable energy, sustainability and related R&D as we discuss in this paper, these have not been realised and research expenditure in the energy sphere is still largely directed towards 'traditional' areas in the petroleum sector, coal based technologies, and electricity sector transmission and reticulation system technologies and nuclear. Thus, similarly to policy attempts to reform the electricity sector discussed in this paper, attempts to significantly re-direct R&D towards fields related to decarbonisation and sustainability remain at level of rhetoric while the traditional MEC incumbents maintain their dominance.

Central to the MEC concept is the system of relationships between the private sector and state or parastatal entities. Thus the MEC can be understood as an 'architecture' (Freund, 2010) which encompasses critical links and networks of power between the financial sector, government, the private sector and parastatals, such as the Industrial Development Corporation (IDC) and Eskom. Similarly Marquard (2006: 71) describes 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'.

Twenty years after the transition to democracy, the homogeneity of the MEC and the formal and informal institutions underpinning it has been subject to economic and political change, due to a combination of endogenous and exogenous factors. Such changes include shifts in the contribution of different sectors to GDP, for example the increased role of finance and tertiary sectors in the country's economy (Ashman et al, 2012), the internationalisation and diversification of the country's mining houses, the introduction of a black economic elite (Tangri & Southall, 2008), the introduction of renewable energy (Baker, 2014), significant shifts in the coal market (Burton & Winkler, 2014), and substantial changes in energy and mineral policy. South Africa's economy is now increasingly characterised by consumption-driven growth and services. The country's financial and business services now account for 24% of GDP, the single largest economic sector in terms of contribution to GDP (Bhorat et al, 2014).³

While, however, the relative contribution that mining, minerals-beneficiation and related manufacturing now make to the South African economy is declining (Figure 5), these sectors remain important to the productive economy. The country's exports are still primarily commodities, coal is the third-largest export by value (StatsSA, 2015), and mining exports are key to maintaining a positive balance of payments. Perhaps more importantly, amongst many actors in government and business, there exists the idea that growth and development in South

³ South African household indebtedness has doubled in recent years (StatsSA, 2014). So while growth in retail in particular has increased, this is based largely on imported goods and consumer debt. Thus while the structure of sectoral contribution to GDP has changed, those higher growth sectors do not for the most part reflect any upstream domestic manufacturing growth. The productive mining and minerals sectors, while not labour-intensive sectors comparatively, nonetheless are large absolute employers – jobs that are important in a context of 25% or 37% unemployment. This contradiction between the decline in manufacturing and growth in services without socio-economic development is a key industrial policy challenge for South Africa, and the DTI's support for mineral beneficiation stems from an assumption that downstream minerals beneficiation will provide labour-absorbing manufacturing growth.

Africa simply cannot take place without the country leveraging its 'mineral wealth' or using its 'comparative advantage' in energy-intensive beneficiation (ANC, 2011; DMR, 2013; DTI 2010-2015; DTI, 2014).

The country's mining industry has been beset by strikes and labour unrest while national economic growth is in decline. The World Bank (2015) has estimated that South Africa will have GDP growth of 1.5% in 2015, and has revised its 2016 and 2017 forecasts downwards to 1.7% and 2% respectively. With changes in international demand for the country's coal (from Europe to India), depletion of the country's cheaper coal resources and the end of long-term coal contracts between tied coal mines and Eskom, the era of cheap coal is coming to an end (Burton & Winkler, 2014). Ownership of assets is shifting in response to investment strategies by mining houses and growing pressure from government for increased black economic empowerment (BEE) ownership of mining houses. Delays at Eskom's new coal plants have resulted in substantial cost overruns. Increasing electricity prices together with declining prices in international commodity markets have reduced the international competitiveness of many of South Africa's beneficiated products while international greenhouse gas emissions agreements are placing further pressure on an already fragile economy.

The nature of many entrenched relationships has also been subject to significant shifts. As McDonald (2009) has previously argued, the relationship between 'big state and big capital is changing' and, as we illustrate, relationships between and within different state, industrial and financial sectors are increasingly dispersed and fragmented. While elements of the relationship between the state and energy-intensive business remain intact, there are emerging changes that could potentially herald new processes around energy and climate change policy in the future. As we show, however, much of this change arises, not from mitigation concerns, but rather from parallel economic, technological and ideological pressures. If it continues it could thus play out contrary to requirements for a transition to a low-carbon economy.

A further shift can be found in the activities of the Industrial Development Corporation (IDC). Historically 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 & 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 during 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. The IDC has historically been oriented to the development of extremely large-scale minerals beneficiation projects, with close links to previously state-owned enterprises as well as the major conglomerates. Creamer (5 August, 2011) 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'.

However, the IDC's support to the mining and manufacturing sector has recently declined, at the same time as its investment in the country's emerging renewable energy industry has increased. In the past three years it has supported 24 projects with financial commitments totalling R14 billion. Under Rounds one and three of REIPPPP the IDC has committed R13.2 billion to 22 projects (IDC, 2014). Such support is for projects as well as associated manufacturing and assembly plants, in alignment with the country's New Growth Path (EDD, 2010). Renewable energy projects constituted 40% of the funding approved during financial year 2013/14, with the IDC playing a major part in support of REIPPPP, especially concentrating solar power projects (EDD, 2014: 45). Mining and minerals beneficiation and upstream chemicals received 18% of funding approved, while more labour-intensive industries, such as downstream chemicals, metal products and clothing and textiles, received 23%.

These policy processes must be understood as embedded in a broader political context. Not only is the African National Congress (ANC) itself characterised by ideological differences and factions within the party, but it must also accommodate both organised labour, the Congress of South African Trade Unions (Cosatu), and the South African Communist Party (SACP), with

which it forms the Tripartite Alliance. 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'. Besides historical internal divisions, the means by which Zuma came to power and the dynamic of his presidency has highlighted further factional divisions within the party that are often more about networks of patronage than about questions of policy (Butler, 2010, 2013, & 05 June, 2015; ANC, 2015).

Organised labour has furthermore fallen into internal disarray, with, for example, the important Cosatu union the National Union of Mineworkers (NUM) having faced growing competition from new unions such as the Association of Mineworkers and Construction Union (AMCU) that are not ANC-aligned. In late 2014 Cosatu ejected the National Union of Metalworkers (NUMSA). While parts of organised labour provide a progressive voice on climate change mitigation policy, environmental justice and a just transition, such statements do not appear to have any real impact given the realities of the carbon-intensity of many important union sectors.

The supply-side crisis in the electricity sector, discussed in Section 4, which has resulted in regular load shedding since late 2014 and rising electricity tariffs, has further exposed fragilities in the MEC. Shifts in international and national energy markets, including coal (Section 3.2) and renewable energy (Section 7) have also undermined the historical structural stability of the MEC. At the same time, investment in coal and coal-related infrastructure, such as power plants, rail export lines and new mines, continues, the state attempts to promote new entrants in the energy sector, firms and business groupings continue to attempt to maintain the structural elements of the past and yet lack the coordination of the past. As we now discuss Eskom, as the state electricity utility, has long been a central actor within the MEC and played a central facilitating role in the country's carbon-intensive path dependency. However, now crisis-ridden and struggling with high levels of debt, questions are raised over how long it may maintain its monopoly position in generation, transmission, and distribution, what this means for the coordination required for economic development, and, significantly, what implications this might have for the realisation of decarbonisation.

3.1 Eskom

As South Africa's vertically integrated state-owned monopoly, Eskom is the primary generator and sole transmitter of electricity via the country's high-voltage transmission grid. Eskom has an installed capacity of 42 GW, comprising 35.7 GW coal-fired stations, 1.8 GW nuclear, 2.4 GW gas-fired stations, 600 MW hydro and 1.40 GW pumped storage stations, as well as the recently commissioned 100 MW Sere Wind Farm (Eskom, 2015a). As can be seen, 85% of installed capacity comes from 13 coal-fired power plants, many immediately adjacent to privately owned coal mines. Figure 4 shows Eskom generation (concentrated in the north-east of the country) and transmission lines connecting to load in other parts of the country. Meanwhile the power purchased from IPPs made up 2.7% of total sales of 216 274 GWhs in 2014/2015 (Eskom, 2015a).

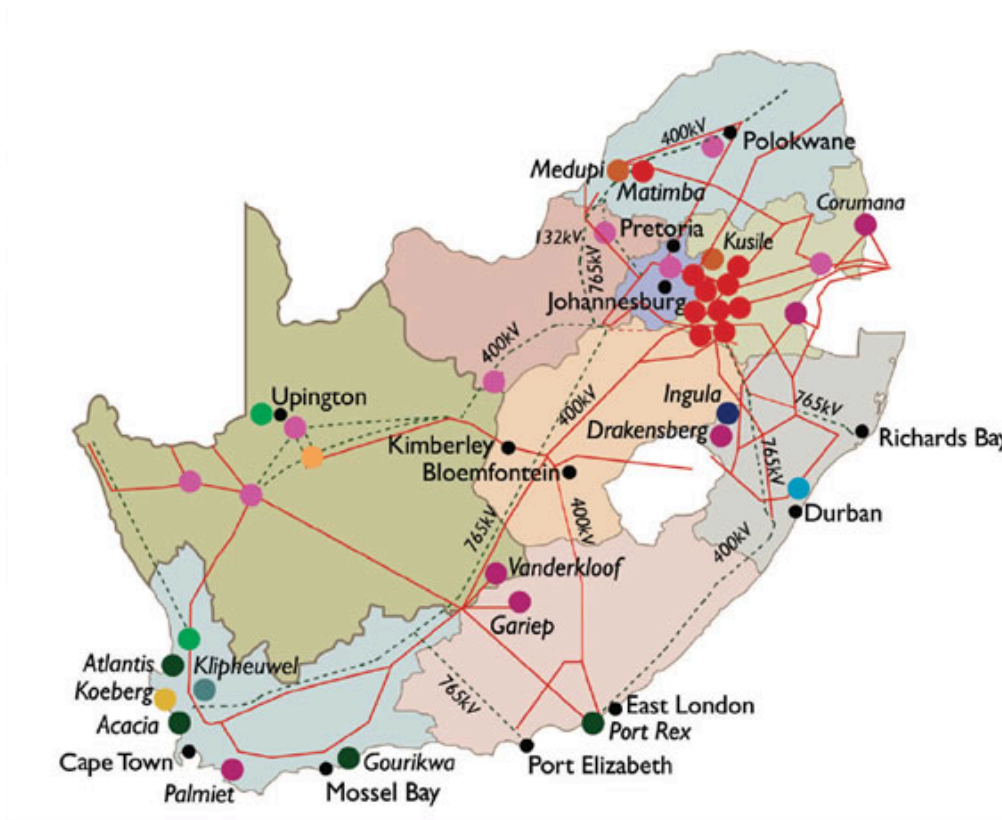


Figure 4: Generation and transmission infrastructure
(Eskom, 2015a)

Despite installed capacity of 42GW, many of the utility's generating units are non-functional. Of Eskom's 121 generating units, only 49 are in a healthy state, with 26 units in a poor condition and 32 in a critical state, having been taken out of service for major maintenance. The utility is therefore struggling to meet peak demand of less than 30 000 MW in summer and 35 000 MW on cold winter days (Creamer 18 June, 2015a) due to poor plant availability and high outages, with unplanned maintenance of around 8GW⁴. Load shedding has therefore taken place throughout 2015, in accordance with the levels of planned and unplanned maintenance. This capacity shortfall is the main driver of the current electricity crisis and has become a catalyst for institutional shifts in the electricity sector.

Lack of available capacity is partly due to failed attempts to liberalise the power sector in the early 2000s, as we discuss in more depth in Section 4.2 (see also Eberhard, 2007). As part of this process, Eskom was prevented in 2001 by Cabinet from investing in new capacity. However, when it became apparent that new private investment would not be forthcoming and given that at the time new capacity could not compete with Eskom's tariffs, and moreover there was no institutional framework for private sector investment and access to the grid, Eskom was permitted in 2005 to invest in new generation capacity. The result was that two coal-fired power plants Medupi and Kusile and the Ingula pumped storage scheme were approved. Due to numerous delays they are currently still under construction, with only one unit of Medupi commissioned thus far. This has contributed to the capacity shortfalls.

⁴ Eskom's energy availability factor has declined considerably over the past 15 years: from 92% in 2001 to only 75% in the 2013/14 financial year (Eskom, 2003:3; Eskom 2014: 89). This is due to lack of maintenance and an ageing fleet of power stations.

Table 2: Eskom sales by customer category, 2014/2015*(Source: Eskom 2015a)*

Sector	Total sales (216 274 GWh)
Municipalities	42.1%
Industrial	24.7
Mining	13.8%
International	5.6%
Residential	5.4%
Commercial	4.5%
Agriculture	2.5%
Rail	1.4%

Eskom is directly responsible for 58% of sales to end-users, while municipal distributors purchase their energy and services from Eskom and supply about two thirds of the country's customers who account for the remaining 42% of sales (see Table 2). Municipal distributors are dominated by the large metropolitan distributors, such as City Power, which reap significant profits from their on-selling of electricity and cross-subsidise municipal rates for services such as waste collection and roads. This system has created perverse incentives to limit small- and medium-scale embedded generation within cities, despite rising costs of electricity and supply shortages. Own generation by large energy-intensive users remains limited due to the regulatory/licensing system, as do options for bilateral contracts and wheeling of electricity. We discuss this in more detail in Section 11.

The post-apartheid state's commitment to the universal provision of electricity as part of the ANC's national electrification programme was in conflict with its continued servicing of the demands of industry, which has consistently taken preference over household use.⁵ While 85% of households are now connected to the grid (StatsSA, 2011) as compared to 30% during apartheid (Bekker et al, 2008), residential consumption of electricity remains low for many households, and many low-income users rely solely on the state's Free Basic Electricity allowance. Residential consumption contributes significantly to peak demand on the system, but in general remains at around 20% of total sales for South Africa either directly from Eskom or through municipalities). Newly connected, usually poor, households are not large consumers of electricity (see Table 2), despite claims to the contrary, with concomitant sub-optimal health, welfare and education outcomes. Eskom's residential sales (which are primarily poorer households) have consistently accounted for around 5% of total sales (5.4% currently), and have not grown significantly despite the electrification programme.

Since its inception in the 1920s, Eskom's very reason for being has been as a provider of electricity as an input for heavy industry, notably mining and minerals processing sectors. As pointed out by Fine & Rustomjee, Eskom has fulfilled a 'particularly important function in lubricating both the growth of MEC core sectors and the ascendance of large-scale private capital' (Fine & Rustomjee, 1996: 97). Thus, as the utility expanded its capacity, particularly from the 1970s onwards, to meet growing demand from energy-intensive mining, first gold, then later ferrous metals and platinum group metals, it also awarded coal contracts to encourage the growth of what was viewed as domestic/local capital or 'Afrikaner capital' during apartheid. These companies are contrasted against what was viewed by the state as 'imperial' or foreign capital, companies that had developed as foreign investors.

On the consumption side, this has resulted in a demand profile that remains skewed towards industrial users. The Energy Intensive Users Group, which is composed of Eskom's 31 largest customers, consumes approximately 44% of the electricity produced by the utility (EIUG,

⁵ Electrification was largely limited to white South Africans and industry during apartheid. Eskom commenced more widespread electrification in the late 1980s, and electrification has remained a key ANC policy since 1994. Although the number of connected households has risen considerably access remains limited and unaffordable for many.

2015). Eskom's large customers include mining houses that received cheap electricity during apartheid as well as companies who received some of the cheapest electricity in the world under deals made in the 1990s when the utility had substantial overcapacity (e.g. BHP-Billiton/South 32's Hillside aluminium smelter and Xstrata/Glencore ferrochrome projects). Over 80% of coal supply to Eskom remains concentrated in major mining firms that originated or grew out of firms that originated in apartheid-era South Africa: Anglo American, Exxaro, South 32 and Glencore.

However, while Eskom has long served to benefit the interests of the coal mines who supply it at one end and the energy-intensive users who benefit from it at the other, recent developments, including the introduction of privately generated power, particularly the baseload IPP programme (Section 9) suggest that it is starting to lose its monopoly control over the country's electricity supply sector. Arguments for the expansion of privately generated power or reform of the electricity supply industry have gained traction in light of Eskom's financial and supply-side crises.

Due to its isolation under apartheid, Eskom evaded the global trend of power sector liberalisation in the 1980s and 1990s which was supported by the World Bank as part of structural adjustment programmes. This trend, which was largely based on the experience of high income countries, saw a shift away from a usually publicly-owned, vertically integrated monopoly utility to a model based on privatisation and competition. Known as the 'standard model' of power sector reform, this would involve a series of steps of reform, including the unbundling of a monopoly utility into separate transmission, generation and distribution companies, the introduction of independent regulation, commercialisation and corporatisation, and the introduction of wholesale and eventually retail competition. Such a model has since lost traction in light of repeated failings in low- and middle-income countries. In many cases it has been replaced by more diverse models of 'hybrid power markets' where incumbent utilities remain the dominant player while IPPs generate alongside them (Gratwick & Eberhard, 2008).

The South African electricity supply industry now finds itself in this position. Eskom holds the monopoly on generation, transmission and 60% of distribution. However, key functions that historically fell to Eskom, such as planning and procurement, are now the ambit of the Department of Energy (DoE) or the IPP office (see Section 5 for a discussion of roles and functions), as legislation has evolved. This has brought with it tensions as Eskom seeks to maintain its monopoly position while facing severe financial and technical crises as we go on to explore in Section 4. First, though, we turn to the central role that coal has played in South Africa's electricity sector and its MEC more generally and that, as we discuss, poses a significant challenge to the realisation of major national shift towards decarbonisation.

3.2 The coal sector

Key to understanding the structural elements of the MEC is the role coal plays in South Africa's energy system, both in the conversion to electricity by Eskom, and to liquid fuels by Sasol. In turn, electricity, direct coal use and liquid fuels are important inputs into the mining, concentrating, smelting and refining of various commodities, including coal, gold (now in geological decline), platinum group metals, manganese, chrome and iron and steel. These commodities are then exported either as ore that is unbeneficiated or beneficiated to various degrees up to a refined product, while also linking back into the production of other mining products. Similarly, Sasol converts coal and natural gas⁶ into liquids that are used both for energy and as feedstock for a chemicals complex.⁷ The economy remains highly dependent on mineral-extractive and energy-intensive industries, however, especially for exports and employment (given the low levels of employment in the economy). As discussed in the previous

⁶ This is currently a small proportion of the input into Sasol's proprietary coal-to-liquid (CTL) process but under various gas-supply/price scenarios presents a potential driver for future large gas-to-liquids prospects, building on/substituting for the current CTL.

⁷ Key to the original conception was the idea that, while South Africa appeared to have industrialised, this was merely a misrepresentation of downstream beneficiated minerals as manufactured goods, which gave the economy the appearance of diversification out of mining and into manufacturing.

section, Eskom is the fulcrum on which the input of coal and outputs of cheap electricity turned, with large mining houses providing coal at one end and receiving electricity for the extraction and refining of other commodities at the other.

As was seen in Figure 2 coal accounts for the majority of South African emissions. The sector contributes roughly 1% directly to GDP, but more importantly, it is a key input to the remainder of the mining and minerals-extracting economy that evolved in response to low electricity prices. Therefore any shift towards decarbonisation of the electricity sector would significantly affect the coal sector and the South African economy more broadly. Since the 1990s, there has been a relatively stable set of actors and institutions in the coal sector,⁸ but the sector is undergoing three major shifts: changing global markets, geological decline and increasing production costs, and the entrance of new firms and ownership structures. These shifts are causing conflict between firms, Eskom and the state.

