



REAL ECONOMY INSIGHT: ELECTRICITY

JUNE 2015

Real Economy Insight: Electricity

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South Africa's power system is extremely constrained and vulnerable, owing to decades of underinvestment in ageing power plants and delays in the completion of major new power stations. The power deficit has forced State-owned power utility Eskom to resort to rotational load-shedding, which Public Enterprises Minister Lynne Brown has warned will be instituted for two years.

Eskom has delayed critical maintenance over the past six years by relentlessly operating its generating fleet to meet demand ahead of the introduction of new capacity. The maintenance backlog caused plant availability to drop to about 65% last year. Since December 2014, the availability of plant performance has improved to about 70%, against a target of more than 80%, which Eskom aims to achieve in the next three years.

Plant breakdowns have resulted in a higher number of unplanned outages and, as a result, the utility's reserve capacity, which is considered adequate at 2 000 MW, has decreased significantly.

The poor performance of the existing coal-fired generation fleet was given as one of the main reasons for the suspension of former Eskom CEO Tshediso Matona and three other senior executives in March this year. The Eskom senior executives were suspended pending the outcome of an inquiry into the status of Eskom and its challenges.

Zola Tsotsi, who ordered the investigation, resigned as chairperson on March 31, after concerns were raised about the procedure he had followed in appointing management consultant Nick Linnell to oversee the inquiry. Subsequent to Tsotsi's resignation, the Eskom board has agreed to new terms of reference for the investigation, which will focus on Eskom's finances and maintenance protocols, as well as diesel costs, and coal supply and costs. It also appointed global law firm Dentons to lead the inquiry.

Matona and Eskom have since mutually agreed to part ways on an amicable basis.

Eskom maintenance interventions

Following an analysis of its generation assets, Eskom has broken the performance of its 121 producing units into four colour-coded categories: good (green), not so good (yellow), bad (orange) and very bad (red). Only 49 units are in the green, with 14 falling into the yellow category, 26 in the orange category and 32 in the red category.

The net result is that the energy availability factor (EAF) across the fleet has fallen from 90% in 2001, to about 70%, with unplanned breakdowns having surged to about 15% the 2014/15 summer.

To halt its maintenance backlog, Eskom is pursuing a three-year maintenance plan, which is focusing on halting the unplanned losses in 2015/16; stabilising the EAF in 2016/17; and shifting the balance between proactive and reactive maintenance from 2017/18 onwards.

The utility is facilitating the programme by operating and maintain the generation assets to agreed "availabilities, capacities, reliabilities and efficiencies".

It involves 14 project interventions, ranging from deploying maintenance engineers from head office to the actual power stations to improving outage planning and management. However, the plan does not involve a major increase in the volume of planned maintenance, which has been increased from 7% to 10% instead of the 15% level initially envisaged. This is because Eskom's analysis indicates that it does not have the people, the parts and spares, the finances or the reserve margin to make such a step change.

Instead, its focus is on improving the quality of its maintenance through improving planning processes and project execution. The theory is that, once Eskom has reduced the capacity lost, it will have more space available for proactive maintenance, which will trigger a virtuous circle and shift in the balance in favour of proactive and preventative activities.

Source: *Engineering News*

The suspension of the senior executives and the departure of the chairperson have thrown the Eskom leadership into a state of turmoil, which Brown stabilised in April with the appointment of Transnet CEO Brian Molefe as acting Eskom CEO for one year. Upon his appointment, Molefe stated that his immediate focus would be to improve the efficiency of the coal fleet and that his medium-term focus would be to introduce alternative energy sources into the coal-heavy electricity mix.

The board also appointed Dr Ben Ngubane as interim chairperson from March 31.

Eskom financial status and tariffs

The operational crisis at Eskom is placing financial strain on the utility. Government has provided a R60-billion subordinated loan, which it supplemented with commitments to provide a further R23-billion in funding, which will be paid in three instalments, with the first transfer to be made in June 2015.

While the financial support will help to meet Eskom's short-term needs, the utility has long maintained that cost-reflective tariffs are imperative to secure its long-term health. Lower-than-requested tariff increases in the third multiyear price determination (MYPD3) period have left Eskom with a R225-billion revenue shortfall over the five-year period to 2018. Although Eskom had applied for yearly increases of 16% in 2013, the National Energy Regulator of South Africa (Nersa) granted an 8% yearly tariff increase for the MYPD3.

