TRADE & INDUSTRIAL POLICY STRATEGIES

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Electricity supply in South Africa: Path dependency or decarbonisation?

OVERVIEW

Renewable energy technologies have experienced an exponential growth in South Africa, thanks to the procurement of large-scale power plants. However, South Africa's electricity sector still lacks a level playing field. Significant vested interests have maintained overwhelming support for centralised, coal-based electricity generation, preventing the development of renewable energy technologies to their optimal potential. Active efforts are required to enhance the transformation of electricity supply in the country by truly incorporating the low-carbon transition in electricity planning, opening the policy space for the development of embedded generation, and phasing out fossil fuel subsidies.

Trade & Industrial Policy Strategies (TIPS) is a research organisation that facilitates policy development and dialogue across three focus areas: trade and industrial policy, inequality and economic inclusion, and sustainable growth

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Policy Brief
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INTRODUCTION

Renewable energy technologies have experienced an exponential growth globally from 800 GW of generation capacity in 2004 to 1 712 GW in 2014 (REN21, 2015). Forecasts predict that renewable energy technologies, predominantly solar- and wind-based systems, will further grow in the coming decades, overcoming coal-based electricity around 2030 (IEA, 2015). South Africa is no exception and renewable energy has entered the country's electricity landscape as a significant trend. However, despite recent progress, the full potential associated with renewable energy technologies has yet to be harnessed. Indeed, the country remains far from demonstrating a strong, long-term commitment to developing renewable energy technologies.

Government's initial steps to introduce renewable energy technologies in the electricity sector have been seminal. The commissioning of renewable energy-based electricity generation capacity was a clear policy choice set by the 2003 White Paper on Renewable Energy and introduced in the 2010 Integrated Resource Plan for Electricity (IRP 2010). This is particularly important as electricity supply accounts for about 60% of the country's direct greenhouse gas (GHG) emissions (DEA, 2013). Since 2011, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has procured 6 376 MW of generation capacity, with more than 2 500 MW already operational. The programme has already triggered close to R200 billion of investment in the country, including R31.6 billion from South Africa's development finance institutions and state-owned enterprises (DoE et al, 2016).

A number of municipalities have also moved forward with the active promotion of solar photovoltaic systems for municipal, residential and commercial buildings.

Against these promising developments, South Africa's electricity sector lacks a level playing field. Significant vested interests have maintained overwhelming support for centralised, coal-based electricity generation, through energy planning, procurement, subsidies and support programmes. These have in turn prevented the development of renewable energy technologies to their necessary level (from a socio-environmental perspective) and their techno-economic potential. A better understanding of the full extent of the often hidden support that goes towards coal-based electricity generation has policy implications, including areas where more support needs to be given to the renewable energy sector.

CONSERVATIVE ENERGY PLANNING

At the energy planning level, much room exists to fully harness the techno-economic potential of renewable energy technologies, particularly for large-scale generation, and raise the commitment to the ambition of the country's climate change mitigation goals. It has been previously argued that the IRP 2010 fails to set the country's electricity sector on a sustainable development path.[1]

While the IRP factors in the transition to a lower-carbon and more environmentally-friendly energy mix, the persistent domination of coal-based electricity remains at its core. Indeed, the IRP 2010 relies on a cost-optimised scenario developed under a carbon emission constraint of 275 million metric tons of carbon dioxide equivalent ($MtCO_2e$) per year from 2025 for the electricity sector, incorporating localisation objectives and bringing forward the roll-out of renewable energy technologies. As a result, the IRP 2010 provides for an increase of the share of renewable energy technologies from 0% in 2010 to 9% of electricity production in 2030 and a reduction of the share of coal-based electricity from 90% to 65% over the same period (DoE, 2011).[2]

This does not, however, correspond to an absolute decline in the importance of coal in the country, or even a stabilisation. Coal-based electricity is expected to grow in megawatt of generation capacity, notably with the construction of the two large-scale Medupi and Kusile power plants. Correspondingly, coal-based electricity generation is planned to increase over the 2010-2030 period from 235 gigawatt-hour (GWh) to 295 GWh per annum over the 2010-2030 period (DoE, 2011).

Furthermore, the 2013 IRP update, which was never adopted, acknowledges that the cap of 275 $MtCO_2e$ per annum for electricity, set in the IRP 2010, is clearly insufficient for the sector to be in line with the country's climate change commitment (DoE, 2013). While keeping the IRP 2010 target as its base, the 2013 review proposes more aggressive scenarios aimed at setting the electricity sector on a genuine low-carbon development path compatible with the country's objectives.