The evolution of the MEC required closely aligned state and private-capital coordination and decision-making. For example, Eskom's expansion of generating capacity in the 1970s to match mineral output and growth in mines was linked to the development of a coal export railway line by the state-owned railways and dedicated coal export terminals by mine-owners. This required coordination between railways, private miners and Eskom. The railway line, developed in 1976 and connected to the privately owned Richard's Bay coal terminal, allowed South Africa to export beneficiated (washed) coal to Europe while using either the 'middlings' (i.e. the coal that remains after washing) or low-grade run-of-mine domestic coal for Eskom. This resulted in cheap coal for Eskom as the coal was either mined and sold on long-term cost-plus contracts at 'tied' mines connected to power plants via conveyors, or at fixed prices from multi-product mines. Exports allowed mining houses to recoup their capital and indirectly cross-subsidise the Eskom supply as returns could be met from exports (Eberhard, 2011; Burton & Winkler, 2014). Politically, coal contracts also enabled Afrikaner empowerment to take place through the sale of the assets of so-called 'imperial' capital to new mining houses. In this, the role of state-directed finance through the IDC and Eskom coal contracts was key (Baker, 2014; Marquard, 2006), for example in the development of Gencor (which became BHP Billiton and has now become South 32).

The diversification of the coalmining sector has similarly brought with it tensions and problems. The stable post-apartheid relationship between major mining houses and Eskom has evolved as major mining houses have internationalised their operations and new players have entered the market. Not only are major mining houses subject to increasing pressure to grow their BEE ownership shares, but the state is attempting to develop new BEE miners. Current low commodity prices are concurrently impacting company returns, precisely as relations between government and the sector have deteriorated because of new export regulations in the 2013 amendments to the Mineral and Petroleum Resources Development Act which propose ministerial discretion over coal and other mineral exports.

While South Africa is a relatively low cost producer of coal, various drivers are putting the industry under pressure. Although the industry historically exported primarily to Europe, exports have 'swung' to the Pacific market as demand for lower-grade coal (notably from India) has grown. More than half of South Africa's coal exports now go to the East. This swing resulted in growing competition between domestic consumers – primarily Eskom – and the export market, thus exposing Eskom to increasing price pressure (IEA, 2014) during the commodities boom and up until export prices collapsed in 2013. This was exacerbated by long-term contracts between Eskom and the country's major coalmining companies coming to an end. This, as well as underperformance at certain tied mines, has forced Eskom into procuring coal increasingly on short-term contracts at spot market prices.

Price increases and quality issues at certain tied mines have contributed to growing distrust between mining houses and the utility, exacerbated further by inconsistent procurement policies

8 Anglo American, Exxaro, South 32 (BHP-Billiton spin-off) and Glencore (former Xstrata assets) produce over 80% of South Africa's thermal coal; with Sasol, these five major producers account for 85% of total production. But there is an active and growing contribution from 'junior miners' with smaller outputs.

driven by BEE imperatives and legislative attempts to reduce export coal competition. This is exemplified by the failure of Eskom and Anglo American to sign a coal contract for the Kusile power station. Eskom is insisting that procurement of coal for Kusile is only possible from a 50% plus 1 black-owned firm, even though this is higher than the Mining Charter requires (Burton & Winkler, 2014). Similarly, throughout the commodities boom, Transnet, the state-owned rail and ports company that runs the coal export line and port, threatened to construct its own export terminal for BEE/junior miners, thereby altering the closely co-ordinated coal export industry in favour of state-supported BEE. Transnet has also invested in expansion of the export rail line, although the Department of Mineral Resources (DMR) was at the same time trying to pass legislation that would limit the export of 'strategic minerals', including coal, to try and protect Eskom from price increases through regulating coal exporters (MPRDA, 2012).

While export prices of coal are now substantially lower – prices have fallen by half over the past two years, and are down to around \$50/t (Creamer 08 October, 2015) – the historical structure of the coal market, premised on high-grade exports and lower-grade domestic use of thermal coal, is a thing of the past. These market developments and the loss of cross-subsidisation of earnings for mining houses from exports have been exacerbated by geological decline in the Central Basin. This has added to the costs of extraction and beneficiation which are then passed on to Eskom, increasing logistical costs for Eskom (as it rails and trucks coal rather than using conveyors from tied mines), already under political pressure to adhere to BEE procurement. Smaller, often black-owned mines are often not located at the mine mouth and come with similar cost issues. Since the collapse of global export prices, Eskom coal contracts appear more lucrative for miners, especially once export transport costs are accounted for. But whether the international seaborne coal trade is in structural decline or subject to cyclically low prices, and whether international prices will bounce back and re-create competition for lower-grade coal, is unknown. Despite higher export volumes, the coal industry is seeing falling revenues from exports, placing it under pressure just as domestic pressures increase (rising costs, BEE compliance, strikes).

Major mining houses appear to be losing confidence in South African investments. BHP-Billiton last year spun off its South African assets (amongst others) into a new company, South32, while there are rumours that Anglo will sell its Eskom-linked mines in response to BEE imperatives. Glencore, which entered the South African coal market through buying up smaller miners and merging with Xstrata, is currently embroiled in a legal case over coal supply with Eskom at its Optimum Colliery. Even BEE major Exxaro has criticised Eskom's policy on changing the structure of coal contracts. Sasol has invested in new coal mines but is subject to different downstream regulation through the liquid fuels pricing regime.

The protracted and widespread conflict is quite different to the way Eskom and miners coordinated the development of the coal industry in the past, with Eskom putting in capital and miners earning a return on their costs, or miners converting mines to ones that served both the export market and Eskom demand. The conflict also comes at a time of rapidly increasing costs and declining prices. Even though Glencore is viewed as having a more export market-oriented pricing approach (Maharaj, 2012: 5) all the mining houses are under pressure to ensure their assets perform, measured against potential investments elsewhere in the world. And new investments in mines by the major mining houses depend on the return that Eskom contracts can ensure – something that has become a bone of contention between Eskom and the major mining houses. Given capital constraints facing Eskom, the cost-plus mine model is also likely coming to an end. Brian Molefe, the recently appointed CEO of Eskom and former CEO of Transnet, has called for the scrapping of cost-plus coal contracts and has claimed that Eskom can put out competitive tenders for new coal contracts, not necessarily linked to tied mines. Again, this depends on particular resources, beneficiation and logistics costs, but would open up the market to newer entrants, specifically black-owned and other junior miners.⁹

⁹ Eskom had proposed the development of an 'emerging miners fund' to assist black-owned (and emerging, i.e. excluding Exxaro) miners from entering the market. However, the capital required was not available and Eskom appears to have dropped the plan.

Thus, even without the potential implications of mitigation policy on demand for coal, market shifts and internal dynamics are causing the sector to face significant coordination challenges. Path dependencies and existing infrastructure will lead to the continued use of coal for the foreseeable future, even as mitigation policy increases longer-term pressure on the sector. At the same time, new and sometimes politically connected entrants are creating a new set of interests in the coal sector that not only satisfies the state's interest in the creation of a new black elite but also leads to further infrastructural, institutional and political lock-in of a coal-based energy system and pattern of industrial development.

4. Opportunity and crisis

Eskom faces a capital crisis and a cash-flow crisis,¹⁰ the symptoms of which include load-shedding since late 2014 and power outages in 2006, 2007 and 2008. Reasons for South Africa's electricity supply crisis are complex and deep-seated and the culmination of events over many years, including a failed attempt at power sector reform (see Eberhard 2005, 2007; Gaunt, 2008; Baker, 2012; Trollip et al, 2014).

Since 2005 Eskom has been struggling to build 17 GW of new generation capacity whilst also facing a \$17 billion funding gap to 2018. In March 2015 Eskom saw its investment rating downgraded to 'junk' status by Standard & Poor's (Fin24 19 March, 2015). The utility is severely under-capitalised due to a depreciation of assets that have not been replaced over time and tariffs that are not cost-reflective despite recent dramatic increases. The crisis is exacerbated by the fact that many municipalities are in arrears and collectively owe the utility R4 billion, while Eskom also faces the ongoing problem of electricity theft through illegal connections.

Given the lack of functional generation capacity, Eskom has been relying on its open-cycle gas turbines (OCGTs) to make up the capacity shortfall since late 2014. Load factors for the OCGTs were 19.3% in financial year 2013/14 but they are supposed to be run only to meet peak demand at load factors of less than 6% (Eskom, 2014). The OCGTs cost roughly R3.50/kWh to run, compared to Eskom's average tariff of around R0.79/kWh. This heavy reliance on OCGTs has been justified with a claim by Eskom CEO Brian Molefe that it is still economically cheaper than load-shedding (Theron 24 June, 2015), although such a claim would depend on assumptions about the cost of unserved energy. Regardless, the use of the OCGTs has come with significant financial cost to Eskom to keep the lights on.

In 2010 Eskom received a \$3 billion loan from the World Bank as a 'lender of last resort' for its Eskom Investment Support Project, of which the bulk went to the 4800 MW Medupi coal-fired power plant. Medupi has since been subject to labour unrest, delays and cost escalations with the final bill estimated to be between R155 billion and R300 billion (News24 03 July, 2015). Other new build projects, namely the Kusile coal-fired power plant, also 4800 MW and the 1330 MW Ingula pumped storage scheme have also been significantly delayed. Eskom sales have stagnated since 2007 at around 217 TWhs, for which contributing factors include supply-side constraints, decreased demand caused by low growth rates, and some energy-efficiency and demand-side management interventions (Eskom Integrated Demand Management has reduced load by just under 4GW since 2005 (Eskom, 2014: 113).

The electricity supply side crisis can be described as a 'trigger event' in policy terms (Keeley & Scoones, 2003) or a 'policy window'¹¹ of opportunity (Kingdon, 1995) for a diversification of generation sources and procurement models from IPPs. Not only are new supply-side technologies gaining traction, including co-generation, coal, gas and renewables as we discuss in Sections 7, 8, and 9, but pressure to reform the sector has grown. In the words of one industry

¹⁰ The minister responsible for representing the shareholder (government) Lynne Browne (Department of Public Enterprises) has explicitly acknowledged the crisis. There has not only been a protracted supply shortfall, but also the need for a substantial financial bail-out. Also, the IEA has used the word crisis to refer to electricity shortfalls of the type faced by South Africa (IEA, 2005).

¹¹ Kingdon (1995): Policy windows emerge when a 'focusing event' occurs (usually a crisis, though not always). At the same time, potential policy solutions and political forces emerge to create an opportunity for change (Marquard, 2006: 28).

member 'the crisis is a wonderful lever'. In the words of another, 'the impasse around Eskom's role is almost impossible to resolve without crisis. The ideology is so deeply entrenched it needs to be resolved by crisis'. Thus, while ideological preferences in the ANC may not have been resolved one way or another, Eskom's position is becoming increasingly tenuous as it is placed under pressure to accommodate new entrants, faces significant cost overruns in its new build programme, and the National Energy Regulator of South Africa (Nersa) continues to limit Eskom's requests for tariff increases in the face of increasing financial and operational costs.

This crisis has also become the basis on which emerging coalitions and alliances are forming around new technology options and procurement models. As we describe in section 5.5, this includes the country's traditional energy-intensive users collaborating with relatively new renewable energy associations. And, as we further discuss in Section 12, the crisis is also being used as justification for a potential 9.6 GW nuclear fleet. One civil society member stated that 'there is panic in government due to load shedding' and this could lead to decisions being rushed through without appropriate consideration or transparency. Such 'panic in government' has also contributed to staff changes at the utility, including a series of acting CEOs and board-level shenanigans. This has since settled somewhat with the permanent appointment of Brian Molefe in September 2015. Additionally, a Cabinet-level 'war room' has been set up to coordinate a response to load-shedding in the government (Section 5.3).

We turn now to provide some of the detail of Eskom's financial crisis and the developments that have unfolded in attempts to deal with this.

4.1 Financial crisis, cash flow and tariff hikes¹²

In recent years South Africa's National Energy Regulator (Nersa) has approved significant tariff increases for Eskom under the multi-year price determinations (MYPD) albeit below the amounts applied for. Tariffs are now, and continue to be, below full cost-reflectivity but have also increased sharply in response to the revaluing of Eskom's asset base and increasing costs. However, Eskom's recent applications for tariff increases under MYPD 2 and 3 (see Annex 1) have resulted in revenue significantly lower than applied for, leading Eskom to refer to a 'hole' in its financing of approximately R250 billion in 2013 (FIN24 22 October, 2014).

Eskom's financial crisis is further exacerbated by the costs of Eskom's Medupi and Kusile power plants which have increased significantly since they were announced in 2005. The final cost remains unknown for both plants, given the uncertainties around delays and Eskom's cost of capital. As things stand, the costs of both power plants do not compare favourably with REIPPPP prices which as demonstrated in Section 7, have fallen substantially throughout the four bidding rounds, nor with the anticipated prices of new smaller-scale coal IPPs. As discussed in Section 9.1, the coal baseload programme is capped at R0.82/kWh (in April 2014 Rand) (DoE, 2014). Eskom's average tariff for 2015/16 is R0.79c/kWh (Eskom, 2015b: 28), which means that the renewable energy projects in the more recent rounds have now either reached or are close to reaching grid parity.

The disparity in costs between Eskom's new build plants versus new private sector power has added to criticisms of Eskom's monopoly position, raised concern over the complexities of regulating a monopoly utility, and drawn attention to the inflexibility and cost overruns of megaprojects (Flyvbjerg, Bruzelius & Rothengatte, 2003). IPPs have added new renewable energy capacity quickly, typically on budget and with significant decreases in price, although the initial rounds remain significantly more expensive than Eskom's average tariff (R0.79/kWh in 2015). This stands in contrast to the potential overruns of a fleet of nuclear megaprojects and the as yet unknown final costs of Medupi and Kusile. Questions around institutional design and incentives are not new (Steyn, 2001) but comparisons between Eskom and REIPPPP have provided further support to those who argue that restructuring the electricity sector may be necessary.

¹² For more in-depth detail, see Annex.

Finally Eskom's financial crisis has been paralleled by a governance crisis significant upheaval in its leadership in recent years. Since 2007 it has seen six different chairs of the board, seven chief executive officers and six chief financial officers.¹³ On 25 June 2015, Eskom's finance director resigned, after being suspended by the Board along with three other senior executives, including the CEO and executive for group capital. The chairman of the board also resigned subsequently. Eskom is thus facing concurrent financial crises and conflict and instability at the board and executive level. This is reflected in the inability of the utility to offer credible plans of how it is dealing with the on-going supply crisis which has led to a further blurring of the multiple lines of accountability for security of supply through the DOE and DPE and Nersa, and with the establishment of a further governance element in the form of the 'War Room' as we now discuss in Section 4.2.

4.2 Restructuring of Eskom

In 1994 the Office of Public Enterprises (now Department) 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 (Eberhard, 2005). Subsequently the 1998 White Paper on Energy Policy (DME, 1998) promised a gradual liberalisation of the power sector. A Cabinet memo in 2001 announced that 30% of generation, including renewable energy, would come from IPPs (BDlive 23 August, 2010). The White Paper also envisaged that Eskom would be corporatised and would outsource various functions, in line with the standard model of reform. For instance, it anticipated that the electricity distribution industry would be restructured to consist of six independent regional electricity distributors (REDs); that separate transmission utility and system operator (Transco) would then be created and owned by the state with a view to possible sale in the future (Bekker et al, 2008: 3129; Gaunt, 2008). However, key aspects of the White Paper were never implemented and remain highly contested (see Eberhard, 2004) for a full history of failed liberalisation). This includes the setting up of a separate transmission utility in the form of an Independent System Market Operator (see Section 5.2).

The supply-side crisis has provided further impetus to these unresolved policy conflicts with regards to the restructuring of Eskom and the broader electricity supply industry. As a further response to the crisis in May 2015, the country's National Treasury announced that it was considering the sale of some of state-owned monopoly Eskom's 'non-core' assets. According to newspaper reports there are conflicting opinions between and within different government departments and members of the ruling party the ANC on this matter. For instance, in May 2015 Public Enterprises Minister Lynne Brown stated that she was opposed to the sale of Eskom's assets, in direct contradiction to statements made by the head of the ANC's Economic Transformation Committee Enoch Godongwana. At the same time, the Treasury's Director-General Lungisa Fuzile, was quoted as saying that the energy 'war room' was looking at ways to get the private sector involved in Eskom (Creamer 15 May, 2015). This lack of agreement reflects Eberhard's (2005) description of South African electricity policy as being a swing from 'state to market and back again'. That government has gone to great lengths to avoid the word 'privatisation' illustrates deep ideological differences within the ANC between those advocating for market reform and those for state control. Organised labour in particular is opposed to any privatisation of Eskom, since they see electricity as a public good. In general though, the position within the government and the ANC is contradictory.

A key question remains, however, whether there would be sufficient interest from investors in light of the utility's negative credit rating, soaring tariffs and the fact that a number of the power stations are in need of maintenance. For instance, a member of the regulator indicated that it would be very difficult to find investors to purchase Eskom's assets 'and the ones you do will make you pay for the investment', due to the fact that Eskom is struggling with old plants and is in financial crisis, cautioning that it would be the consumers who would carry the price. How the assets would be sold is also unclear. Given Eskom's poor financial status this is likely to inflate investor risk. Therefore the sale 'needs to be structured in such a way that Eskom does not attract additional expenses that investors can create/perceive to be there.... Eskom would

¹³ Over the same period, there have been four Ministers of Energy and five Ministers of Public Enterprises.

have to look at selling its best assets with above average performance in order to avoid investors adding premiums for where they see risk.’

5. Governing electricity

5.1 Policy making and institutions: formal and informal

Though the DoE is responsible for 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, as this section now discusses.

The DPE has had oversight responsibility for Eskom, as for other parastatals, since the late 1980s¹⁴. Nersa, set up under the National Energy Regulator Act (Act 4 of 2004) which provided for the establishment of an independent regulator, 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 (NERA, 2004). As with the DoE, Nersa also reports to the energy minister. The Treasury meanwhile looks at the financial exposures of Eskom. The Energy Act of 2008 and the Electricity Regulation Act (ERA) of 2006 each delineate certain powers for the Minister of Energy. Other institutions of national electricity governance involved include metropolitan and municipal governments, organisations such as Association of Municipal Electricity Utilities and South African Local Government Association.

Weak institutional capacity has inevitably influenced policy-making in the energy sector (Newbery & 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) highlighted ‘a systemic lack of clarity concerning roles and responsibilities in the electricity sector, with an associated extended period of policy opaqueness and uncertainty’. It further found 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 & Rustonjee, 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). Nearly six years after the DoE was set up, the department is still gaining strength and capacity. As one civil society explained ‘The DoE is finding its feet only now’. One of the reasons for this can be attributed to the neglect of energy policy by the DME in favour of distributing mining rents. As a member of DTI explained (in a 2010 interview, in Baker (2012: 102)), ‘part of the explanation for the policy vacuum on the energy side was because of the overwhelming focus of the DME was 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 preeminent focus with a relative neglect of other policy imperatives, including the growth of mining employment; safety conditions in mining; and energy policy.’