In May this year, Eskom applied to Nersa for the selective reopening of the final three years of the MYPD3 period. Should the application be approved, the 2015/16 increase will surge to 25.3%, inclusive of the 12.7% already granted for the current financial year. Eskom attributed 10.1% of the additional increase to the extra costs associated with the diesel it uses to operate the open-cycle gas turbine (OCGT) plants for extended periods, as well as the extension of short-term power purchase agreements with independent power producers (IPPs). The balance of the increase relates to the 2c/kWh environmental levy increase announced in the 2015 Budget.

Nersa will announce its decision on Eskom's application on June 29, 2015.

To improve its financial position, Eskom has proposed bypassing municipalities and installing prepaid electricity systems. Municipalities owe Eskom

R25-billion, which Molefe says could have been part of the utility's working capital if electricity was prepaid. In April 2015, Eskom indicated that it planned to disconnect supply to 20 defaulting municipalities that collectively owe Eskom about R4-billion. Cooperative Governance and Traditional Affairs Minister Pravin Gordhan has since said that the mayors of the affected municipalities have agreed that the debt should be settled. By early June 2015, all but three of the top defaulting municipalities had settled their outstanding dues.

In light of Eskom's financial position and its inability to guarantee supply, support for privatising the State-owned power utility has been increasing. National Treasury has confirmed that it is considering the possibility of ring-fencing and selling stakes in Eskom's noncore businesses or power stations, as well as Eskom's business as a whole. Strategic private-sector investment will provide immediate cash to strengthen Eskom's financial position and will enable the utility to harness technical expertise to improve the performance of the power system. The State will retain control of the company.

Several groups, including opposition parties, such as the Democratic Alliance, have long advocated for Eskom's privatisation, while labour unions, which believe that privatisation is a threat to jobs, have said they will oppose any proposal to partially privatise the utility.

Eskom capacity expansion

Eskom's capacity expansion programme started in 2005 and will be completed in 2021, increasing generating capacity by 17 384 MW, transmission lines by 9 756 km and substation capacity to 42 470 MVA. To date, about 6 238 MW of new capacity has been added, and 5 814 km of transmission lines and 29 655 MVA of substation capacity have been installed.

Source: Eskom

The failure to keep Eskom's capacity expansion programme on schedule, particularly its three largest new build projects – the Medupi and Kusile coal-fired power stations and the Ingula pumped-storage scheme – has contributed significantly to the utility's operational woes.

The 4 764 MW Medupi power station, in Limpopo, is the most advanced of the three projects, although it has been characterised by numerous technical problems and labour disruptions since construction started in

2007. Eskom originally expected to synchronise Unit 6 – the first 794 MW unit of the plant – in 2011, but reached this milestone only on March 2, 2015. Once the other five units are completed, the power station will represent 12% of Eskom's installed capacity.

The 4 800 MW Kusile power station, in Mpumalanga, is adjacent to the existing Kendal power station. Like Medupi, the Kusile project is also much delayed. The completion of the first 800 MW unit was initially scheduled for mid-2013, but is now expected to be synchronised in the first half of 2017, entering commercial operations by the second half of that year.

The Ingula project is a 1 332 MW pumped-storage power scheme, straddling the border of the Free State and KwaZulu-Natal. The project suffered a major setback in 2013, when a fatal accident halted work on the site for 12 months, delaying the commissioning of the first unit to the first half of 2016.

While the Medupi, Kusile and Ingula projects are behind schedule, the Sere wind farm, in the Western Cape, achieved its full generating capacity of 100 MW at the end of January – two months ahead of the targeted date of the end of March 2015.

Independent power producers

South Africa's current electricity situation has placed a renewed focus on IPPs. By 2022, an additional 17 000 MW of IPP capacity will have been added to the national grid from renewable-energy, cogeneration, coal and gas sources, with the Department of Energy (DoE) set to procure the capacity at a rate of 2 400 MW/y.