These scenarios suggest substantial changes to the supply mix, as illustrated in Figure 1. Most notably, they include much greater generation capacity from nuclear energy and renewable energy technologies and a reduction in the role of coal-fired power plants. In terms of price implications, the scenarios demonstrate a comparable price path, with the exception of the most stringent "carbon budget" scenario which results in slightly higher prices (DoE, 2013).

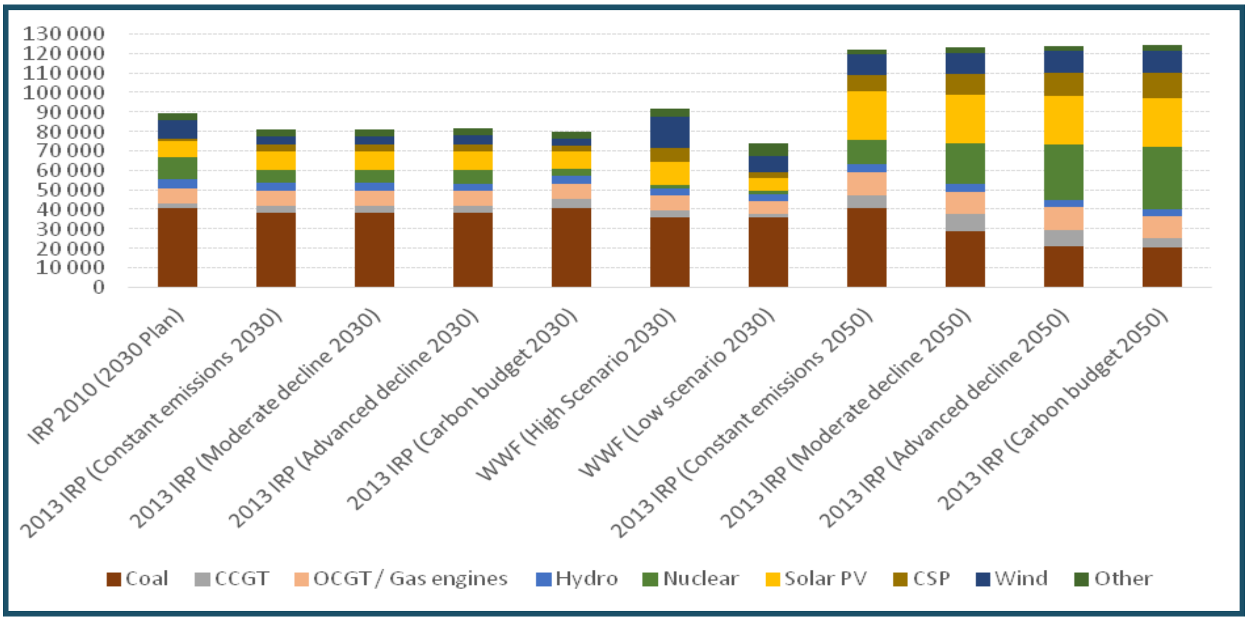
The Draft 2016 IRP, published in November 2016, presented an update only of the 2010 base case, providing little clarity on the way forward (DoE, 2016). While the final plan is likely to differ materially, the Draft 2016 IRP fails to level the playing field. It puts unnecessary limits on solar photovoltaic- and wind-based technologies and does not follow the adequate carbon budget for the power sector, as recommended by the Department of Environmental Affairs.

Other modelling exercises also suggest the necessity and possibility of further decarbonising the country's electricity supply by increasing the share of renewable energy technologies, as also illustrated in Figure 1. This increased renewable energy contribution moreover results in an average system generation cost that is lower than the current IRP base case as well as better system outcomes (in terms of unserved electricity, resilience to changes in demand and cost

[1] See Montmasson-Clair and Ryan (2014a) for a detailed review of the IRP 2010.

[2] The remainder is largely allocated to nuclear power which increases from 5% in 2010 to 20% in 2030. The share of hydropower remains constant at 5% while gas-based technologies are virtually ignored.

Figure 1: Electricity mix (in megawatt of generation capacity) in 2030 and 2050 according to different scenarios



Source: Author's composition, based on data from DoE, 2011; DoE, 2013; Sager, 2014; and Gauché et al, 2015.
Note: CCGT stands for combined cycle gas turbine; OCGT stands for open cycle gas turbine; CSP stands for concentrated solar power; 'Other' notably includes pumped storage capacity.

> ***In the current policy and regulatory setting, the opportunity to invest in a power plant outside of the government-run programme is limited.***

predictability) (Gauché et al, 2015; Sager, 2014; Wright et al, 2016). Most notably, after only five years of government support, renewable energy technologies have proved increasingly cost-competitive, reaching levels, similar to, if not lower than, coal-fired power plants (DoE et al, 2016).