While the DoE has developed some energy-planning capabilities and is looking to control nuclear procurement, it should be noted that much of the policy success as regards procuring privately generated power is actually housed within the IPP Unit (see Section 5.3). Lack of expertise, knowledge and an inadequate understanding of the technology have also affected the DoE's ability to govern electricity. For this reason it has been suggested that decision-makers

¹⁴ The DPE, as the representative of the sole shareholder, is responsible for appointing Eskom's board. In more recent years, this has led to questions about the choice of board members, several of whom have close ties to President Zuma and lacked experience in running an electricity utility. When Eskom board-level conflicts arose, Zola Tsotsi, former chairperson went so far as to claim the backing of Zuma (Southall, 2015; Paton, 2015).

within the DoE have been influenced by those advocating for increased coal generation and nuclear (Baker, 2012:102).

The DoE's formal powers arise from the 2006 Electricity Regulation Act. Under apartheid, Eskom was responsible for all planning and new build decisions, but after the 1998 White Paper on Energy Policy outlined a planned liberalisation of the sector, this responsibility fell away. It was not until the Electricity Regulation Act was promulgated in 2006 that a framework was put in place to allocate responsibility for new build in the sector. Under Section 34 of the Electricity Regulation Act, the Minister of Energy will determine whether new generation capacity is required, and what form of energy source the capacity will use. The right to allocate responsibility is further elaborated on through the Electricity Regulations on New Generation Capacity (DoE, 2011). These regulations state that, following the development of an Integrated Resource Plan, and in line with Section 34 of the Electricity Regulation Act, the Minister shall make a determination of the quantity of capacity to be built, and most importantly, by whom the capacity may be built (i.e. by Eskom, an IPP or another organ of state). This is the mechanism by which the state allocates responsibility for new build options. Capacity is allocated via a Ministerial 'determination' (Burton et al, 2014). Once a determination has been made to allocate capacity to IPPs, the DoE as 'procurer' is responsible for developing Requests for Information, Request for Proposals, and running the competitive bid process.¹⁵ In reality, these actions are now run by the IPP Office set up in 2011 with the initial responsibility of managing REIPPPP. Eskom, however, remains the buyer of electricity (IPP purchases are passed through under its tariff application) and is responsible for grid connection.

Tensions between and within departments, poor communication, conflicting opinions, lack of technical and human capacity, a reluctance to exercise strategic leadership and to be held to account were identified as key obstacles to policy- and decision-making on energy and climate, as indeed across the economy. While these may be generic features of governance the world over, one member of the renewable energy industry claimed: 'There are so many different voices in government. This is not unique to South Africa, just worse.' In the case of energy in particular, the lack of technical understanding of the issues by policy-makers and relevant institutions and individuals was also identified as a key constraint to policy-making. For instance, a member of the renewable energy industry stated: 'A rationally driven, technologically based, quantifiable studied, modelled energy policy is not in existence in South Africa at the moment'. One civil society member referred to 'a failure to govern' and stated that 'many people in government are behaving as if their role is managing consultants ... rather than providing strategic direction and decision-making. They will arbitrate but not take ownership of decision'.

Another government member stated: 'From the political economy standpoint, the biggest issue is disagreement across government, on end goals, who is responsible and the role of various processes ... politicians are not willing to act, they don't understand the policy they are dealing with. This has a lot to do with the structure of departments and political culture.' A further aspect of this is related to the relative power of ministers versus bureaucrats in different departments. During the post-apartheid transition in the 1990s, apartheid-era bureaucrats remained in key positions, fostering tensions and distrust between the 'old' bureaucracy and the new political dispensation, especially ministers. To some extent this still exists, even though, according to one critic 'there is a technocratic class now that really should have more clout in these decisions' but instead, due to lack of trust, 'ministers override the director generals and bureaucrats of the various departments on technical matters they don't understand'.

¹⁵ According to the Electricity Regulations on New Generating Capacity (DoE, 2011b), the procurer is 'the person designated by the Minister in terms of Section 34 as being responsible for the preparation, management and implementation of the activities related to procurement of new generation capacity under an IPP procurement programme including the negotiation of the applicable power purchase agreements, which person may or may not be the buyer'. Under the REIPPPP, the DoE is the procurer, but Eskom is the buyer of the electricity produced.

There are also obvious silos between key departments such as the DPE and the DoE. As recent discussions on the privatisation of Eskom have evidenced, it is clear that Treasury, Eskom and the DPE disagree over fundamental issues of electricity governance. In principle the aim of the War Room, as we discuss in the following section, is to tackle these silos (Creamer 14 May, 2015). However as one member of civil society explained ‘people are not working from the same databases and assumptions.... There is a lack of a clear coherent vision.’

Decision-making on climate change was identified as a particular sticking point. As one government member explained, ‘the DTI and the Economic Development Department do not have people who work on the environment. And the DEA doesn’t have contacts in the economy’. A lack of leadership within the DEA was also referred to. For these reasons explained a member of civil society, ‘DEA is not strong enough to stand up to business and they lack support from other departments such as the DoE’ and therefore ends up ‘pushing through things that are not politically and economically feasible’. However, it was also felt that the DEA often failed to ask members of the public and civil society to stakeholder events who in principle could be a part of their alliance against business.

5.2 Independent System Market Operator

The DoE in 2011 tabled the Independent System Market Operator Bill to Parliament. The bill, which followed an announcement from Zuma in 2010 that a transmission company (Transco) would be established, was later withdrawn from Parliament and was never re-tabled. In early 2015 the ANC’s Lekgotla scrapped the idea, though there are rumours that this was related to a factional dispute rather than an ideological commitment to retaining the current market structure (Paton 12 February, 2015). The bill represented a significant move towards limiting Eskom’s powers over the grid and transmission system. It proposed that these functions would remain state-owned, but would be separated from Eskom generation and distribution, with a view to providing non-discriminatory access to the grid for private generators as per the 1998 White Paper on Energy Policy.

Eskom opposed the bill, claiming that separating its transmission assets would alter its debt-raising abilities and that, given the supply side crisis facing the country, any large institutional changes could adversely affect electricity supply. Civil society and unions similarly opposed the bill because they viewed it as a further step towards privatisation of the electricity supply industry, to which they remain vehemently opposed (see Steyn 2013 for a review of comments submitted on the bill).

However, Eskom’s internal structure (and control of the grid, its role in planning and as buyer of electricity) has come with significant barriers to entry for new players. Not only is Eskom able to prioritise grid expenditure (or expenditure on its own generation capacity instead of grid infrastructure), but its financial crisis has limited the investments it is making in grid strengthening and expansion, which are necessary conditions for an increasingly decentralised grid. Even as IPPs undertake self-build of their grid connections, they are constrained by Eskom’s lack of funding for large-scale transmission investment.

5.3 The War Room

The War Room was set up by The Presidency in December 2014 to deal with South Africa’s electricity crisis and in the process ensure coordination between the Departments of Public Enterprises, Energy, National Treasury, Cooperative Governance and Traditional Affairs, Economic Development, Mineral Resources and Trade and Industry. Structurally the War Room falls under Cabinet’s Inter-Ministerial Committee on Energy, which is chaired by Deputy President Cyril Ramaphosa. He in turn is advised by a six-person panel comprising high-level academics, finance, and business.¹⁶ The War Room is co-chaired by Energy Minister Tina Joemat-Pettersson and Public Enterprises Minister Lynne Brown. Information about the War Room and how it makes decisions is, however, scarce. While in principle it is a government

¹⁶ Anton Eberhard, Dolly Mokgatle, Sy Gourah, Smunda Mokoena, Derick Elbrecht and Bobby Godsell (Creamer, 18 June 2015).

structure, and for this reason non-government members are not included, it does engage regularly with various stakeholders such as Business Unity South Africa (BUSA) and AMEU (Creamer 18 June, 2015b). That said it is understood that the renewable energy sector, in addition to unions and civil society have not been included in the discussion. Critic Saliem Fakir has described it as 'unimaginative in the way that it is dealing with the crisis', particularly for its failure to consider more decentralised energy solutions (Fakir, 2015).

5.4 IPP Unit

Given the DoE's lack of capacity to manage a renewable energy procurement programme, the IPP unit was set up with assistance from the National Treasury's Public-Private Partnership (PPP) unit as well as inputs from international and national technical advisors (Eberhard et al, 2014: 9). The IPP unit was originally set up with a small team of staff from the DoE and PPP unit which 'functioned effectively outside of the formal departmental structure of national government'. The unit has maintained credibility as a high quality, transparent and secure professional body and, according to Eberhard et al (2014: 9), 'did not start out with the level of mistrust of private business that sometimes characterises other government agencies in South Africa'.

Since it was established in 2011, core departmental responsibilities as regards privately generated power are increasingly falling under its remit. The office has now expanded to 70 staff, and is managing processes for all new privately generated technologies, including coal, gas, cogeneration and the potential import of hydro electricity from the Grand Inga Dam in DRC. Moreover there were suggestions by a few interviewees that the IPP unit and Eskom's Systems Operator could together form some variation of an independent systems and market operator or a new market structure. What this implies for the future institutional management of independent power and the design of the electricity supply industry more broadly is significant yet unclear.

There are also concerns as to how the unit does or does not relate to other government departments. Firstly, there are coalitions of interests forming around the IPP unit who do not consider themselves part of a climate change policy coalition, nor do they seem to have any role or interest in supporting the DEA. Secondly, there are suggestions that the IPP unit may be overstepping into the mandate of municipalities. This matter relates to broader concerns regarding the implementation of requirements for community ownership and economic development under REIPPPP and how the overlapping responsibilities of project developers and local government should be managed (Wlokas, 2015). As one member of the unit explained, 'the IPP office is seen as national government imposing on local government ... municipalities are saying that the private sector must not spend money on the integrated development plan as it makes them look bad'. This arguably points to the need for more coordination between the unit and local government.

5.5 Energy coalitions and transformative alliances

Outside of government, influential stakeholders in South Africa's electricity sector include the Chamber of Mines, the Energy Intensive User Group (EIUG), and BUSA. The former represents the interests of most major mining houses covering all commodities in South Africa and is the mining industry's chief umbrella organisation. The EIUG has a membership of 31 companies that includes the largest electricity consumers and the country's five main coal miners. Such companies have 'enormous collective bargaining power' (Nakhoda, 2011: 21). BUSA is the mandated body responsible for representing business to government, and has a focused energy and climate change convenor who co-ordinates BUSA's position on energy and climate change policy.

The influence of such entities is rarely public, however, as the apartheid era legacy of a 'culture of secrecy' continues to impact policy-making (Marquard, 2006). Unions also have leverage over issues of energy policy though are not always representative of organised labour. The formal avenue for labour, civil society and business to engage with the state is through the National Economic Development and Labour Council (NEDLAC), though its Energy Task

Team is now defunct. Much engagement therefore happens through bilateral or private meetings, state-driven processes, ad-hoc fora or through Parliamentary hearings.

A number of potentially transformative alliances have emerged in South Africa in recent years that may assist with the realisation of decarbonisation of the electricity sector. These include the South African Wind Energy Association (SAWEA); the South African Photovoltaic Industry Association (SAPVIA); the South African Solar Thermal and Electricity Association (SASTELA); and the South African Renewable Energy Council (SAREC). As a member of SAWEA explained, 'in terms of coalitions we have gone from SAWEA/SAPVIA/SASTELA to SAREC and also have links at the IPP level'. The extent to which such institutions may challenge vested interests in the coal-based, energy-intensive economy and current political and economic power structures is as yet uncertain. To date, their lobbying power and access to and influence over state entities does not match that of historic alliances in the minerals-energy complex, as exemplified by the EIUG and BUSA. This is likely a reflection of the fact that the industry is young and, in capital terms, much smaller than its carbon-heavy counterparts.

What is notable, however, is that recent developments have seen renewable energy coalitions entering into negotiations with EIUG and the South African Independent Power Producers' Association (SAIPPA) which largely represents the interests of independent coal. These tentative alliances appear in part to have been facilitated by the setting up of the War Room as discussed above, which, as a member of SAWEA explained 'has made it easier to get things over the line. It has put core decision-makers in one place.' Consequently 'we have become much closer to the EIUG. The moment that they came to our offices was symbolically a watershed moment. They have changed their thinking for sure. Not all of them but it's an on-going process.' In a further development, the renewable energy industry is also considering selling electricity direct to industry and has been in discussions with the EIUG over charges for wheeling electricity.

The ability of renewable energy coalitions to participate in the War Room has not, however, always been straightforward; rather, 'renewables get in the back door through the BUSA delegation' rather than having a seat in their own right. Informal avenues and relationships rather than institutional structures clearly play a fundamental role in terms of access to decision makers, particularly from the perspective of the renewable energy industry, as SAWEA explained: 'It does depend on who knows who and if a car runs someone over everything changes. If you get to one critical person you can change everything, but it would better if this could be institutionalised.'

Civil society meanwhile tends not to be interested in advocating for the business models based on electricity liberalisation espoused by the renewable energy industry. Similarly, while unions may be in favour of renewable energy in theory, they are sceptical about the way in which it is being implemented which they see as excessively motivated by profit (Cosatu, 2012). In addition, knowledge and drive which can be found among the rank and file union members has not necessarily filtered upwards into broader policy support or political salience within the alliance.

While there is an ideological spectrum across South African society, for instance those who focus on the poverty-related impacts of climate change (Oxfam) and those that take positions based on environmental justice (groundwork), all draw to some extent on economic arguments or arguments of justice, since in the South African political space this is so crucial to obtaining grassroots support or maintaining legitimacy. There are many active organisations in the energy/climate change policy space, some linked to international groups such as WWF, Oxfam and Greenpeace. There is a South African Climate Action Now network and civil society meet to build consensus on climate policy (e.g. on the INDCs and South Africa's negotiating position; this is coordinated by Project 90x2030). More left-wing groups that oppose coal (and often the MEC and capitalism more broadly), such as Earthlife Africa and groundWork (also the South African branch of Friends of the Earth), while supportive of renewable energy, are concerned for an environmental transition that is echoed in a more radical social transformation. Cosatu's climate change policy similarly uses the notion of an environmental justice and a just transition; union representatives are connected to labour and environmental academics at the

Society, Work and Development Institute at the University of the Witwatersrand and the unions work on certain issues with civil society groupings. Although ideologically diverse, civil society in general is often excluded from policy processes because of the bilateral and ad-hoc way in which the state engages with business interests. Civil society occupies a spectrum on the political space, and also to the degree to which they engage on the technical, rather than economic and political aspects of policy processes. But the climate change focus is often embedded in broader socio-political struggles and organisations are connected to left-wing academics and other groups working on gender, health, water and other issues. This may explain why a broader political alliance with the renewable energy industry has not developed.

Civil society is increasingly using the judiciary to oppose certain administrative decisions, working with organisations such as the Legal Resources Centre or the Centre for Environmental Rights to bring to the courts cases on air quality/coal plants and the nuclear procurement process.

6. Integrated Resource Plan

South Africa's Integrated Resource Plan for electricity, of which a second version was approved in May 2011, is a capacity expansion plan covering total demand requirements for electricity from 2010 to 2030. The IRP is meant to be a subset of the Integrated Energy Plan (IEP) required under the National Energy Act 2008 which is to cover all energy sources. However, while the IEP was to have been completed by 2012, it has yet to be approved by Cabinet. According to the Minister of Energy's May 2015 budget speech: 'Our government's urgent response to load shedding has accelerated the finalisation of the much awaited Integrated Energy Plan. Once approved by Cabinet, the Integrated Energy Plan will be published as a policy document. This Plan will inform our future energy mix and prioritize policy interventions for future programmes within the energy sector' (DoE, 2015).

As previously discussed in Section 5, there has been an ongoing struggle to establish capacity and powers of independent regulation in South Africa. After the 1998 White Paper, DME took responsibility for preparing National Integrated Resource Plans (NIRPs), although this was outsourced to the National Energy Regulator. NIRP1 and NIRP2 were published in 2001 and 2004 respectively, but NIRP3 was not completed and the impact of the NIRP processes seemed minimal. Eskom had its own internal Integrated Strategic Electricity Planning process, which appeared to prevail, and resisted the idea of making this planning information public on the grounds of commercial confidentiality.

The Electricity Regulation Act (Act 4 of 2006) established the necessary powers for the DoE to conduct an open IRP process. This process would contain a generation capacity expansion plan under which technologies would be legally determined and for which Nersa would grant licences. IRP is, therefore, a significant landmark in South Africa's energy planning and therefore any potential transition to decarbonisation. According to one energy analyst, 'it represents a move from back-room decision making with minimal transparency into open planning processes with stakeholder engagement'. Even so, by 2009 transparent planning had not been established and the first IRP, IRP1, was published without consultation and unannounced on 31 December 2009 in the middle of the holiday season with a month to comment. It was just three pages long and covered the period 2010 to 2013.

Following IRP 1, the 'policy-adjusted IRP', or IRP 2010 to cover the period 2010–2030 was promulgated in March 2011 (DoE, 2011). This followed a prolonged and intense stakeholder engagement process throughout 2010, with the plan's initial 'gazetting date' of September 2010 extended into 2011. IRP 2010 includes a cap on CO₂ emissions and plans to include some 17 GW of renewable energy that will deliver 9% of supply by 2030, largely from wind, solar PV and CSP. The plan claimed to be consistent with an emission constraint of 275 million tonnes of carbon dioxide annually after 2024 (DoE, 2011: 6). Despite this, coal is still set to dominate the overall generation mix (DoE, 2013). A project must align with the technological allocations set by the IRP in order for the Regulator to be able to grant it a licence (Pienaar & Nakhooda, 2010). However, according to the latest new generation regulations for electricity, the Minister

of Energy holds the right to approve further technological determinations if s/he deems fit. This has been used subsequently to add capacity for procurement by the IPP unit

The negotiation of IRP 2010 took place throughout 2010 and early 2011 as part of a stakeholder engagement process that included representatives of the coal, renewable, and nuclear industries; the country's energy-intensive users; financial stakeholders; civil society and academics. Other government departments were also involved, with the DEA playing an important role in mitigation in the IRP through promoting renewable energy. According to a bilateral donor (in Baker, 2012: 102) 'the DEA has taken the lead on a lot of projects. [In 2010] one of their members pushed heavily for the renewables component in the IRP.'

In light of the DoE's lack of capacity, the IRP was put together by Eskom's Systems Operator with inputs from a technical task team that consisted largely of members of government, Eskom, coal companies and energy-intensive users (Baker et al, 2014). Government was heavily criticised on a number of counts, including: the rushed nature of the plan's negotiation process; the lack of transparency of critical assumptions; problems with the plan's methodology and input parameters; costs; the continued dominance of coal; and the potential impacts of the plan on the poor. Despite this, many stakeholders considered it a significant advance on previous electricity planning processes (Hughes, 2010; Mainstream Renewable Power, 2010). Nakhooa (2011) argued 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 set an important precedent. One energy analyst added that 'it was the first time in South African history that a plan was formulated in a public negotiation process that was extended in response to intense engagement, even though it is probably still biased towards supply-side planning and legacy technology'.