Since 2011, the DoE IPP Office has procured 5 243 MW of renewable energy from 79 projects in four bidding rounds of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). Of these projects, 37 have been connected to the national grid, representing 1 827 MW of capacity. By mid-2016, 47 projects should be operational and produce at full capacity.

The most recent bid round – window four – presented the IPP Office with 77 projects, 13 of which were selected as preferred bidders. The DoE plans to name additional preferred bidders under this bid window and will also allow unsuccessful bidders from previous rounds to bid for 1 800 MW of capacity.

Renewable-energy tariffs have improved significantly in the four bidding rounds. In April 2014 terms, the average

Window four preferred bidders			
Technology	Number of bids	MW taken by preferred bidders	Maximum allocation for window
Solar photovoltaic	6	415 MW	400 MW
Onshore wind	5	676 MW	590 MW
Concentrated solar power	N/A	N/A	
Small hydro (<40 MW)	1	5 MW	60 MW
Landfill gas	–	–	15 MW
Biomass	1	25 MW	40 MW
Biogas	N/A	N/A	
Total	13	1 121 MW	1 105 MW

Source: Department of Energy, REIPPPP window four announcement

per kilowatt hour tariff for onshore wind has declined by 55% to an average of 62c, while the solar photovoltaic tariff has declined by 76% to 79c. Prices for wind power in round four are understood to have fallen to an average of 62c/kWh, which is a market improvement on the prices of more than R1/MW achieved during the first bid window.

Some renewable-energy investors have warned that South Africa's prices are becoming "dangerously low" and have urged government to ensure that the REIPPPP sustains an appropriate balance between risk and reward.

To maintain the momentum of the REIPPPP, which has facilitated R170-billion in capital investment in South Africa, the DoE has submitted a determination to Nersa for an additional 6 300 MW of renewable-energy capacity.

A small projects IPP programme is also under way, aiming to procure electricity from renewable-energy projects ranging from 1 MW to 5 MW. A total of 29 bids have been submitted, totalling 139 MW.

Grid connections have emerged as a major constraint and Eskom has confirmed that it is increasingly difficult and expensive to integrate IPP projects, with the easy-to-connect projects having been selected during the first two bid windows. Eskom has introduced a self-build policy and is encouraging IPPs to fund connections to the national grid themselves.

The IPP Office is redesigning the REIPPPP request for proposal (RFP) documents, which will take into account, among other aspects, the distribution and transmission system constraints.

Extending its IPP procurement reach beyond renewable energy, the DoE intends to procure electricity generated from gas, coal and cogeneration plants, as well as from hydroelectric sources in South Africa and sub-Saharan Africa. In line with Gazetted determinations, government will procure at least 800 MW of cogenerated capacity, 2 500 MW of coal-fired baseload capacity, 3 126 MW of natural gas capacity and 2 609 MW of domestic and hydro-electricity capacity.

However, the DoE has indicated that the cogeneration allocation could be adjusted upwards and has submitted a new determination for 1 800 MW of cogeneration to Nersa for concurrence.

The DoE issued a notice of a request for bids (RFB) for cogeneration capacity in June 2015. The IPP Office will consider combined heat and power generation projects, as well as waste-to-energy and industrial biomass developments.

The RFB does not indicate an allocation between the technologies. It also does not stipulate a bidding closing date; however, Energy Minister Tina Joemat-Pettersson has indicated that the cogeneration bidding process will be pursued under a model aimed at expediting the approval process and financial close of projects.

The IPP Office is also overseeing the coal baseload IPP programme, which is targeting power stations with a maximum size of 600 MW a project. The RFP, under which 1 600 MW of capacity will be procured in the first bidding round, was issued in December 2014. The first coal IPP bid window was initially scheduled to close in June 2015, but it was extended to the end of August. Preferred bidders will be announced before the end of this calendar year.

The DoE has further released a request for information (RFI) for gas-fired generation, the outcome of which will guide the design of a 3 126 MW gas-to-power procurement programme. The RFP for the programme should be released to the market in September 2015, with a bid submission phase planned for the first quarter of 2016.

Demand-side initiatives

Eskom halted its demand-side management (DSM) expenditure in 2014/15, owing to funding uncertainty. The utility has since moved to restart the scheme, setting a savings target of 975 MW for the coming two years.