CONSTRAINING POLICY AND INSTITUTIONAL DYNAMICS

The lack of ambition for climate change mitigation of the country's electricity planning is a paramount problem due to its domination over the development of the supply industry in South Africa. Indeed, beyond the plans included in the IRP, the development of renewable energy technologies in extremely constrained in South Africa.

The rollout of renewable energy technologies is mostly restrained to the government-run REIPPPP, linked to the IRP process. While the programme has constituted a stepping stone for renewable energy technologies in the country, which were virtually non-existent in the country before 2011, it has had no real impact on competition *in* the electricity market, only introducing competition *for* a limited, defined market (Montmasson-Clair and Das Nair, 2015).

The REIPPPP has also introduced conditions and requirements materially more stringent than for other energy infrastructure projects. The programme has constituted a welcome opportunity to increase developmental benefits associated with infrastructure projects, by including enhanced socio-economic objectives in the project evaluation process. These account for 30% of the project evaluation, along with price (70%). These enhanced requirements have, however, not been without challenges for project developers, financiers and government alike, and particularly for community development (DoE et al, 2016). Renewable energy projects will be at a price disadvantage until socio-economic requirements are mainstreamed throughout the industry and a levelled playing field is established in the electricity sector.

In addition, Eskom remains a vertically-integrated utility controlling the transmission infrastructure and the quasi-totality of generation capacity. It has significant interests vested in maintaining the status quo and little incentive to treat competition, i.e. the Independent Power Producers (IPPs), fairly. In 2015, uncertainty arose around the issuance by Eskom of budget quotes, which are a prerequisite for IPPs' bids to reach financial close, for the connection of new renewable energy IPPs to the grid. The utility has displayed a strong reluctance to provide such budget quotes from 2015 (beyond Bid Window 3 of the REIPPPP) (Slabbert, 2015). Further resistance occurred in 2016 with Eskom's CEO publically indicating its unwillingness of sign further power purchase agreements (PPAs) with IPPs beyond Bid Window 4.5 of the REIPPPP (Creamer, 2016). This is arguably considered as a negotiation strategy to slow the development of IPPs and obtain additional funds from the regulator.

Apart from the IPP procurement programme, the most prominent attempt aimed at opening the electricity supply industry has been the proposed Independent System and Market Operator (ISMO) Bill. Aimed at introducing an unbundled ISMO (i.e. outside of Eskom) to invest, operate and maintain the country's high voltage transmission grid, the Bill was proposed to unlock the potential of IPPs. It would empower IPPs to sell electricity directly to third-party consumers, such as mining and industrial complexes, and provide the platform for South African companies to generate their own electricity and sell potential surplus to the utility and a third party. The Bill has effectively been stalled in Parliament since 2011 and is arguably dead. Establishing an independent system and market operator is therefore likely to remain muted in the short to medium term, and will protect Eskom's dominant position (Das Nair et al, 2014).

In the current policy and regulatory setting, the opportunity to invest in a power plant outside of the government-run programme is limited (Montmasson-Clair and Ryan, 2014b). The available options are to invest in off-grid generation (for self-use or dedicated buyers), which is generally risky, inconvenient and high-priced; or participate in Government's procurement programme, which does not allow self-use. Large-scale grid-tied projects for self-use (by firms or municipalities) are virtually non-existent due to financial limitations, the necessity to be included in the IRP, obtain a generation licence from the National Energy Regulator of South Africa (NERSA) (or a ministerial exemption) and strike an *ad hoc* power purchasing agreements with Eskom.

Similarly, the development of small-scale embedded generation is muted (Montmasson-Clair et al., 2017). The rollout of renewable energy technologies at the local level is aligned with South Africa's energy policies and a number of options are technically available. However, the absence of policies and statutes defining and regulating the role of municipalities as energy generators or procurers has hindered any meaningful development. Municipalities only have the possibility of installing solar photovoltaic-based, small-scale embedded generation on municipal buildings for self-use.

Procuring electricity from small-scale embedded generators, such as households and businesses, is extremely constrained. While some municipalities, such as Cape Town and Drakenstein in the Western Cape, have moved ahead, no regulatory framework is in place to promote the development of small-scale embedded generation. The framework for embedded generation and conditions for municipalities to purchase excess electricity from generators, which have been delayed for a number of years, are yet to be determined by the DoE and NERSA. In addition, issues related to electricity pricing and municipalities' funding model, which can constitute key hindering factors, are still to be resolved.

Furthermore, electricity trading has been at its infancy, and despite successful experimentation with POWERX (previously known as Amatola Green Power) since 2009, the entity remains the only independent electricity trader in the country. The model is limited under current NERSA rules which hinder municipalities from playing a larger electricity trading role (Montmasson-Clair et al, 2017).