In 2013 a revised IRP was put out for public comment in keeping with the expectation that the IRP be updated on a biennial basis (DoE, 2011: 7). However, it is yet to be approved by Cabinet and approval is looking less and less likely. Many commentators assume this is because it challenges the necessity of the proposed 9.6 GW nuclear fleet in light of lower demand projections and relative costs of technologies. Instead, the update proposes a downward adjustment in the demand forecast by 6600 MW in light of the drop in economic growth since the promulgation of IRP 2010, reductions in energy intensity, Eskom buy-backs (i.e payments to large users to cease production), enhanced energy efficiency and some suppressed demand. It proposes to reduce allocations for new coal (from 6250 MW to 2450 MW) and wind (from 9200 MW to 4360 MW) and increase contributions from solar PV (from 8400 MW to 9770 MW) and CSP (from 1200 to 3000 MW). It also discusses the potential for an increased role for gas, including resources from the region and shale gas. It also states that 'the revised demand projections suggest that no new nuclear baseload capacity is required until after 2025 (and for lower demand not until at earliest 2035)' (DoE, 2013: 8). The draft also states that rather than the 'fixed capacity plan' espoused by the IRP 2010, 'flexibility in decisions should be the priority to favour decisions of least regret' and therefore 'commitments to long range large-scale investment decisions should be avoided' (DoE, 2013: 9). Many of the findings of the IRP's 2013 revision, particularly with regards to the anticipated demand growth and assumptions over the need for nuclear energy, are in keeping with a study commissioned by the National Planning Commission, which states that many of the IRP 2010's assumptions are out of date and no longer valid (ERC, 2013: 3).

Reactions to the plan were mixed. According to the wind industry, the IRP draft was based on 'old and false assumptions' which did not reflect REIPPPP price decreases, especially assumptions on technology costs. Despite such criticisms levelled at the IRP draft, others argue that the main reason that it is unlikely to be approved is due to its lack of transparency, which undermines the legitimacy of politically driven nuclear procurement. 'The whole approach of putting in decision points in the revised IRP is sensible but too transparent for our government. It removes the arbitrage available to our DoE officials', said one member of civil society. An industry member stated: 'The presidential ambitions for nuclear power didn't match the official policies. If they publish those policies then there is a strong case that the procurement of nuclear power will be illegal. So you kill the policy.' Probably for this reason, the status of this revised draft is highly uncertain. One person interviewed suggested that the country has since reverted

back to the original document with another predicted for 2015. As one Eskom employee stated, 'no one seems to recognise the 2013 version'. It is anticipated that a new version of the IRP will be published by March 2016 and will contain a higher allocation for nuclear energy than the 9.6 GW thus far included (Paton 02 September, 2015).

As a planning process for electricity, IRP is significant. However, since the initial relative success of the IRP 2010-2030, its enabling impact on the REIPPPP and potential moves to decarbonisation recent events indicate a return to less open planning processes, as we discuss below. Recent developments in the IRP appear to provide evidence of a closing down of open-consultative planning.

In terms of climate change mitigation, the update retained the carbon trajectory of the original IRP policy-adjusted scenario of 275 Mt to 2030. While the inclusion of any carbon constraint in the IRP 2010 was profound, given the history of electricity planning in South Africa, a longer-term trajectory (as in the update) needs to be formally adopted in line with South Africa's domestic policy and international commitments on climate change mitigation.

The IRP 2010 assumed the electricity sector would account for 50% of national emissions to 2030, an assumption for which it was later criticised (electricity sector emission accounted for 45% of total emissions in 2010) (DEA, 2014). In the policy-adjusted scenario, emissions peak at 304 Mt CO₂-eq and then decline to 275 Mt, roughly in line with the upper end of South Africa's 'peak, plateau and decline' trajectory, which had not yet been formalised in policy when the IRP was released. Since significant coal-fired capacity will be retired in the 2030s, the mitigation and supply options after this date are important. Decarbonisation will require significantly scaling up of low-carbon options. The IRP update therefore provides a longer run view on the technology shift required for mitigation in the electricity sector. Total emissions in 2010 were 518 Mt CO₂-eq. Of this, energy emissions accounted for 428 Mt, and the electricity sector for 62.5% of energy emissions, or 237 Mt CO₂-eq. The IRP therefore assumes an absolute growth in emissions until at least 2030. This echoes South Africa's national policy which is a reduction against a business as usual trajectory until 2035, when emissions start to decline in absolute terms.

Beyond 2030, three options were explored in the IRP update (Figure 5): retaining the constant emissions trajectory of 275 Mt; a moderate decline scenario where emissions decline from 2037 onwards to 210Mt CO₂-eq in 2050; an advanced decline scenario where emissions decline from 275 Mt in 2030 and reach 140Mt in 2050. Assuming electricity maintains a 45% share of national emissions, the moderate decline is slightly above the DEA's PPD upper range, while the advanced decline trajectory is somewhat higher than the 95 Mtpa allocated to the electricity sector for the lower PPD. That is, both trajectories allocate the electricity sector more than 45% of national emissions in 2050 – or assume the rest of the economy contributes more to mitigation so as to meet national benchmark range for emissions.

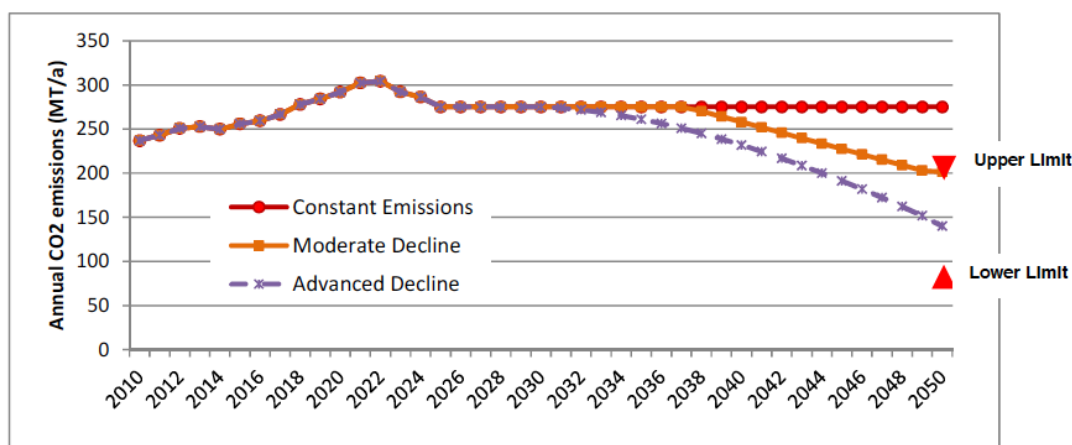


Figure 5: Comparison of emissions trajectories for the electricity sector for IRP 2010 update (DoE, 2013: 27)

If a carbon budget approach is used, the IRP update found that mitigation would be pushed further into the future, with a more severe decline in the 2040s. Again, however, the assumption is that the electricity sector's proportional allocation of the remaining carbon space is static, while Altieri et al (2015) found that decarbonising the electricity sector is an important supply-side option to reduce emissions and meet a carbon constraint for the energy sector as a whole. The IRP is limited in its analysis because it cannot capture inter-sectoral costs and benefits or substitutions between different carriers. This is the remit of the Integrated Energy Plan which has not yet been released, despite a legal requirement under the 2008 Energy Act for it to be updated annually.

Given the importance of the electricity sector to absolute emissions, there are also inconsistencies between other aspects of climate policy and a regulated procurement process and tariff in the electricity sector (Tyler & Cloete, 2014). Electricity users are locked in to electricity related emissions that are set through the DoE's allocation of new build based on the IRP. The IRP carbon constraint is therefore key to decarbonisation, yet the IRP assumes a certain share of carbon space.

While the IRP 2010 process was an improvement on previous electricity planning processes that took place inside of Eskom and without any public participation, aspects of the legislative and regulatory regime that remain highly concentrated in ministerial discretion, relatively closed off to the public, and continue the apartheid-era secrecy in the energy sector still remain. The IRP remains key to decarbonisation in South Africa, yet none of its scenarios examine the implications of fully decarbonising the sector. Without an Integrated Energy Plan, the relative costs of decarbonising the energy sector cannot be compared, and electricity infrastructure is being procured on the basis of an assumed share of carbon space for the electricity sector.

7. Renewable energy independent power producers' procurement programme

The Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) was launched in 2011 having been initiated as a renewable energy feed-in tariff (REFIT) in 2007 by individuals within Nersa's electricity regulatory division with the support of inter-alia, bilateral donors, renewable energy companies, banks and investors. The prolonged consultation process was subject to delays and disagreements over issues that included how risk should be allocated between government and developers, how the tariff levels should be set, and who the buyer of power would be in light of uncertainty over the ISMO bill, discussed in Section 5.2 (Baker 2012). The consultation process to establish what at the time was still REFIT was also accompanied by mistrust of renewable energy within some factions of government and industry. Despite this and the on-going uncertainty over the policy and regulatory framework, by late

2010 the process had attracted significant attention from international investors and technology suppliers. Subsequently in May 2011, the DoE made changes to the 2009 Electricity Regulations on New Generation Capacity (see Section 5.1) which effectively transferred powers over the procurement process away from Nersa to the DoE and National Treasury. This move also facilitated the shift from a feed-in tariff to a competitive bidding system under RE IPPPP and followed a declaration by Treasury that REFIT was in violation of national procurement legislation. RE IPPPP was eventually launched in August 2011 and managed and implemented by the IPP unit as discussed in Section 5.4.

In addition to the establishment of a national regulatory framework, a further reason for the success of RE IPPPP was due to intense interest from international renewable energy developers and technology suppliers who, following the global financial crisis in 2008 which had reduced opportunities in Europe and US, were seeking new markets. RE IPPPP has generated significant momentum since its launch in 2011 and has been celebrated nationally and internationally for its open and transparent bidding processes, low tariffs and for the successful procurement of privately generated power after several decades of thwarted attempts. The nature of its development, and some of the stakeholders involved has been well documented by a number of authors (Eberhard et al, 2014; Baker and Wlokas, 2015; Pegels, 2011).

At the time of writing, RE IPPPP has resulted in the approval of just over 6327 MW GW of utility-scale renewable energy under four bidding rounds. Of this, 53% is for wind, 36% for solar PV and 10% for CSP. A total of 92 projects have been approved, for which a combined investment value of R192-billion (approximately \$14 billion) has been committed. Forty two projects totalling 2142 MW were connected to the grid by October 2015. Successful projects sell to Eskom's grid under a 20-year, local currency-denominated, government-backed power purchase agreement (PPA).

At its launch in August 2011, REIPPPP had an initial allocation of 3725 MW to be allocated under five bidding rounds. An additional 3200 MW of capacity was later declared by the Minister of Energy in December 2012. On 18 August 2015 a new ministerial determination allowed for the procurement of a further 6300 MW. This announcement has been welcomed by prospective bidders and investors for providing greater certainty to the industry. A submission date for an 'expedited' round to absorb 1800 MW of projects that failed marginally in previous windows was set for 1 October 2015 and then postponed until November 2015. This 1800 MW is included in the additional 6300 MW announced in August. Beyond this, it is anticipated that a new tender framework for round five and beyond will then be introduced.

The programme has further been celebrated for the savings it has created for the South African economy. According to the Council for Scientific and Industrial Research (CSIR, 2015), solar and wind projects collectively generated a R8.3 billion benefit in the first six months of 2015. This is firstly through savings in diesel and coal fuel costs, to a total of R3.6 billion replaced by solar and wind energy, and secondly through savings to the economy by avoiding load shedding or 'unserved energy'. This has been calculated through a methodology developed by the CSIR's energy centre which determines whether, at any given hour of the year, renewables have replaced coal or diesel generators, or whether they have even prevented 'unserved energy' (Steyn, 2015).

REIPPPP has also been praised for its progressive requirements for community ownership and economic development. Specifically, under REIPPPP projects bid are assessed 70% on price below a certain tariff, which decreases with each round (see Table 3) and 30% on economic development criteria which include factors such as job creation, participation of historically disadvantaged individuals, protection of local content, rural development, community ownership, and skills development (Baker & Wlokas, 2015). A project's tariff submission will be invalid without also meeting the economic development criteria and so successful bids are the ones that meet these criteria at the lowest tariff. However, tensions have been identified between REIPPPP's potentially transformative requirements for economic development and community ownership on the one hand, and commercial priorities for 'bankability', the minimisation of risk and short-term, profit-driven interests on the other. Whether these tensions can be successfully managed will determine the long-term success of the industry and the extent

to which it will result in sustainable social, economic and environmental benefits beyond the generation of renewable electricity (Baker, 2015; Wlokas, 2015).

As previously discussed, even with additional requirements which add costs for the developer, the dramatic decrease in the tariffs bid by project developers under REIPPPP are now cost-competitive, if not lower than new build coal under Eskom. This has provided strong arguments in favour of an increased renewable energy allocation and is an important consideration for the decarbonisation of South Africa's electricity sector. On the flip side however, these low tariffs have also been identified as a risk to the project's 'bankability'. Notably, there are questions as to how sustainable these tariffs are, given that projects are now operating on very tight contingencies. As one member of the finance industry explained, 'no one wants projects that can't close, can't be built and can't produce'.

A further concern relates to the high transaction and financial costs involved in bid preparation and the significant though undetermined amounts that will have been lost in making successful projects 'bid ready'. These amounts have been compounded by the six-month delay in the announcement of the successful winners of round four, largely due to issues of grid connection as discussed in Section 7.2. While this is a risk that is carried by the private sector rather than Eskom, inevitably these costs will be structured into any successful project.

7.1 A new industry

The renewable energy industry under development in South Africa involves globalised networks of developers; engineering, procurement and construction (EPC) companies; technology suppliers; and flows of national and international investment. Limited companies or special purpose vehicles (SPVs) are set up with the sole purpose of developing, operating and owning the actual project. As part of REIPPPP's ownership criteria these companies must have a minimum of: 40% South African shareholding, 12% BEE shareholding with a target of 20%; and 2.5% community ownership within a 50 km radius of the project. As previously documented (Baker and Wlokas, 2015), despite these criteria for national ownership and local content, a key concern is that the growing industry has rapidly fallen under the domain of international companies who dominate at the level of project development; engineering, construction and procurement; and technology supply. This has led to concerns that opportunities for small and medium enterprises to involve themselves in the renewable energy industry and supply chain is limited. The predominance of foreign ownership has further led to concerns that financial returns are more likely to leave the country rather than being invested nationally.

Players that dominate as lead developers within the project company include Ireland's Mainstream Renewable Power and China Longyuan Power in the wind industry; Italy's Enel Green Power in both solar PV and wind; Sun Edison (US) and Scatec Solar (Norway) in solar PV; and Spain's Abengoa in Solar PV. The structure of project ownership is complex and hard to track, more so because international shareholdings are likely to change hands following the rule that equity can be sold after three years of project operation. BEE and community shareholders meanwhile will struggle to on-sell given that projects must maintain a minimum BEE shareholding of 12% and a minimum community shareholding of 2.5% in order to meet the economic development requirements of REIPPPP, or risk losing its licence (Baker, 2015).

The range of companies carrying out the EPC contracts for wind energy projects is also dominated by global leaders. In the case of wind the EPC contractor is often the same company as the original equipment manufacturer (OEM) who supplies technology to the projects and in many cases holds the contract for operation and maintenance. This illustrates the vertically integrated nature of the global wind technology industry and its supply chain. Such companies hold the warranties required by debt financiers and equity investors who seek guarantees and international experience in order to reduce risk under the norms of project finance (Baker, 2015). While European companies, namely Nordex, Siemens and Vestas, still dominate, a significant minority of emerging market companies have become involved. These include India's Suzlon and China's Sinovel in round one of REIPPPP and China's Guodian United Power in round three (Baker and Wlokas, 2015). In round four, Chinese Goldwind is

undertaking the EPC for two projects being developed by South African company Biotherm Energy.

The EPC for solar PV is dominated by European companies such as Enertronica, ABB and Juwi. Unlike the wind industry, the EPC for solar PV is less often involved in technology supply given the more dispersed nature of the supply chain and the components involved e.g panels, frames, inverters, transformers, tracking system, cable trays, cells, glass. However, Chinese companies play a significant role technology supply, reflecting their role as the world's largest manufacturers of solar PV technology since 2008, having overtaken Germany which was the original market leader (Dunford et al, 2013:30). There is greater potential for innovation in solar PV than wind, given that the latter is more mature as a technology and therefore harder to break into (Rennkamp and Boyd 2013:12). There is less information in the public domain relating to CSP, however Spain's Abengoa and Saudi Arabia's ACWA Power are lead players.

7.2 Financing renewables

The majority of REIPPPP projects have been project-financed. Project finance is a mechanism for long-term, capital-intensive financing for privately generated energy projects (Yescombe 2013), as compared to the financing of a state-owned utility using public sector debt as has been the case with Eskom. In renewable energy, project financing is generally structured on the basis of a 70:30 debt to equity ratio of the capital cost of the project (Mendonça et al, 2010:24) though in South Africa's case this is sometimes up to 80:20. The higher debt levels, the lower the average cost of funding of the project will be. Debt providers, or lenders provide finance-based debt on fixed-loan terms and will not take liability for any potential project losses. Therefore the key priority of lenders is to minimise risk before agreeing to lend, as for instance has been witnessed through a requirement for internationally experienced contractors and technological guarantees (Baker & Wlokas, 2015). In rounds one and two, the majority providers of debt financing were South Africa's four biggest commercial banks, Standard Bank, Nedbank, ABSA Capital and First Rand Bank, as well as financial services group Investec, providing a total of R57 billion (Eberhard et al, 2014:1). Lenders are in first receipt of the financial revenues generated by the project which means that returns for equity investors or project sponsors are more dependent on the project's successful generation of a return (Eberhard et al, 2014:13). Equity investors carry the greatest risk for which they expect to generate a higher return (Baker 2015).

Other lenders include development finance institutions such as the World Bank's International Finance Corporation and International Bank for Reconstruction and Development, and the European Investment Bank who have provided debt to a small number of projects, usually to 'unproven' technology, i.e. CSP, and always in partnership with other lenders; export credit agencies; insurance funds and in some cases, the project developer. Rounds three and four saw a shift to some projects being financed off balance sheet which has reduced the role for some of South Africa's banks and their influence over the nature of the project.

As discussed in Section 3, South Africa's Industrial Development Corporation (IDC) has also played a major role in RE IPPPP project finance in the capacity of a debt financier, an equity investor and in providing finance to BEE companies and community trusts so that they can pay for their share of equity. Of the R13.2 billion the IDC provided in rounds one to three, R2.7-billion of this was for community participation (IDC, 2014). The Development Bank of South Africa (DBSA) has also played a similar though lesser role.

Table 3: REIPPPP prices by technology and bid round, (per kWh; April 2011 rand)

(CSIR, 2015; DoE, 2015c)

Tariffs	Round 1 bid cap	Round 1 average bid	Round 2 average bid	Round 3 average bid	Round 4 average bid
Wind	R1.15	R 1.36	R 1.07	R 0.78	R0.62
Solar PV	R2.85	R 3.29	R 1.97	R 1.05	R0.79
CSP	R2.85	R 2.69	R 2.51	R 1.46	

7.3 Renewable energy innovation

While REIPPPP has been deemed an unprecedented success in terms of investment and the rapid construction of renewable energy, questions have been raised over the long-term impact of its economic development criteria, including local content. Such criteria relate to government commitments to the green economy and a labour-intensive industrialisation path.

Local content thresholds and targets under REIPPPP have increased with each bidding round, for which reason a number of manufacturing and assembly plants for low technology components, including towers for wind and solar PV modules and inverters, have been set up or are under development. However, it has been argued that the limited market size created by REIPPPP will be inadequate to generate local production and that the technological upgrade and job creation impacts have remained at the lower- and medium-technology levels (Rennkamp & Westin, 2013). This echoes Bell and Albu's (1999) assertion that local content requirements alone are more likely to benefit short-term activities in construction rather than a long-term local manufacturing industry with high levels of domestic ownership and 'technological capabilities'.