The utility is aiming to achieve more than 500 MW of savings from incentivising mining and industrial



Picture by Duane Daws

companies for projects that either reduce demand or shift consumption from peak periods. It will focus on a small number of large projects, rather than following the previous model that incentivised a large number of small projects.

Eskom will target savings of 455 MW through the mass replacement of household light bulbs with energy-saving bulbs.

It has set aside R1.7-billion for the implementation of the DSM programme and intends to spend about 90% of the budget in the current financial year and during 2016/17.

Meanwhile, South Africa is also pursuing a solar water heater (SWH) programme to reduce demand on the grid. The DoE took over the responsibility of implementing the programme from Eskom on February 1, 2015. The

department aims to accelerate the installation of SWHs with a new rebate system, and subsidies for local content.

The DoE is also gathering information on the potential for demand reduction, load shifting and energy efficiency initiatives. In response to an RFI, the IPP Office received 150 responses, 27 of which are classified as immediate opportunities and 42 as medium-term opportunities. A procurement programme is expected to be launched during the second half of 2015.

Energy planning

The Energy Minister said in May that government had accelerated the Integrated Energy Plan (IEP), which would inform the future energy mix and prioritise policy interventions, but she did not give an indication of



Picture by Duane Daws

when Cabinet was likely to approve the plan. Cabinet approved a draft version of the IEP in July 2013.

It is understood that the IEP has to be completed before government will update the Integrated Resources Plan (IRP), which outlines the country's electricity requirements. The IRP is supposed to be updated every two years and was revised in 2013. However, Cabinet has not yet approved the update, which was published in December 2013, making the now-outdated policy-adjusted IRP, or IRP2010, still the framework informing investment decisions in the electricity sector.

The DoE is also finalising a Gas Utilisation Master Plan, which will guide gas-related infrastructure decision-making and will pave the way for the 3 126 MW envisioned gas-to-power procurement programme. The plan will be released for public comment in the July-to-September quarter.

A National Energy Efficiency Strategy and Action Plan is also being finalised. Draft regulations have been published for compulsory energy management plans to be put in place by targeted end-users.

Nuclear procurement

The IRP2010, which remains the official policy document until it is replaced by a full iteration, recommends 9 600 MW of additional nuclear power. Joemat-Pettersson has announced that the nuclear procurement process would start in the July-to-September quarter of 2015.

The outcome of this process will be presented to Cabinet by the end of 2015. Government plans to connect the first nuclear unit to the grid by 2023.

Workshops have been completed with representatives of Canada, China, France, Japan, Russia, South Korea and the US, with nuclear vendors from those countries having shown an interest in participating in South Africa's nuclear new build programme.

The IRP update of 2013 recommended that additional nuclear capacity be delayed or abandoned.

Outlook

The power system will be constrained for the foreseeable future, while Eskom is dealing with a large maintenance backlog on its coal-fired generation fleet and is working towards adding new capacity from its three major baseload projects.



Picture by Duane Daws

For 2015, there is a probability of load-shedding for 25% of the days in the year, or for over 90 out of 365 days. The risk is lower in winter when planned maintenance is reduced and the prospect of partial losses associated with high temperatures and wet coal falls.

New Eskom capacity, non-Eskom supply and demand-side management should bolster electricity supply in the medium term.

The utility's dispatchable installed capacity should increase to more than 45 000 MW, from 43 500 MW, next year, with the introduction of Medupi Unit 6 from July 2015, the introduction of DoE peaker projects late in 2015 and the introduction of the first unit of the Ingula scheme in early 2016.

Eskom is also considering procuring hydropower from the Kariba dam, in Zambia, thereby exploiting renewable-energy sources and importing energy supply on power barges to introduce about 4 800 MW of capacity in two years.

Turkish floating power plant group Karpowership has indicated that it is in a position to introduce about 500 MW of capacity into South Africa by the end of 2015 and as much as 2 000 MW within 18 months. The company claims that the powership solution could deliver a R43-billion saving when compared with the cost of operating OCGTs.

Not only will developments regarding Eskom's generation capacity be closely monitored but also progress regarding new electricity capacity from IPPs.

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