CONTINUAL SUPPORT FOR COAL

Not only is the policy environment constrained for renewable energy, but the coal value chain continues to receive significant governmental support despite its highly established status. Although coal-related subsidies have been significantly reduced in the country over the past few years, notably through the increase in electricity prices, and include a share for the support of low-income households, substantial support is still directed to the development of fossil fuels in South Africa.

The exact amount of fossil fuel subsidies provided in South Africa is difficult to ascertain and numbers largely diverge. Their scale nevertheless remains impressive. The International Energy Agency identified around US$1.4 billion (or 0.3% of GDP) in consumer subsidies for 2011 in South Africa (down from more than US$5 billion in 2007), essentially for coal-fired electricity, representing an average subsidisation rate of 4.6%. (OECD, 2013).

According to International Monetary Fund data, South Africa's energy sector benefitted in 2015 from substantial subsidies, including US$2.5 billion in pre-tax subsidy and US$5.4 billion in foregone consumption tax revenue. Direct subsidies, in the form of pre-tax subsidies and foregone consumption tax revenue, amounted to 2.2% of GDP. Indirect subsidies linked to externalities associated with fossil fuels, such as global warming, air pollution, congestion, accidents and road damage costs, reached US$38.5 billion or 10.9% of GDP, as illustrated in Table 1. Altogether, pre- and post-tax subsidies totalled US$46.4 billion or 13.2% of GDP. Most of these subsidies were allocated to coal (52.0%) and petroleum (37.8%), followed by electricity (9.2%) and natural gas (0.9%). South Africa is the fifth largest provider of coal subsidies in percentage of GDP terms.

Indeed, significant public money is spent to support the development of coal-based electricity and other fossil fuels. Despite recent tariff increases, energy-intensive industries have historically developed thanks to under-priced, coal-based electricity. This is particularly true for aluminium smelters under a long-term special pricing arrangement linked to the metal price and the US$/ZAR exchange rate (TIPS, 2013). South Africa's public development finance for fossil fuels totalled US$852 million between 2013 and 2014, i.e. US$425 million per annum on average. Furthermore, direct government budgetary transfers included US$8 million per annum for research and development (R&D) on hydraulic fracturing and carbon capture and storage and US$12 million for oil

Table 1: South Africa's direct and indirect fossil fuel subsidies

Indicators	Pre-tax subsidies	Foregone consump-tion tax revenue	Untaxed externalities					Total subsidies
			Global warming	Local air pollution	Conges-tion	Acci-dents	Road damage	
2013 subsidies in US$ billion (nominal)	2.52	5.79	17.80	7.73	3.25	5.27	0.09	42.45
2013 subsidies (% of GDP)	0.72	1.65	5.07	2.20	0.93	1.50	0.03	12.10
2015 subsidies in US$ billion (nominal)	2.51	5.37	20.34	8.37	3.67	6.01	0.10	46.38
2015 subsidies (% of GDP)	0.71	1.52	5.77	2.37	1.04	1.71	0.03	13.16

Source: Author's composition, based on IMF data downloaded in August 2016 at http://www.imf.org/external/np/fad/subsidies/data/codata.xlsx.

and gas exploration. Like the renewable energy industry, fossil fuel-based industries also benefit from tax incentives, such as tax deductions for exploration and R&D, and accelerated depreciation for capital exploration activities (Garg and Kitson, 2015).

In addition to the mammoth investments in coal-fired power plants, the coal sector benefits from substantial public investment through one of the government-led Strategic Integrated Projects (SIPs), which is aimed at unlocking the northern mineral belt (with Waterberg in Limpopo as the catalyst). Public investment just in water infrastructure (R3.1 billion for the De Hoop dam[3], R1.9 billion for a new bulk water scheme from Magalies to the Waterberg) and transport infrastructure (R45.5 billion and R8.9 billon for the two-step expansion of the Richards Bay coal line, R5.1 billion for the proposed Waterberg rail project) provide an indication of the scale of resources allocated in support of the coal industry in South Africa (TIPS, 2015).

CONCLUSION

The electricity sector in South Africa is a highly contested space. The emergence of renewable energy technologies (along with energy efficiency and other demand-side management opportunities) has generated healthy revitalisation and disturbance of the status quo in the industry. Discussions around other technologies, such as gas-to-power and nuclear energy, are also adding to this vibrant dynamics. Significant vested interests are still at play alongside massive state support to maintain the domination of the coal industry over the electricity supply industry in South Africa.

Active efforts are required to provide a level playing field for all energy technologies and enhance the transformation of electricity supply in the country. This includes truly incorporating the low-carbon transition in electricity planning, open the policy space for the development of embedded generation and phase out fossil fuel subsidies.

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[3] While the De Hoop dam was primarily built to service platinum mining, the coal industry has also benefitted from the infrastructure.