Given that South Africa does not have a well-established industry for the manufacture of renewable energy equipment (Ahlfeldt, 2013:xiv), or indeed manufacturing more generally (Bhorat et al, 2014), in global terms it is behind the curve. The wind and solar PV industries involve trajectories of increasingly complex technology and are more knowledge- than labour-intensive (Olsen, 2012:138). They also require semi- to highly-qualified skills rather than blue collar/artisan level, and often internationally mobile labour. These factors will evidently challenge the extent to which the South African government will be able to set up a local manufacturing industry and develop innovative capabilities, despite its commitments to localisation and the green economy.

National commitments to the green economy are important to South Africa's policy context and are included in various national plans and documents on growth and industrial policy. Significantly, the Green Economy Accord, published by the Department for Economic Development and one of the six priorities of the New Growth Path was signed in November 2011 in time for the UNFCCC Conference of the Parties in Durban by representatives of government, business, organised labour and a small number of 'community constituents'. The Accord has a target of 300 000 new jobs through green investments by 2020, of which 50 000 in the renewable energy sector (EDD, 2011:19), though it is unknown how these figures were calculated (Musango et al, 2014:11). Secondly, the 2013–2016 Industrial Policy Action Plan (IPAP 2) proposes to revise REIPPPP's local content requirements in order to achieve an 'increased local content threshold for renewable energy projects in line with the development of a competitive local renewable energy manufacturing industry' (DTI, 2013:122). The National Development Plan also highlights the need to development the renewable energy sector (National Planning Commission, 2013). A number of educational initiatives have also been set up for the creation of 'green technical skills', including at various technical colleges across the country as well as the establishment of the South African Renewable Energy Technology Centre in the Western Cape.

Studies on localisation of the wind (DTI, 2015), solar PV (Ahlfeldt, 2013) and CSP industries (SASTELA, 2013) have been carried out by various different departments and/or donors and the private sector. Incentives have also been set up or amended to attract investment and manufacturing to South Africa. For example the Special Economic Zone (SEZ) Act was approved in May 2014 in order to strengthen the current Industrial Development Zone (IDZ) Act. SEZs are geographically designated areas set aside for specifically targeted economic activities identified by the IPAP. Under the act, manufacturing facilities will qualify for various financial and other incentives including a reduced corporation tax rate. Of the ten SEZs now being set up in South Africa, the Atlantis IDZ in the Western Cape has been designated for green technology and currently houses a wind tower facility run by GRI industries; the Coega IDZ houses DCD wind towers; and the East London IDZ is home to the solar PV manufacturing facility ILB Helios. The aim of an SEZ is to keep as much of the value chain process in one place by, for instance, supporting a larger manufacturer that would then allow small, medium and micro enterprises and smaller suppliers to input into the value chain e.g through logistics,

transport, nuts and bolts, wiring and supply of personal protective equipment. Ideally this will create economies of scale in various different industries in order to be able to compete with the scale of manufacturing from Asia, particularly China (Baker, *forthcoming*).

7.4 Connecting renewable energy

As discussed in Section 10, the viability of depending on Eskom's transmission grid to incorporate intermittent and/or variable sources¹⁷ of generation is becoming a challenge and potentially a risk to the future success of renewable energy projects. Not only was the challenge of grid integration a key factor in delays to the announcement of winning projects bid under round four but also to the realisation of the financial close of round three. This is likely to affect projects in future rounds as well. As one member of the renewable energy industry stated, 'the grid is becoming an issue – not a death knell but an issue'. While IPPs pay for the connection of their projects, there is a requirement that Eskom strengthen the transmission network and upgrade substations to connect projects accordingly. However, Eskom has stated that capital of R162 billion to 2024 is required (Eskom, 2015c). In certain areas where proposed sites are located, grid access is becoming scarcer. It is anticipated by industry that solar PV and wind will start to compete for access to the same line but if the transmission capacity is not available then the ability to incorporate further renewable generation sources will plateau. With this in mind, members of the finance industry are starting to see the issue as an investment risk, and have suggested that it is more financially viable to force the market to bid in regions where connections are still available, given the additional costs and time involved in constructing transmission and distribution infrastructure. This is supported by Eskom grid planners, who argue that project bids should have some spatial component so that successful bidders are located in areas with excess substation and grid capacity (Eskom, 2015c, see Section 10).

A further challenge relates to the 'budget notes' that project developers require from Eskom if they are to reach financial close, in a move which saw Eskom effectively holding Nersa and the renewable energy procurement process hostage. This budget note outlines the costs of connecting each project to the grid and is determined by the amount of engineering planning that needs to be carried out, depending on the complexities of the project. Eskom has a regulatory requirement to produce these notes within six months. However, Eskom requested an exemption to providing these notes on the basis that no capital allocation had been allocated for Eskom to pay for the electricity from IPPs beyond bid window three under the current multi-year pricing regime (MYPD3) which runs until 2018 (Slabbert, 2015). The lack of a budget note would effectively prevent new projects from becoming commercially operational and connecting to the grid in that they cannot reach financial close without it. In addition to investor 'risk' discussed above, this and poses a real threat to the construction of renewable energy going forward. It also highlights the pressures placed on Eskom by institutional mismatches, in this case between Nersa's tariff-setting processes, DoE procurement, and Eskom's role as buyer and transmitter of electricity.

¹⁷ Renewable energy is considered 'variable' or 'intermittent' because the output from a wind farm varies considerably over time, being determined by numerous factors including seasonal variations and site-specific factors (Rycroft, 2011; Sinden, 2008). 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, but significant increases in reserve generation and/or storage only come into play at energy proportions of non-dispatchable wind and PV power of above 10% (Trollip & Marquard, 2014) 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 (Jacobson & Delucchi, 2011:1172). However, the mainstream roll out of these possibilities is some way off even in countries with high levels of grid penetration.

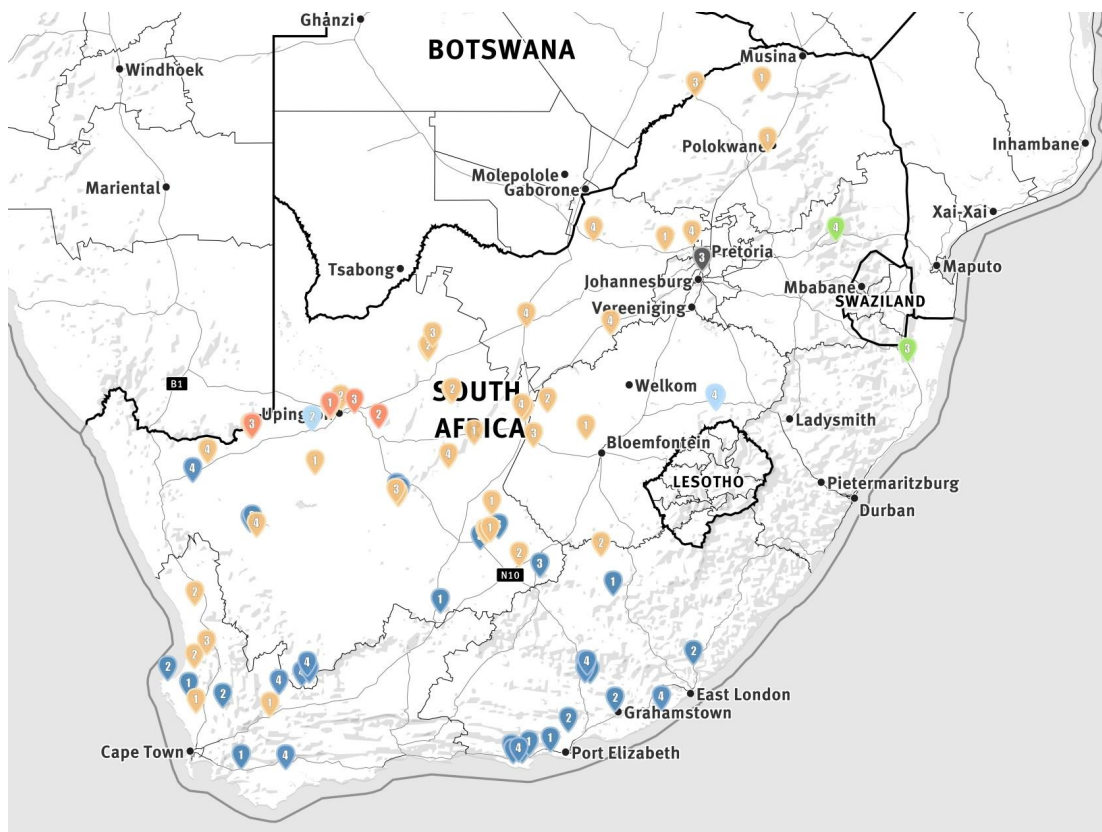


Figure 6: Map of REIPPPP projects rounds 1–4
(Forster, 2015; www.energy.org.za)

8. Embedded generation and rooftop solar PV

While the country's renewable energy developments are mainly dominated by REIPPPP, more recently a rooftop solar PV programme has been emerging, particularly as a response by wealthy consumers and businesses to repeated load shedding. Consequently, in February 2015 the energy regulator released a consultation paper for small-scale commercial and residential embedded generation will allow small-scale solar PV generators to supply electricity to the grid. A public consultation was held in April 2015 and it is understood that the regulatory framework was meant to be completed by September 2015. The consultation document covered grid connection standards, inverter regulations, codes of practice on small-scale embedded generators and tariff design (Nersa 2015). Optimistically, it is estimated that rooftop PV will reach grid parity in three to four years. The latest draft of the IRP released in 2013 estimates that embedded residential and commercial PV has the potential to provide as much as 22.5 GW by 2030 (DoE, 2013). The creation of a regulatory framework is long overdue given that in its absence, many illegal connections of grid-tied rooftop solar PV of between 100 KW and 1 MW have already been made. Municipalities and those who have installed grid-tied rooftop solar PV units have been 'making up their own rules', for which reason industry is asking for this to be formalised. As one member of the industry stated in May 2015 'government is playing catch up on embedded generation'. The South African Solar Photovoltaics Industry Association estimates that 31 MWs peak have been installed and it is estimated that only 20% of installations less than 10 KW have been reported.

Unlike coal-fired power or nuclear, solar PV embedded generation units can be installed very quickly and some of the electricity generated is consumed on site. One example of this is Black River Park in Cape Town which has a generating capacity of 1.2 MW. This is the first project to legally transmit electricity back into the City of Cape Town's electrical distribution network. However, in the past there has been resistance to demand-side management by many municipalities who use the revenue they gain from selling electricity for other expenditures such as healthcare and education.

The development of small-scale roof-top solar PV has accelerated in recent months as a solution that permits mid-to-high-income domestic and industrial customers to 'opt out' of relying on a faltering grid and soaring electricity tariffs. The implications of this, however, are that low-income consumers, unable to afford their own alternatives, may be left behind and forced to depend on an increasingly unreliable and expensive coal-fired electricity grid.

9. Emerging non-renewable independent power producers

The way in which REIPPPP has been and continues to be implemented clearly has implications for independent power from other sources including coal, cogeneration and gas. Having discussed REIPPPP in Section 7, we now discuss other upcoming programmes for privately produced power. A baseload IPP procurement programme (BLIPPPP) was announced via ministerial determination in 2012,¹⁸ covering gas (2652 MW), coal (2500 MW), and imported hydro (2609 MW) (RSA, 2012). The determination was amended in August 2015 to increase the capacity allocated to gas to 3126 MW (ie the CCGT and OCGT capacity in the IRP up to 2025) (RSA, 2015a). The IPP Office has also issued a request for bids for a cogeneration programme of 800 MW.

9.1 Coal

A request for proposals in relation to 2.5GW of new coal fired generation was released in December 2014. The bid submission was initially scheduled for June 2015 but has since been extended to November 2015. The first round was to have comprised 1.6GW of new coal-fired IPP projects of which 1GW in South Africa and 600 MW in cross-border projects. However, the IPP unit later indicated that the 600 MW in cross-border capacity would not be contracted during the first round (Creamer 17 September, 2015). Projects under this process will be 600 MW or smaller and will need to submit bids below a tariff cap of 82c/kWh. Provision has been made in the design documents for IPPs to pay the proposed carbon tax (see Section 14). It is expected that the preferred bidders will be announced in January 2016 with financial close anticipated for mid-2016 (Creamer 17 September, 2015).

The reason for the extension of the bid submission apparently took place following requests for extension from potential bidders. The extension was justified on the basis of the greater complexity and size of the coal projects as compared to renewable energy projects under the REIPPPP. This complexity includes the need for projects to secure supplies of coal and water and obtain environmental authorisation. Requirements for local ownership are also greater than those stipulated under REIPPPP; South Africans must own 51% of the project companies, of which 30% must be owned by black economic empowerment shareholders. This is in comparison to a minimum target of 40% local ownership and a minimum of 12% for black ownership under REIPPPP. Projects can be either pulverised fuel or fluidised bed plants, though it appears that most potential projects will be fluidised bed technology.

As in the REIPPPP, there are contractual arrangements for how the electricity generated by IPPs will be used by the system operator. In the case of renewable energy, all the electricity generated is taken and is paid for. For the BLIPPPP, this has been set at a certain level. This raises the potential, once the grid has returned to a better supply and demand situation, of the dispatch of newer, potentially more expensive baseload power taking precedence over older, typically cheaper, Eskom generating capacity. While this is not an issue given current supply constraints, market design or policy will need to evolve to deal with dispatch issues in the future. It requires close coordination between the System Operator and the IPP Unit to balance the risks for private players versus the system-wide efficiencies of the grid.

Based on publicly available information at the time of writing, Table 4 gives details of companies that have applied for, or obtained, environmental authorisation for coal-fired power

¹⁸ Under the Electricity Regulation Act (2006) and the New Generation Regulations, the Minister of Energy must 'determine' (ie allocate) new build capacity to be built and by whom, in consultation with Nersa.

stations. Given the challenges of transparency and the early stages of the process, information is limited. However, it is significant to note that at least two of the lead owners include players also involved in South Africa's REIPPPP: ACWA power and Engie, formerly GDF Suez (see Baker, 2015), although Engie has announced a moratorium on new coal ventures in the run up to COP 21 and exited the proposed Thabametsi project. Marubeni Corporation, which has since partnered with Exxaro on the project, is also indirectly involved in the REIPPPP through its holdings in Mainstream Renewable Power.

For some of the proposed projects, the rationale for the coal plant is to support new mining ventures or utilise discard coal or product that would be otherwise unsaleable (for example, Thabametsi and Umbani). In other cases, the development is also intended to provide energy security for large energy-intensive users or for other mining operations (for example, Sibanye Gold and the Waterberg station). Khanyisa was initially developed by Anglo American for this reason; to provide security of supply for Anglo Platinum whilst utilising Anglo Coal's discards. This latter rationale is justified because the RFP allows for either single-buyer or multi-buyer contracts, i.e. projects where Eskom is the sole buyer or where Eskom buys only a portion of the plant's output.

Table 4: Potential coal IPPS (compiled from EIR and EIA reports)

<i>Project</i>	<i>Location</i>	<i>Technology</i>	<i>Ownership</i>	<i>Environmental authorisation</i>	<i>Proposed coal supply (if available)</i>
Khanyisa	Emalahleni	3x150MW circulating fluidised bed	ACWA Power Africa Holdings	Granted	Discard
KiPower	Delmas	4x150MW circulating fluidised bed	Kuyasa Mining through subsidiary Kipower Pty Ltd	Granted	Kuyasa Mining Delmas Colliery, via conveyor
Umbani	Emalahleni	3x 300MW circulating fluidised bed	ISS global mining (Pty) Ltd		Discard coal from Exxaro's (formerly Total Coal South Africa) Dorstfontein East mine via conveyor
Boikarabelo	Waterberg	260MW	Resgen	Granted	Resgen Boikarabelo Mine
Thabametsi	Waterberg	2x600MW	Formerly Engie with Exxaro, now Marubeni Corporation	Granted	Exxaro's prospective Thabametsi mine, via conveyor
Waterberg	Lephalale	600MW	Waterberg Power Company (subsidiary of Waterberg Coal company)		Waterberg Coal Group mine (Firestone Energy /Sekoko Resources)
Colenso	KZN	1050MW	Colenso Power (Pty) Ltd		Proposed greenfield Colenso project

Although bid submission has not yet been reached and preferred bidder status has not been announced, the Eskom Transmission Development Plan (TDP) 2015–2024 already includes four coal IPP connections, split evenly between Lephalale and Emalahleni. Eskom transmission planning has assumed that the following connections will take place: a 600MW Coal IPP 1 (Khanyisa) will be connected in 2019; a 750MW Coal IPP 2 (Exxaro project) will be connected

in 2022; a 400MW coal IPP 3 in Witbank 2020 and a 4x250MW Coal IPP 4 in Lephalale from 2022-2024 (Eskom, 2015c).

This programme not only represents a move away from Eskom by facilitating quicker, more dynamic, and less costly sources of coal-fired power, but also represents the first time Eskom is facing real competition for its core business – provision of larger-scale dispatchable power. The multi-buyer contracts also allow for companies to subvert their reliance on Eskom, which retains control of the grid but not necessarily of supply to its key industrial customers.

From a decarbonisation perspective, the programme will replace retiring Eskom coal-fired plants with IPP coal-fired plants and is thus perpetuating the country's dependence on coal for electricity. As discussed above, the carbon constraint in the IRP is set under the assumption that the electricity sector does not decarbonise before 2030 (if at all), thus allowing for the construction of new coal fired power. Decarbonising electricity, however, is an important option for reducing emissions in South Africa (Altieri et al, 2015). In this sense, the coal BLIPPPP will contribute to carbon lock-in in the country's electricity sector. The use of FBC technology may have potential air quality benefits but plant efficiencies are typically similar to traditional coal-fired power plants; the precise emission implications would depend on final technology choice and rank of coal utilised (EPA, 2010).

Furthermore, the addition of new Waterberg (Lephalale) plants has implications for the promotion of mining in that area. Since the Waterberg currently only has one active mine and the geology of the area is such that the viability of export only mines is unknown (i.e. mines are thought to need both an export and a domestic offtake to make them viable) (SACRM, 2011), new power plants enable the development of upstream coal infrastructure that may not have been developed otherwise given constrained rail capacity. Expanding power supply in the Waterberg also has implications for water and other infrastructure planning, air quality and health, but is viewed by the coal industry as necessary given that most of South Africa's remaining coal resources are in the Waterberg region.

9.2 Gas

Natural gas-fired power has been proposed as a lower-carbon 'bridge' for South Africa's coal-based electricity grid and as back-up in a grid with high penetration levels of non-dispatchable power. As it stands, the gas industry as a whole in South Africa is relatively small, accounting for 2–3% of total primary energy supply, made up almost entirely of Sasol imports by pipeline from the Pande and Temane fields in Mozambique. Sasol sells more than half of this gas to industrial customers and uses the remainder as feedstock in its coal-to-liquids processes. The Pande and Temane fields are relatively small, some 5.5Tcf especially compared to new offshore discoveries in Mozambique in the Rovuma basin in 2010 which has 85-100Tcf estimated recoverable reserves and could have far more (Ledesma, 2013: 9). This resource within the immediate South African region represents significant potential although current plans are to initially develop Rovuma for LNG export.

From an upstream perspective, limited offshore exploration in South Africa has taken place. Other potential sources include shale deposits in the Karoo (as yet unexplored in South Africa), the development of underground coal gasification (one small demo plant at Majuba currently exists) or coal bed methane projects, and imported liquefied natural gas (LNG) or compressed natural gas (CNG), potentially from offshore fields in Mozambique. In early 2014, government began the development of a Gas Utilisation Master Plan (GUMP). This has yet to be finalised and released, though the intention is to outline the infrastructure and other requirements of growing the contribution of gas to the South African economy. There are many potential direct uses of gas in sectors such as transport or industry, but the role of gas-to-power in anchoring demand and thus driving infrastructure development is key to expansion of the sector, the potential for which is significant (McKinsey, 2015).

In 2012 the Minister of Energy made a determination in respect of gas-fired power, allocating 2500 MW to be procured. The determination has since been amended and the capacity allocation expanded to 3126 MW. This is in line with the capacity allocated to CCGTs and OCGTs in the IRP 2010 policy adjusted scenario of 237 MW/year CCGT in 2019, 2020 and

2021 and 805 MW per year of diesel OCGT in 2022, 2023, and 2025) (DoE, 2011). It should be noted that the IRP update increased the allocation of capacity to CCGTs in the base case to 3550 MW to 2030 (DoE, 2013), but the plan remains unofficial.

The amendment to the determination also altered the original source (assumed to be LNG or pipeline gas) to include other potential sources of gas, probably with a view to encouraging upstream development of the industry. Thus the new generation capacity determined in August 2015

may be generated from any gas type or source (including natural gas delivered to the power generation facility by any method including by pipeline from a natural gas field or elsewhere or an LNG based method; coal bed methane; synthesis gas or syngas; above or underground coal gasification; Shale Gas and any other gas type or source as may be considered appropriate by the procurer), and may be generated using any appropriate technology, notwithstanding that the IRP 2010 – 2030 may not have contemplated such technology or have considered it viable. (DoE, 2015a).

Several of these are domestic upstream options. They are presumably loosely based on the initial findings of the GUMP, since one of its key objectives is to 'enable the development of indigenous gas resources and to create the opportunity to stimulate the introduction of a portfolio of gas supply options' (DoE, 2015e). However, while the legislative and regulatory regime allow the minister discretion over the capacity that is procured, it is problematic to simply override the IRP. The Minister of Energy is responsible for energy planning and should have ensured that the now outdated technology choices and prices in the IRP were updated, rather than simply regulating over the IRP supply options.

In May 2015, the IPP office released the Request for Information for gas-fired power. The RFI has requested information from potential projects, including 'early power generation facilities' such as power ships or barges that may use heavy fuel oil, light fuel oil or diesel. The RFI is anticipated to be released Q4 2015 with bid submission in Q3 2016 according to the DoE (see figure above).

From a decarbonisation perspective, gas is often viewed as a potential 'bridge' to a lower-carbon future, since it has lower GHG emissions at the point of combustion than coal. However, several studies have highlighted that assumptions about fugitive emissions of methane (during production and transport in particular) differ widely (1–8% of produced volumes), and this can affect the overall mitigation benefit of switching from coal to gas (IEA, 2012). Others have found that high-gas scenarios can result in limited climate change mitigation effects in the long run (see McJeon et al, 2015 for review and analysis). While production-related emissions may be less serious for South Africa if it is only importing gas, the inclusion of several upstream options would likely have ramifications for national GHG emissions by adding production and increasing processing and transport emissions, for example in the production of unconventional gas such as shale. Furthermore, altering the fuel from natural gas and replacing it with coal-based gases as in the ministerial determination above (using for example, syngas/underground coal gasification/coalbed methane) subverts the IRP's switch to a lower-carbon fuel such as natural gas. The emission implications for the rest of the economy are potentially significant, but further analysis would be required to understand the emissions and decarbonisation implications of different sources and technology options.

The potential for a gas sector was limited historically by the absence of domestic gas resources and Eskom's reluctance to act as an anchor customer for imports. Development therefore required either a large local discovery or imports of significant additional pipeline gas for the sector to establish itself within the coal, Eskom and Sasol dominated energy economy. Recent moves to develop a gas to power customer is a strong indication that this process is underway, although there have been similar initiatives that have floundered in the past. The latest initiative appears to have support of more necessary key players and has been given impetus by the current energy security crisis.

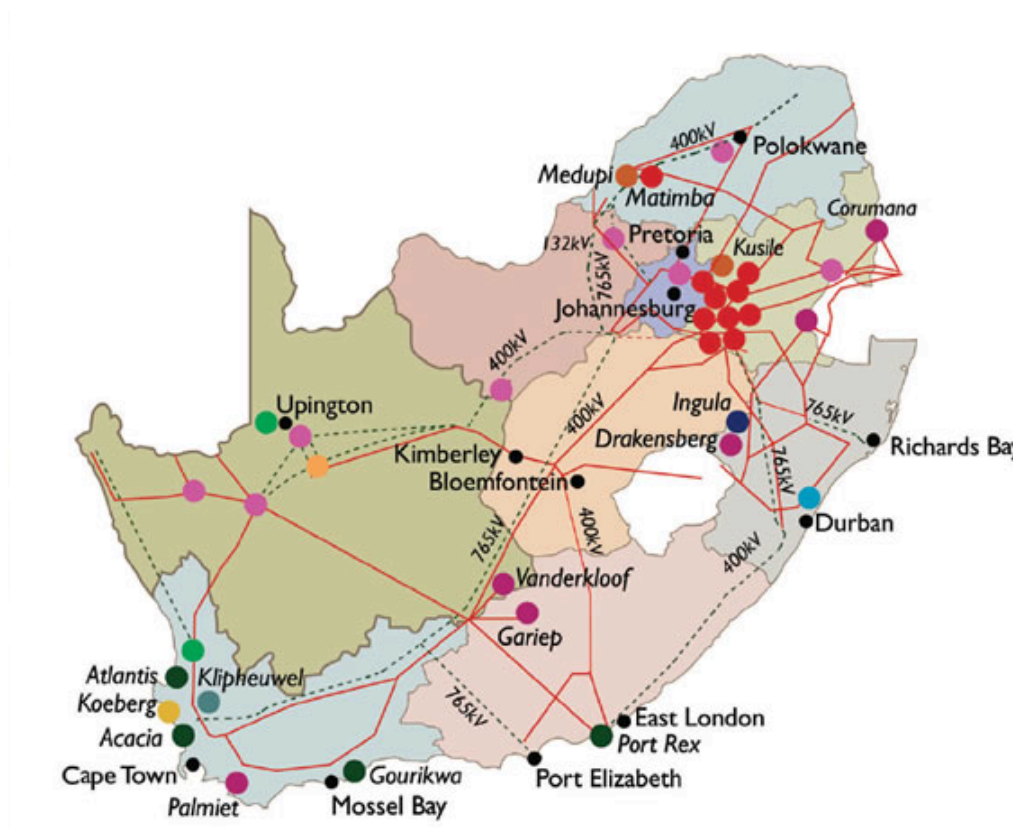
9.3 Cogeneration

In June 2015 the IPP Office released a Request for Bids for 800 MW of cogeneration (though the IPP Office are in the process of expanding this to 1800 MW). The technology options are split into 200 MW of combined heat and power, 250 MW of waste-to-energy, and 350 MW of industrial biomass. Round 1 bids were due in August 2015 but the announcement of preferred bidders for round 1 and 2 have been delayed, with no information on when the preferred bidders will be announced. Unlike the supply options for coal and renewables, the cogeneration programme does not have set local ownership, economic development or community trust requirements/criteria. This is partly because the initial rounds were intended to encourage brownfield expansion at existing industrial facilities in response to the power crisis.

10. Transmission constraints

Key challenges in the rollout of utility-scale renewable energy is the cost and time-line for the creation of grid capacity to connect new projects. The location of generation plant in relation to the grid directly impacts on grid connection scope, cost and timeline. The proximity of new generation plant to the existing grid is not necessarily an indicator of availability of grid capacity, as the existing grid may have little or no capacity to accommodate additional generation. Grid constraints are becoming more prevalent as the REIPPPP progresses, and the limited spare capacity, especially in areas with good resources, is depleted. Grid connection will continue to be an increasing challenge in future bid windows. As we discuss proactive plans are required to procure grid capacity in alignment with the spatial generation plans of the country. This relates to the very real technical challenges to the realisation of decarbonisation as much as economic and political challenges. These technical challenges were recognised when the REFIT became the REIPPPP (Baker, 2012), but there continue to be inconsistencies between the DoE's procurement process and the technical capacity to absorb further renewable power, exacerbated by Eskom's financial constraints and limitations on capex.

The South African grid has evolved historically with a high generation and high load centre concentrated in the north-east of the country, around the mines and power plants. This is demonstrated in Figure 7 which also highlights the cluster of thermal plants (red) to the East of Johannesburg. Eskom is the sole transmitter of electricity via a transmission network that supplies electricity at high voltages to a number of key customers and to the distribution network. Eskom Transmission holds the transmission licence and is responsible for planning, construction of transmission infrastructure, maintenance and operations, system operations, imports, and houses the grid code secretariat (Eskom, 2012). Planning is undertaken by the Grid Planning Department in the Transmission division (Eskom, 2015e).



Red dots indicate thermal plants; dotted lines indicate planned grid strengthening

Figure 7: Generation plant and transmission grid
(Eskom 2015a)

High-voltage transmission corridors evacuate power from the generation centre to other important load areas. As it stands, the north east of the country provides the most power and is a net exporter, while the rest of the country is a net importer of power. Yet most load is also in the north-east, where energy-intensive smelters, refiners and other heavy industry is located (Figure 8).

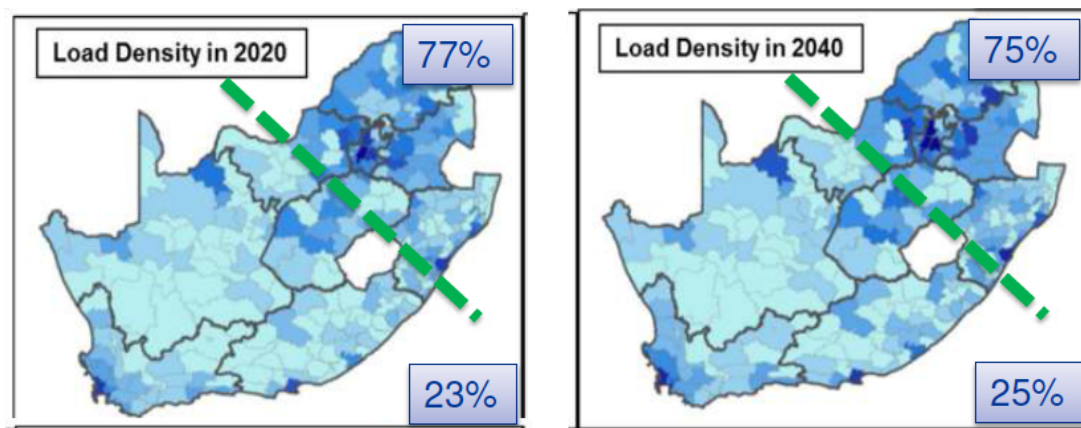


Figure 8: Load density in 2020 and 2040
(Marais, 2015)

The introduction of dispersed renewable energy, of which 6400 MW has been approved and 2400MW connected thus far, much of which is concentrated in the north-west and south of the country (Figure 7) has posed a serious challenge for Eskom and required the utility to invest in grid expansion and strengthening in response to the introduction of IPPs. As it stands, Eskom has invested R2.4 bn in grid development to connect projects from rounds one to three (Marais,

2015), yet the first three bid windows have taken up much of the existing and newly created capacity in the Northern Cape, Eastern Cape and Western Cape, and there is therefore 'an urgent need to create additional capacity for the REIPPPP' (Carter-Brown et al, 2015).

Going forward, however, Eskom grid planning continues to assume that most load will still be concentrated in the north-east, even by 2040, which means that as generation becomes more dispersed transmission infrastructure will be required to import power to areas that are currently net exporters of electricity. Figure 9 shows the shift from Eskom's current generation footprint to a generation footprint incorporating significant new generation capacity dispersed over the country. Given the assumptions on decommissioning and load growth, this means that by 2030 up to 8GW could need to be evacuated into the now dominant north-east (Marais, 2015).

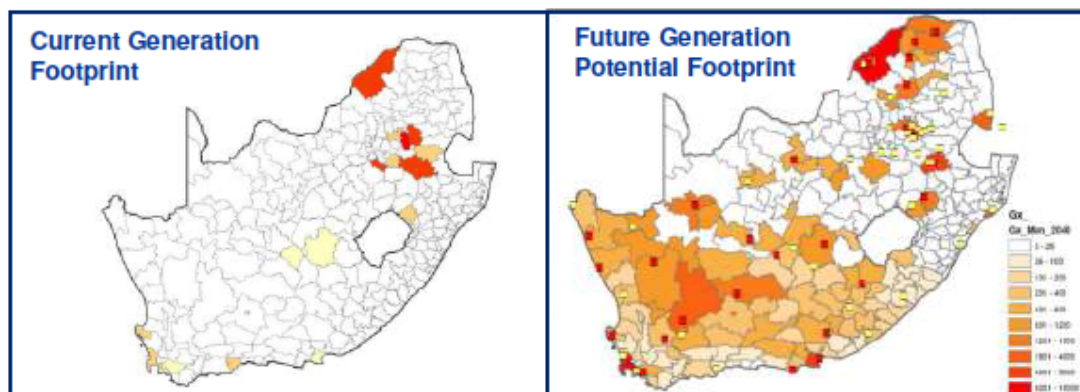


Figure 9: Comparison of current generation footprint vs potential future generation footprint
(Marais, 2015)

Transmission challenges facing Eskom are three-fold: financial, operational, and institutional. Firstly, Eskom is facing challenges to finding the capital necessary for grid strengthening and expansion required for the integration of IPPs as well as expansion from Medupi, Kusile, and Ingula. Capital expenditure required from 2015–2024 is estimated at R162bn, of which R145bn is for expansion, R7.6 bn for refurbishment, and R5bn is for land and servitudes (Eskom, 2015c: 80). The third multi-year price determination (MYPD 3) also covers only the short term (to 2017/18) and not beyond; given the lead times and inefficiencies of building incrementally, this raises significant financial risks for both Eskom and IPPs, especially if significant capacity is required in the long-term. As pointed out by one interviewee, 'by the mid-2020s if there is no blueprint you wonder how many more renewable energy projects one can build'.

After a lower than requested allowed revenue under MYPD 3 (R51bn allowed versus R75bn requested), Eskom 'reprioritised' its capex further, reducing transmission expenditure by R16bn to R35bn over the period to 2018. An effect of financial constraints and the quicker than anticipated rollout of IPP capacity has been that Eskom has revised its Generation Connection Capacity Assessment (GCCA) 2016 to reflect that the IPP connections would happen more slowly than initially anticipated. The GCCA is produced to assist IPPs identify areas with spare grid capacity, though it is not the official Transmission Development Plan. Unless the MYPD 4 decision allocates Eskom with further budget for transmission expansion (assuming Nersa approves a further increase of revenue), there will continue to be constraints for new IPPs to connect especially as Eskom is redirecting capex to its own generation capacity expansion programme. Eskom's role as both generator and grid and transmission operator has key short- and long-term effects on access to the grid, raising questions about control and planning of a grid in a hybrid power market. As one interviewee said, 'we can function without an ISMO but it is frustrating to live without it'.

Besides financial barriers, operational barriers and risks include the timing of Environmental Impact Assessment applications (three years), and obtaining servitudes, and land (6–8 years), and construction of lines (three years) (Creamer 14 October, 2014) which have also contributed to the rephasing of transmission capex. Eskom's response has been to develop a 2040 Network

Plan to understand the shifts in power flows and areas that will need grid strengthening in the long term. A Strategic Environmental Assessment is now underway to create five transmission corridors: including the western and eastern coastal corridors, a solar corridor, a central corridor and a northern import corridor, through which capacity from Mozambique could enter. The rationale is to limit the resources associated with grid planning and obtain general environmental authorisation from the Department of Environmental Affairs. From a generation planning perspective, the corridors will play a 'major role' in the successful integration of

whichever future generation scenario unfolds and wherever the new generation will be finally located....The investment in and the development of these Power Corridors will provide flexibility of implementation and faster connection schedules for all three IRP 2010 update scenarios or a completely different IRP scenario in the future. (DoE, 2013)

In the short term, system wide inefficiencies could be dealt with by incorporating the levelised cost of Transmission and Distribution into the IPP bid process, to deal with risks of timing and capital, as has been suggested by GIZ (2015). The study found that the costs of locating PV closer to load (i.e. in areas with lower solar resource) are negligible once the network costs are included. Thus, the economic risks of locating solar in areas with greater grid capacity are low, and avoiding other risks associated with grid expansion means it would be sensible to develop solar resources in line with the current grid capacity of 2.8 GW in the northeast, but then to locate new generation capacity beyond the remaining 2.8 GW elsewhere, weighing up the costs of grid and other spatial aspects. This highlights a current issue with the REIPPPP procurement process which focuses on levelised cost of generation, and excludes other costs related to spatial location and system planning.

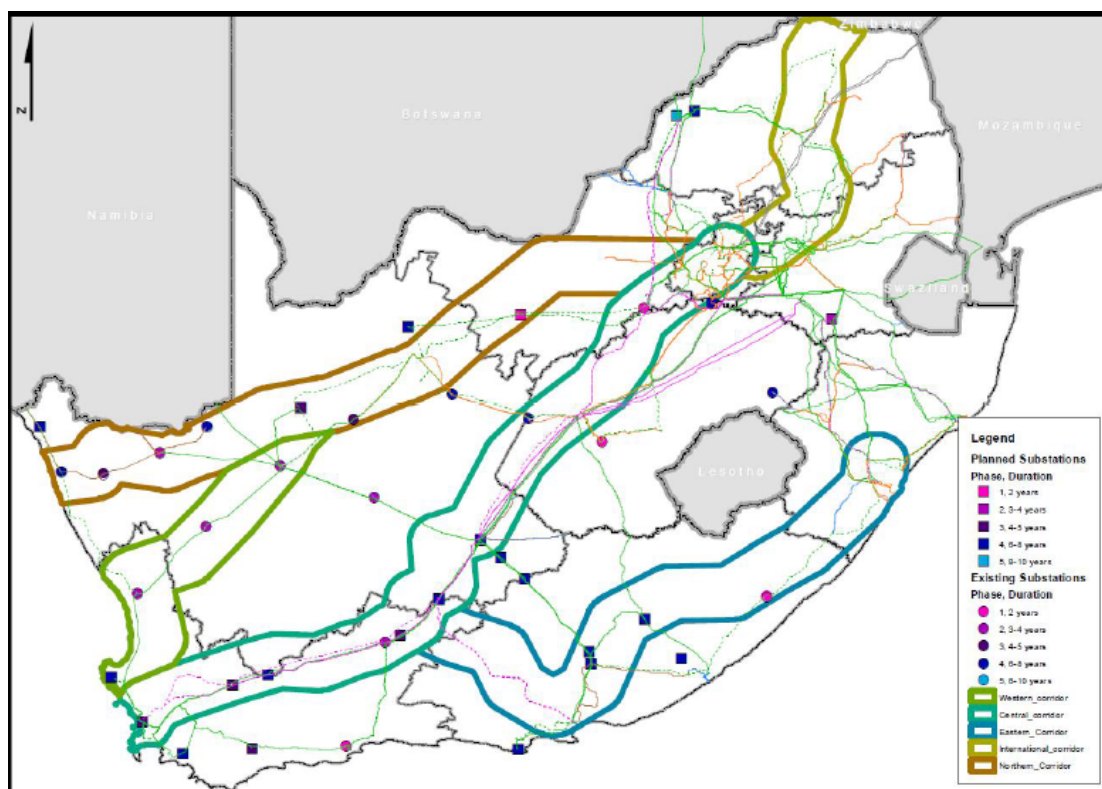


Figure 10: Proposed transmission corridors
(Eskom GCCA 2022, 2015: iii)

Finally, these challenges highlight deeper institutional questions, which will have to be resolved if decarbonisation is to be achieved. These include the unresolved role of Eskom in a vertically-integrated market, Eskom's access to sufficient capital given limited tariff increases from Nersa, its internal allocation of capital, and more specifically, how to plan appropriately in the

context of rolling bid windows, and how non-Eskom procurement can be co-ordinated to minimise system-wide inefficiencies.

11. Wheeling

A 'wheeling agreement' allows a third party generator access to the transmission grid in order to transport electric power to a private off-taker. For this the transmission operator is paid a wheeling tariff. While national legislation allows wheeling under Section 22 of the 2006 National Electricity Act there have been few wheeling deals agreed to date. However since the start of the electricity crisis Eskom has developed an interest in facilitating and approving wheeling. According to Nersa [in interview, May 2015] Eskom is currently reviewing its policy on third party access and has removed a number of barriers to entry. Nersa is also running a consultation process on its policy on 'Regulatory rules on network charges for third-party transportation of Energy' and in early 2015 launched an advisory forum on wheeling. This has involved consultations with the Energy Intensive User Group, Eskom, South African Renewable Energy Council, South African Independent Power Producer Association and Association of Municipal Electricity Users to deal with pricing issues. While Eskom's willingness to work on this issue has improved, there have been problems in cases where electricity needs to be transported via a municipal network. In particular there are instances of municipalities posing blockages to facilitating wheeling, given that there is a disincentive caused by the significant revenue they gain from on-selling electricity.

12. South Africa's potential nuclear programme

As discussed above, IRP 2010 allows for a 9600 MW nuclear programme. The revised IRP, released in late 2013, which is now unlikely to be approved (see Section 6) has raised questions about the costs and viability of nuclear. According to announcements by the DoE, a bidding process for a 9600 MW nuclear programme which would consist of up to eight nuclear power plants was slated to start in June 2015. This would see procurement starting in September 2015, preferred bidders being chosen in December, and nuclear power stations being built between 2017 and 2030. However, at the time of writing such a process does not seem to have been initiated.

Details regarding how the nuclear programme will be financed, how much it will cost, who will pay for it, who might build it and who might own and operate it have been entirely lacking in transparency (Paton 02 June, 2015), although Russia's state-owned atomic energy company, Rosatom, appears to be the preferred partner in any deal. Current capital cost estimates by external experts, as yet unconfirmed, are at R1 trillion. While National Treasury has been excluded from the process of the costing of any potential nuclear programme, it has raised questions about the programme's affordability (Mantshantsha & Marrian 31 August, 2015) and in July 2014 insisted on a 'thorough assessment' of the programme's financing. According to *Business Day*, the first time that Treasury were included in the discussions was in August 2015 who according to journalist Xolisa Phillip, were 'roped in at the end to work out whether or not SA can afford it' (Phillip 28 August, 2015).

The procurement of nuclear has become ever more secretive, in keeping with recent moves described in Section 5. According to President Jacob Zuma's 'Written reply to questions in the national assembly of 27 March 2015' (The Presidency, 2015), The National Nuclear Energy Executive Coordination Committee (NNEECC) was established by cabinet in November 2011 and 'is tasked with providing oversight and decision making on the nuclear policy and new build programme'. In June 2014 The NNEECC was converted into the Energy Security Cabinet Subcommittee (ESCS) 'responsible for oversight, coordination and direction for the activities for the entire energy sector', chaired by President Jacob Zuma. While the committee reports to cabinet, 'its proceedings and documents are classified under the Minimum Information Security Standard Act (MISS Act) as TOP SECRET' [*sic*] and therefore its agenda and minutes are not publicly available.

Government has held a series of 'vendor parades' with interested companies and countries, including Russia, China, France, and South Korea. In addition, representatives from Russia's Rosatom have met a number of times with government delegations. Zuma is understood to have visited Russia in 2014 (Ashton, 2015) and engaged in further meetings in July 2015 during the BRICS summit. In the energy budget speech in May 2015, the Minister for Energy stated:

South Africa has signed various Inter-Governmental Agreements or IGAs, laying the foundation for cooperation, trade and exchange for nuclear technology as well as procurement. These agreements describe broad areas of nuclear cooperation and they differ on emphasis, based on the unique needs of each country. Completed IGA's will be submitted to Cabinet for discussion and endorsement in the coming weeks. The requisite parliamentary processes for ratification of these agreements will follow. (DoE, 2015d).

Government also announced that a nuclear skills development and training programme is under way in cooperation with China, Russia and South Korea.

Many have argued that the nuclear process is being largely driven by the presidency and a minority within the DoE, something which Gumede has described as an issue of patronage (Kings 18 August, 2014). One policy analyst argued that most ministers would not even understand how the nuclear deals would work. Others argued that Zuma lacks the political constituency to push through the nuclear programme to the end, particularly in light of the lack of support from National Treasury.

Concerns over the viability of the programme are widespread. For instance, Nersa implied that there are serious opportunity costs associated with nuclear and that there is little justification for the affordability argument. An Eskom representative indicated that to construct the entire fleet would not make economic sense even though there might be a role for some nuclear to displace coal. Moreover, the country would need an innovative financing model in order to be able to develop nuclear, particularly given that Eskom's current credit rating would seriously inflate the utility's cost of borrowing. According to Nersa, it is more likely that nuclear would be implemented by a special purpose vehicle in which Eskom would be involved, rather than as a pure Eskom project. In September 2015, the Minister of Energy stated that a study on affordability and the funding model will be shared with the Parliamentary Portfolio Committee on Energy, but in the interests of commercial sensitivity would be tabled as 'classified' until procurement has been completed (Paton 01 September, 2015).

As we have discussed in Section 6, government's authority to procure nuclear is set by the integrated resource plan (IRP 2010). While the cabinet-approved IRP 2010 provides for 9 600 MW of nuclear power, the IRP update in 2013 suggests that the decision on nuclear could be postponed until at least 2025. It further refers to 'persistent and unresolved uncertainty surrounds nuclear capital costs' and calculates an estimated overnight cost of \$5800/kW in 2012 US dollars (DoE, 2013: 12). In comparison the DoE has estimated that it would cost \$4200 per KW (Creamer 14 August, 2015). This lower estimate appears to be based on the lower end of Rosatom's estimated cost of \$40-50 billion for eight units of the VVER-1200 (Russia's version of a pressurised water reactor), excluding owner's costs and own consumption of each plant. As one member of the industry stated: 'Nuclear was forced into the IRP. The model didn't choose nuclear. It results in an almost 40% reserve margin'. It is hard to envisage that we will be in a state of oversupply and we will have to pay for oversupply. The desirability and/or timing of nuclear is further questioned in the National Development Plan (NPC, 2012).

In general the undue haste and lack of evident rationale of the nuclear programme strongly suggests that the electricity planning framework set up in the Electricity Regulation Act (2006) and recently given effect to in the IRP 2010 is giving way to centralised, behind-closed-doors planning that is open to the potentially very powerful influence that nuclear investments would involve. In the meantime the DoE is justifying the programme on the grounds that it will help to meet the country's climate change commitments as well as providing a solution to the electricity crisis (Gqirana 01 September, 2015). While nuclear generation may be considered a 'low-carbon' technology, at a more fundamental level decarbonisation should also prioritise the collective public good. If low-carbon electricity generation is achieved while at the same time undermining or corrupting the intended operation of electricity planning legislation, questions

arise as to the ultimate net impact on the public good. The gradual rolling back of the painstakingly constructed systems that have to some extent brought energy and economic planning into transparent public procedures threatens to undermine the ability of democratic government to counter these influences. Finally, given the potential yet currently unknown cost of any potential nuclear programme, as Butler (2015) points out, the 'real price of nuclear power will also depend on who absorbs the risks' (Butler 05 June, 2015).

13. Climate change mitigation policy

South Africa has both domestic climate policy and an international pledge it has made under the United Nations Framework Convention on Climate Change (UNFCCC). Going forward, international pressure on South Africa to at least maintain its Copenhagen pledge is likely to increase as countries submit their 'intended nationally determined contributions' (INDCs) in the lead up to COP21 in 2015. These may become commitments (obligations with a legal nature) or remain voluntary or conditional – that remains to be negotiated. Whatever the outcome, the mitigation commitments by South Africa and other developing countries will be more like those of developed countries. Increased reporting and review has already been agreed, and greater transparency will be expected in future. This will increase the expectations on South Africa, which has submitted an INDC that reiterates its Copenhagen pledge and formalises the emissions trajectory range outlined in domestic policy in the international sphere. This reiteration of Copenhagen was subject to significant opposition from domestic emitters and parts of the state, for whom coal is viewed as a driving force for industrialisation (NCCC 26 March, 2015).

Domestic policy is codified in the South African National Climate Change Response White Paper (NCCRWP) (RSA, 2011) which was led by the DEA and approved by Cabinet in 2011. The NCCRWP is a key document for decarbonisation and provides a foundation for both mitigation and adaptation that is well integrated with the UNFCCC negotiations and agreements, while being firmly based in the South African context. However, this policy has had minimal impact on, and is poorly integrated with, other key policy areas related to decarbonisation that we describe above, such as minerals, energy, industrial planning, trade and industry, and economic development (Tyler & Trollip, 2011). Initial attempts at implementing key elements of the policy have proved to be undermined by this disconnect and the relative weakness of the department behind the policy, the DEA. Despite the political will within the DEA and the driving forces of the UNFCCC process, this policy fragmentation has characterised the development of the policy. Hence the DEA failed, and continues to fail, to integrate with other policies, departments and actors. However progressive and aspirational the NCCRWP may be, addressing this fragmentation will be fundamental in its success and the role it plays in decarbonising the South African economy.

The NCCRWP was the outcome of a six-year process. In the early 2000s it became clear that the UNFCCC process would eventually lead to an agreement in which developed and the developing countries would be required to contribute to mitigation efforts through the reduction of GHG emissions. In anticipation of this, and within the context of South Africa's moral and legal obligation to make a fair contribution to the global mitigation effort, the then Department of Environmental Affairs and Tourism released the Climate Change Response Strategy (DEA, 2004). In 2005, a National Climate Change Conference was held, and in 2006 Cabinet mandated a process where the potential for mitigation of GHG emissions in South Africa would be examined in order to provide a sound scientific basis for a long term climate policy. The outcome of this process was the Long Term Mitigation Scenarios (LTMS). The LTMS modelling was completed in 2007, and in 2008 Cabinet released the 'Vision, Strategic Direction and Framework for Climate Change Response Policy', which considered the results of the LTMS (Van Schalkwyk, 2008). The Copenhagen COP15 in 2009 was important for renewed commitment to climate change mitigation internationally and nationally, and saw President Zuma committing to reduce emissions from a business-as-usual trajectory by 34% and 42% by 2020 and 2025 respectively. This commitment and the figures were loosely underpinned by the LTMS analysis but were decided politically. This international undertaking, reinforced by top-level political commitment, as well as the South African hosting of COP17 in Durban in 2011,

fast-tracked the creation of South Africa's climate policy – perhaps contributing its disconnect from other policies and departments.

The NCCRWP has two key objectives. The first is to effectively manage and prepare for the impacts of climate change while building and sustaining South Africa's socio-economic development. The second is to make a fair contribution to GHG emission reduction in order to avoid dangerous anthropogenic climate change while maintaining commitments to national economic development. Meeting these objectives, as well as the commitment to the PPD trajectory, are conditional on international financial, technology and capacity building support. The key elements of mitigation policy outlined in the NCCRWP are: setting the performance benchmark, identifying desired sectoral mitigation contributions (or desired emission reduction outcomes – DEROs), defining carbon budgets for significant GHG emitting sectors, the development and submission of mitigation plans associated with DEROs by different sectors, the use of different types of mitigation approaches, policies, measures and action to optimise mitigation outcomes, using the market to support DEROs, and establishing a national emissions data-base in the form of a GHG inventory to monitor and evaluate progress.

The NCCRWP is currently facing challenges associated with implementation. The main issues are around the benchmark National GHG Emissions Trajectory Range, the Carbon Budget, and the DEROs process. This is further stressed by a number of actors challenging the LTMS process and its relationship with the NCCRWP, especially the benchmark range (see Tyler & Torres-Gunfaus, 2015).

The benchmark National GHG Emissions Trajectory Range, detailed in the NCCRWP, provides a base from which to measure the efficacy of mitigation action. According to this benchmark range, South African policy projects emissions will peak between 2020 and 2025 in a range with a lower limit of 398 Mt CO₂-eq and upper limits of 583 Mt CO₂-eq and 614 Mt CO₂-eq respectively. South Africa's emissions will then plateau for up to 10 years after the peak, and from 2036 emissions will decline in absolute terms to a range with a lower limit of 212 Mt CO₂-eq and an upper limit of 428 Mt CO₂-eq by 2050. With GHG emissions already reaching 518 Mt CO₂-eq (including FOLU)¹⁹ according to the 2010 GHG Inventory, South Africa is already well above the lower limit of the peak range. The challenges to the benchmark range, as well as the others mentioned, stem from the impact that implementing this policy will have on key sectors in the economy (most importantly energy, industry and trade), and the disconnect between it and other policy areas.

DEA has been in the process of establishing a system for implementing mitigation policy. According to the NCCRWP the benchmark range is to be cascaded down to emissions budgets for sectors and entities within three years, with the large emitting entities required to 'submit mitigation plans that set out how they intend to achieve the desired emission reduction outcomes' (DEA, 2011: 27). The NCCRWP states that within two years an 'optimal mix of measures will be developed' (DEA, 2011: 27). However, four years after publication of the NCCRWP the budgets for sectors and entities have not yet been allocated, and the mitigation plans and optimal mix of measures have not been forthcoming.

Desired Emission Reduction Outcomes and company-level carbon budgets are part of the planned implementation system which remains incomplete. Overall, the system is likely to be a hybrid, meaning a mix of top-down and bottom-up elements. Work on DEROs is currently dealing with the division of an overall national trajectory among sectors, recognising that the contributions of sectors can change, and may be very different in the long-term (2050) compared to now. Further, as sectors are not legal entities, the work on DEROs aims to provide important guidance and policy signals in lieu of direct regulation with the use of regulatory instruments.

Company-level carbon budgets are being developed into regulatory instruments. This requires data reported by companies and probably a firmer legal basis. The process of discussing carbon

¹⁹ FOLU refers to forestry and other land use. In South Africa, FOLU is a net sink; excluding FOLU, emissions in 2010 rise to 544 Mt CO₂-eq.

budgets has been initiated by DEA, although at the time of writing no carbon budgets had been allocated to any company. DEA and National Treasury have negotiated the inclusion of an allowance for companies paying the carbon tax if they are subject to company-level carbon budgets. However, despite a process to negotiate the allocation of emissions space between users (the DEROs), DEA has instead elected to implement a process whereby firms are asked to report but are not legally bound to report or reduce emissions in line with sectoral or company level budgets. This was a key criticism in interviews. As one civil society member stated:

‘they won’t be incorporated into law and are not legally binding. Governments are supposed to make, implement and regulate laws. If you have a government process that is not implementable, enforceable and has no regulation... then it is just a bunch of people talking. One would assume for something like this you would need a raft of legislation.’

The carbon tax, discussed below, will therefore potentially be the only legally enforceable mitigation action currently being implemented, and still faces significant opposition from emitters and other government departments. Business in the past argued for implementation of the carbon tax to be delayed to align it the carbon budget and DEROs processes within the DEA (Sasol, 2013; BUSA, 2013), although the tax has been delayed anyway as the policy and legislative processes have not been completed. Business in early 2015 walked out of the DEA’s public consultation for mitigation policy processes on carbon budgets and desired emissions reductions outcomes. The carbon tax, when implemented, will thus be the primary enforceable mitigation action in the country, since DEROs will not be legally enforceable in the short-term. The other primary instrument is the IRP and the ministerial determinations, which allocate new build under the Regulations on New Generation Capacity (as discussed in Section 6).

14. Carbon tax

The National Treasury initially introduced the idea of a carbon price as part of a broader process of environmental fiscal reform in the early 2000s. After a discussion document was released in 2010 (NT, 2010) outlining the reasoning for implementation, a carbon tax policy paper was released in 2013 that included the design elements of the tax (NT, 2013). Implementation of the tax was targeted for 2016, but Treasury had yet to release a Bill for approval by Parliament by mid-2015, even though this needs to be approved by Cabinet before it is presented to the legislature, and a January 2016 commencement is increasingly unlikely given that Parliament closes mid-November. The Carbon Tax Bill (2015) was released for comment in November 2015, with a new targeted commencement date of January 2017.

The policy work has been underpinned by several economic analyses including by Treasury itself, academics, and the World Bank (Legote, 2012; Caetano & Thurlow, 2014 for a review of modelling work on the tax). Industry has undertaken its own analysis, (usually at a sector- or firm-specific level) though the modelling is seldom made public. At this stage, executive and legislative approval is a ‘political process’ according to one government member. While the Minister of Finance is supportive (as is the DEA, who are driving mitigation policy but are known to be a less powerful ministry), Treasury faces opposition in Cabinet from the DTI and Department of Economic Development (EDD), which are ‘strongly opposed’ to the tax. It is unclear whether the DoE is politically supportive, but the IPP Office has incorporated the carbon tax into the baseload coal programme bid documents, and IPPs will be expected to pay the tax.

Treasury also faces significant opposition from carbon-intensive business such as Sasol and Eskom, mining and minerals companies, and business groupings such as Business Unity South Africa, the Chamber of Mines, and the Steel and Engineering Industries Federation of Southern Africa (SEIFSA). Other parts of business have not been strong supporters of the tax, including those that stand to benefit from a shift in relative prices of technologies. The renewable energy industry, for example, has not seen the need to support the carbon tax in public. As one industry interviewee said, ‘the market has been won for them, so why fight when they don’t need to?’. Treasury’s analysis of the comments received on the tax found that most respondents were supportive of mitigation policy in general, but with caveats around the use and design of the tax. This is contradicted by the ongoing public opposition and lobbying, especially by business; it

may also indicate growing opposition as implementation of the tax approaches. At this point, some business groupings are stating that they no longer support either the tax or mitigation policy more generally.²⁰

Within government, DTI and EDD remain strongly opposed to implementation of the tax. It is understood that within DTI there exists a constituency who see any threat to industry as something to be prevented due to the risks of de-industrialisation (interview with government) and the concomitant (assumed) impact on jobs and growth. This is despite a 'green industries' component in the Industrial Policy Action Plan and the inclusion of the green economy in the EDD's New Growth Path. As one interviewee pointed out, this may reflect a bias within those departments towards the interests of large energy-intensive industry as opposed to small and medium business.

In short, DTI have 'adopted the business line'. They view South Africa as a small player in the international negotiations with relatively small emissions who will be unfairly prejudiced by action. As business has argued, South Africa is a 'minor player' (Chamber of Mines), the country's emissions are 'tiny' (AngloGold Ashanti), and South Africa accounts for less than 1% of global emissions and requires space to grow (Chemical and Allied Industries Association) (all presentations to the Davis Tax Committee).

In terms of costs, BUSA has stated that the "economic impacts are likely to be substantial" (BUSA, 2013). This is in line with DTI's public concerns around electricity price increases, which is 'informed by the often repeated perspective that sharply escalating electricity prices... constitute serious dangers to the viability of the manufacturing sector' (DTI, 2013).²¹ As one government interviewee summarised, the tax comes at 'too high a cost. It is not the right time for a carbon tax. If you are going to increase the electricity price you might as well raise taxes and give that money directly to Eskom. If you want to raise taxes then you should do so.' Furthermore, as the Minister of Trade and Industry, Rob Davies has said:

On the climate change front, our view is that great caution must be exercised to ensure that emergent carbon mitigation policy interventions and environmental regulation – including the proposed carbon tax – are carefully sequenced and calibrated, taking into account the concrete circumstances of the most vulnerable sectors, so that important domestic capabilities are not destroyed and jobs lost in the process. (DTI, 2014: 7)²²

This is partly due to real concerns about affordability for firms currently impacted by low global commodity prices and rising costs; yet macroeconomic analysis has also shown that the impacts of the tax on the economy will be relatively small, provided the revenue is recycled (Alton et al, 2012). But business has also used arguments that go to the core of the DTI's (and the ANC's) ideas about industrial development and mineral resources. Although the DTI has several streams within its industrial policy, energy-intensive sectors remain important within the Industrial Policy Action Plan and the IPAP includes a Minerals Beneficiation Strategy taken over from the Department of Mineral Resources (DMR, 2011) some years ago. This strategy is currently being

²⁰ For example, the Chemical and Allied Industries Association (CAIA) stated at the Davis Tax Committee that 'CAIA does not support South Africa's continued development of climate change policy, including that of the carbon tax' (CAIA, 2015).

²¹ Similarly: 'In addition, government has committed to ensuring that administered prices do not, as a group, rise faster than inflation. EDD undertakes to monitor administered prices and on that basis work with the relevant authorities to help develop more sustainable balances around cost to users, financing options, and quality of service' (DTI, 2014: 55).

²² The dti, as is well-known, supports measures to promote structural change in the South African economy towards more value-adding, labour-intensive and less energy-intensive sectors of production. The fact remains, however, that at present the distribution of capital stock across the economy continues to reside largely within the MEC sector. To ensure continued economic growth, job creation and poverty reduction will require measures to manage the transition of our traditional resource-processing sectors so that they do not collapse under increasing electricity prices and/or a mistimed or miscalibrated carbon tax – whilst at the same time implementing measures to improve the competitiveness and support the growth of downstream value-adding, labour-intensive sectors and the new green industry sector. These can and must include investment in green energy, industrial energy efficiency and demand-side management linked to localization. (DTI, 2014:114)

developed into a Minerals Beneficiation Action Plan (MBAP) by the DTI. It reflects support for beneficiation in DMR and equally, in the African National Congress's policy on minerals. Thus, arguments such as the 'Shift to significantly lower carbon intensity [is] not possible concurrent with beneficiation objectives', made by BUSA (2013), are received receptively.

Initially, commentators characterised this opposition as 'misalignment', assuming that the viewpoint of different departments on mitigation could be aligned. However, there are far more fundamental oppositions, related to understandings of how industrial development in South Africa can take place, how to use the country's resources, and the risk and opportunities of climate mitigation and international censure. While a narrative around 'green growth' opportunities does exist, it does not clearly outline the complexities and difficulties of transition and how to manage the process of winners and losers. As one government interviewee pointed out, 'the cost of transition is critical and this is what we need to focus on', yet there does not appear to be co-ordination within government about understanding short-, medium- and long-term impacts of mitigation policy. One business interviewee said succinctly: 'Without understanding the short-term dynamics of industry and business, government will make a decision', yet 'we are not having a conversation about [the] short-term economic transition'.

Opposition has not only arisen from energy- and carbon-intensive industry, though they have been the primary actors. Criticism from labour and civil society have centred primarily on design issues and impacts on the poor, i.e. how to protect the poor from price increases or how best to recycle the revenue. NUMSA, for example, have agreed that tackling climate change is a necessity and supported the introduction of the tax subject to design changes related to revenue recycling. Indeed, unions in general 'are progressive until it affects their workers', including in energy-intensive industry such as aluminium smelters. Their interests are clear, and the unions 'are on your side until their members suffer'.

Despite evidence that the current carbon tax would not be high enough to encourage significant shifts in emissions (Alton et al, 2012), the impacts on firms may still be substantial. Business has therefore not been supportive of the implementation of the carbon tax, and opposition has increased as the process has progressed. The concerns of other parts of society – who are supportive of mitigation policy and carbon pricing in principle – have centred on equity and welfare impacts on the poor. Despite ongoing debates around design issues, the enactment of the Carbon Tax Bill will be a key emissions reduction mechanism, especially as in the short-term it will be the only legally enforceable mechanism besides the IRP.

15. Conclusion

This research has focused on South Africa's electricity sector as a central feature of its highly energy-intensive economy. This paper has been written to accompany the recent study undertaken by Altieri et al (2015) who unpacked the technical possibilities of meeting South Africa's development objectives at the same time as commitments to climate change mitigation. While such a task obviously goes beyond the electricity sector – and we highlight the significant contribution of other sectors such as transport and liquid fuels to the country's carbon emissions as areas for further research – we have selected electricity as our main focus. This is firstly because the electricity sector currently emits 45% of the country's emissions: decarbonisation in South Africa's electricity sector and the economy more broadly cannot be achieved without reducing the absolute contribution of coal-fired power at the same time as integrating a range of renewable energy (such as wind, PV and CSP) and storage technologies. Secondly, the country's electricity sector and the coal that supplies it are tied up within complex and path-dependent relationships between the historic core of the country's growth path predicated on its MEC. This is still significant, despite recent national and international shifts that have seen a decline in the contribution that mining and associated commodities make to the economy. Notably South Africa is, on the one hand, attempting to implement a policy requiring significant reduction in future emissions from coal combustion in the form of the National Climate Change Response White Paper at the same time as the coal industry appears to be promoting expansion both for local consumption and export, supported by planned capital expansion in railways and

ports. In the meantime, a successful renewable energy procurement programme is underway which has had little interaction with national policy for climate change policy.

This paper has provided an in-depth and historical analysis of the key features of South Africa's electricity sector and the stakeholders and beneficiaries operating within it. In order to analyse the structural, institutional and political constraints to the realisation of decarbonisation, we have considered the nature of formal and informal relationships including between different government departments, the national utility Eskom, coal mining companies, energy-intensive users and finance. We began by exploring the country's MEC as central to the country's historical core based around mining and minerals-beneficiation. This exploration was followed by an analysis of the crucial and dominant role that the monopoly utility Eskom has played in the economy, some of the dynamics of the coal industry and its relationship to the electricity sector. Section 4 explored Eskom's financial crisis including some of the long-term and path-dependent factors that have led up to it, and importantly what this crisis might mean for the future of Eskom as a monopoly utility going forward. Section 5 examined the way in which electricity is governed in South Africa, in particular key developments in policy and regulation that have attempted to remove energy policy and planning from opaque processes previously dominated by Eskom and the former DME. However, we found that while a carefully constructed legal and regulatory framework has taken significant steps towards transparent governance and policy, this has been undermined by more recent measures such as the war room, and government's side-lining of the IRP process, discussed in greater depth in Sections 6 and 12.

Despite its various shortcomings and the significant role that coal will continue to play in the next 20 years, the IRP still represents a step forward due to its carbon constraint, and as the first and relatively transparent process involving public consultation for energy planning. But the latest draft of the IRP seems to have undermined this, having apparently been scrapped by government on the grounds that the plan questions the need and rationale for a large nuclear procurement programme. In the words of one energy analyst, such a move 'indicates a swing back to energy planning by secret back-room decision-making', and the 'excessive secrecy' (DME, 1998: 24) that the 1998 Energy White Paper had hoped to overcome. Section 7 describes the REIPPPP as perhaps the most successful site of decarbonisation in South Africa to date and considers various factors that may threaten its sustainability going forward, including Eskom's ability and/or willingness to connect projects to the grid and tensions between the demands of project finance and potentially progressive economic development and community ownership. The section on REIPPPP is followed in Sections 8 and 9 by a discussion of how moves to introduce other forms of privately generated power are emerging, namely embedded generation solar PV, coal, cogeneration and gas. The technical and financial challenges of the transmission grid to adapt to new sources of generation, particularly renewable energy was discussed in Section 11. Section 12 considers that, while nuclear is arguably 'low-carbon' and therefore could be considered as contributing to decarbonisation, there are serious questions with regards to its effect on the public good. It is being negotiated via a highly secretive and undemocratic decision making process with potentially catastrophic effects on the public purse. The final section discusses the nature of South Africa's commitments to climate change mitigation and the fundamental disconnect between climate policy and energy policy.

Our research has demonstrated how decision-making and changes within South Africa's electricity sector are embedded within complex social, political and economic forces and relationships. Such a reality makes it evident that there is no discrete solution for the realisation of decarbonisation and that any serious steps towards it must embrace these dynamics. We would argue that while ministerial discretion over technology choices may in some instances work in favour of decarbonisation, as we have seen in the case of REIPPPP. However, such discretion may also work in favour of other sources of generation, such as coal and nuclear. We would argue, therefore, that the answer to a power crisis is not to allow ministerial discretion over technology choices. Rather, South Africa needs a planning process that is flexible enough to respond to the challenges of the current supply crisis in the short-term, as well as longer-term crises related to economic and environmental sustainability.

Beyond the technological considerations of decarbonisation is that of the 'just' transition (Swilling & Annecke, 2012). If moves to a lower-carbon economy are to be sustainable, they must also take into account questions of economic inequality, social welfare and an inclusive growth path. Yet levels of access to energy in South Africa are paralleled by its major development challenges as one of the most unequal countries in the world, linked to its legacy of racial oppression and inequality. As we have also uncovered, a just transition in South Africa's electricity sector is further challenged by what appears to be the reintroduction of opaque decision making processes characteristic of the apartheid era in electricity as much as in other parts of the economy. Amongst other things, such opacity may facilitate a substantial, as yet undetermined, investment in nuclear power that will shape the country's electricity mix, its infrastructure and related tariffs for years to come.

In analysing the structural, institutional, and political constraints to the realisation of deep decarbonisation, we have considered the nature of formal and informal relationships between the DoE, Nersa, Eskom, municipalities, the DPE and the DEA. We have uncovered the shifting nature of networks between institutions, actors and technologies involved in the electricity sector. This includes complex and often opaque relationships between the state, the ANC and business, and the emergence of new players in renewable energy investment and technology supply who are in turn forging alliances with more conventional players in the country's MEC. While we have primarily focused on national factors in this paper, it must be emphasised that the country's electricity sector is further linked to and influenced by an evolving global system that includes increasing pressures on the world's resources, priorities for climate change mitigation, global technological transitions and a globally financialised and interdependent economy.

We have further demonstrated how in recent decades, and particularly since the end of apartheid, the governance of South Africa's electricity sector has gone from a monopoly parastatal, closely integrated with the historical economic core of mining and minerals beneficiation, supplied by long-term contracts for cheap coal, to one that is now in financial crisis and unable to meet national requirements. Eskom is no longer able to rely on the country's abundant coal supplies and is now accompanied, if not challenged, by a credible though still emerging programme for independent power production, notably in renewable energy. At the same time, an untransparent and highly contested process for the procurement of nuclear power is developing in parallel, to be procured and paid for by the state and in turn electricity consumers, but is likely to be supplied by, managed and controlled by a foreign company.

The various cases of decarbonisation taking place within South Africa's economy and electricity sector are due to a diversity of drivers. Some are clearly conscious attempts driven by environmental and sometimes social concerns, but more often than not they are driven by economic, financial, and often political interests. Within the electricity sector we have uncovered serious tensions between priorities for economic growth that often depend on high-carbon infrastructure development, and priorities for climate change mitigation that depend on its reduction. In either case, such moves are unlikely to replace the important role played by coal in the energy sector and economy, and a core feature of the country's unique system of accumulation, the minerals-energy complex. Coal interests still hold a dominant sway within national decision-making and within the electricity sector, both in upstream supply and consumption. The introduction of coal IPPs, though not part of Eskom, are both a cause and a symptom of such interests. The role of nuclear, the subject of significant debate and controversy, currently remains uncertain. Furthermore, as the country faces its worst electricity crisis in 40 years, wealthy domestic and business consumers are implementing measures to 'buy themselves out' of the risks of insecure supply. Such a practice may marginalise the poor, who do not have the capital to invest in rooftop solar PV or alternative forms of energy generation and are increasingly unable to afford rising costs of electricity supply.

Finally, in South Africa there is a recognition that the conventional supply-demand paradigm of electricity at the national level and elsewhere is shifting. This, it has been argued forms, part of a global transformation in the way in which electricity is generated and consumed and offers new opportunities and challenges for both consumers and producers of energy and is resulting in new regulatory models (PWC, 2014). The key question is whether new modes of power

generation and consumption that are emerging in South Africa have the potential to disrupt Eskom's business model and the institutional structure in which it has evolved, and whether Eskom as a key element in the country's MEC is subject to change. Finally, will shifts in the electricity sector herald fundamental changes to the economy, to society and to the environment, or will emissions continue to rise as established technologies and interests continue to dominate in the electricity sector in particular and the energy sector more broadly?

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Annex: Eskom's financing

Eskom's capital expenditure programme is being funded by debt raised by Eskom, the utility's internally generated cash flows, contributions from National Treasury; electricity tariff increases, a 2009 loan from the African Development Bank of €1.86 billion (about \$2.63 billion) which was co-financed with €1.22 billion from European Export Credit Agencies (AfDB 2009), and \$3.75 billion from the World Bank and other bilateral donors approved in 2010 as part of the 'Eskom Investment Support Project'. Eskom also received a R60 billion subordinated loan from the South African government in 2009 and a R176 billion guarantee facility, of which the latter was extended by another R174-billion to a total of R350-billion in late 2010 (Donnelly, 2011), as well as a R23bn equity injection in 2015.

Prior to the pursuit of these funds, Eskom's income was determined almost entirely by the regulated tariffs for its electricity sales. In recent years the Regulator has approved significant tariff increases, albeit below the amounts applied for by Eskom. Tariffs are regulated by Nersa through the multi-year price determination process. Nersa considers Eskom's application and approves itemised expenditure for capital plant, primary fuel, salaries, demand side management programmes, electricity purchases (including imports or 'buy-backs', i.e. payments to large users to cease production) and other operating expenditure. Along with a return on assets, this makes up the revenue requirement for a given year. Eskom then needs to account to Nersa for expenditure under these items. The effective tariff is meant to cover costs, including a profit for the sole shareholder (government, as represented by the DPE) to reward it for its capital investment, and also to ensure that capital is valued. The revenue allocated is used to set generation, transmission wholesale, retail and distribution tariffs, according to the Electricity Pricing Policy (DME, 2008) and interpretation of the policy by Nersa. Such an arrangement provides significant discretion to Nersa. In the 1990s, the Eskom price compact with National Energy Regulator, Nersa's predecessor, resulted in the real price of electricity falling for several years. Tariffs are now, and continue to be, below full cost-reflectivity but have also increased sharply under the MYPD application rounds in response to the revaluing of Eskom's asset base, and increasing operational costs especially a large increase coal prices, and a very large capital expansion programme largely to make up a shortfall in supply capacity costs.

Eskom's recent applications tariff increases under MYPD 2 and 3 have resulted in revenue significantly lower than applied for, leading Eskom to continue to refer to a 'hole' in its financing to the tune of R250 billion in 2013 (FIN24 22 October, 2014). Under MYPD 2 (2010/2011-2012/2013), Eskom requested tariff increases of 35% per annum and was awarded tariff increases of 24.8%, 25.8% and 25.9% (Nersa, 2010). When Eskom applied for tariff increases under MYPD 3 (2013/14-2017/18), it requested year on year increases of around 16%²³, but was awarded only 8% per annum and a total approved revenue of R906 553 million. The shortfalls in tariffs have severely impacted Eskom's finances.

In January 2015 Eskom's financial crisis became particularly acute, with questions over whether Eskom would be able to make primary fuel purchases. This led to a government bailout which came in two parts. The first in the form of an equity injection of R23 billion, to be spent over a five year period which was to be raised from the sale of government's 'non-strategic assets' under the Eskom Special Appropriation Act²⁴ (Act 7 of 2015). The second part was the conversion of a R60 billion subordinated loan, paid between 2008 to 2011 and converted into equity under the Eskom Subordinated Loan Special Appropriation Amendment Act²⁵ (Act 6 of 2015). The R23 billion made provision for cash flow to allow Eskom to continue operations and the conversion of the loan to equity improved Eskom's financial position to allow it to raise debt for its capital expansion programme. However, a funding plan remains outstanding to

²³ 16.07%, 15.95%, 16.19%, 15.89%, 16.04% over the period (Eskom, 2012).

²⁴ In mid-June 2015 Finance Minister Nhlanhla Nene tabled in parliament the Eskom Appropriation Bill which would allow the utility to convert a R60 billion (\$5 billion) subordinated loan from government paid between 2008 and 2011 into equity (ESI-Africa 5 June, 2015). The rationale for doing so is that it will strengthen the utility's balance sheet (Creamer, 5 June, 2015).

²⁵ The Amendment Bill (Creamer, 04 June, 2015) will enable the respective appropriation of the R23-billion allocated to the power utility.

bridge the gap between revenue allocated by Nersa and Eskom's budget estimates for the next five years in the order of R250 billion (FIN24 22 October, 2014).

In April 2015 Eskom made an application to Nersa for additional tariff increases from the country's consumers for the period 1 April 2015 until 30 June 2018 through a 'selective tariff re-opener'. This sought to receive an additional R16.8 billion per year for three years (R50.4 in total) and requested: an additional R32.9 billion to pay for the additional diesel currently capped at R1.5 billion per annum; R5.3-billion per year to pay for the short-term power purchase programme²⁶ contracts (Yelland, 2015); and a proposed 2.5c/kWh increase in the environmental levy. This would raise the tariff increase by a further 12.6% in addition to the 12.7% that was approved in April 2015 until April 2018 (Creamer 2 June, 2015). The hikes were opposed by business (Creamer 18 June, 2015b) and unions (Fin24 17 June, 2015) alike, as well as civil society. Nersa denied the request, arguing that Eskom needed to make a complete application for a full tariff re-opener.

Eskom's financial crisis is further exacerbated by the costs of Eskom's Medupi and Kusile power plants which have increased significantly since they were announced in 2005. The final cost remains unknown for both plants given the uncertainties around delays and Eskom's cost of capital. Medupi is expected to be fully commissioned in 2021 and Kusile only in 2022 (Le Cordeur, 2015). As things stand, the costs of both power plants will not compare favourably with REIPPPP prices which as demonstrated in Section 7 have fallen substantially throughout the four bidding rounds, nor with the anticipated prices of new smaller-scale coal IPPs. The coal baseload programme is capped at R0.82/kWh (in April 2014 Rand) (DoE, 2014). Eskom's average tariff for 2015/16 is R0.79c/kWh (Eskom, 2015b: 28), which means that the renewable energy projects in the more recent rounds have now either reached or are close to reaching grid parity.

²⁶ Power purchased from independent power producers in order to meet the generation shortfall.