

Challenges for South Africa's Electricity Supply Industry



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The power crisis of early 2008 was an experience most South Africans are not likely to forget soon. The experience, and its lessons, must loom large in any discussion of the electricity supply industry and its challenges.

The months of rolling blackouts were a powerful reminder of the importance of keeping the lights on. Though much has changed since 2008, South Africa's power system remains constrained and will be for some years, until Eskom's large new power stations, Medupi and Kusile, deliver the capacity needed to relieve the shortage of supply. Keeping the lights on is therefore, arguably, the most immediate and pressing challenge for South Africa's electricity supply industry now and for the next few years. It is also key to the longer term prospects for the economy. A secure supply of electricity, at a cost which South Africa can afford, is essential if the economy is to sustain faster rates of investment and economic growth as well as to provide access to electricity for all¹.

At the same time, an industry which has been dominated by coal-fired power and by a single player – Eskom – must make the transition to more diverse sources of supply, and more diverse players. Diversifying the energy mix is important if the industry is to address the challenges of climate change. Bringing in new players will bring in new funding, technology and skills. But those transitions will take time and will have to be carefully managed.

Perhaps the biggest challenge then for the industry, and for the policymakers shaping it, will be that of finding the right balance between these imperatives – a secure supply of electricity now and in the future, a 'cleaner' and more sustainable supply, and all at a cost which is affordable for the country and pitched at a level which can attract the necessary investment in infrastructure.

And if keeping the lights on must be a priority, so too must switching lights off. Energy efficiency is one of the key issues that will shape the environment for the electricity supply industry and the capacity it will be required to deliver in decades to come.

Keeping the Lights On

The power crisis in 2008 was long in the making, and was the result of policy and regulatory uncertainty over the previous decade as much as of shortcomings in the management of the system².

Government policy in the late 1990s and into the early 2000s was that the electricity supply industry should be opened up to competition and that Eskom, therefore, should build no new power stations. However, the policy and regulatory frameworks were not put in place for private sector participation. Nor, crucially, were electricity tariffs at levels which could have given private investors the returns they needed to make investment in the sector attractive. It was recognised that

South Africa was going to need massive new investment in generating capacity to meet growth in demand. However, by the time the government retreated from privatisation and, in late 2004, gave Eskom the mandate to build, it was too late to bring big new baseload power stations on to the grid fast enough to prevent a shortfall in generating capacity.

The result was that by 2007, after a period of strong economic growth, the margin between supply and demand had fallen to levels which made the power system extremely vulnerable. The shortage of capacity, volatile operating performance, low coal stockpiles and unusually wet weather made it increasingly difficult to meet demand. Eskom resorted to national rotational ‘load shedding’ from late in 2007 to protect the power system from a total blackout, and a national emergency was declared on 25 January 2008. Load shedding continued until the end of March 2008, while Eskom initiated a recovery plan, with the support of government and business.

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Economic recession helped initially to provide the space for recovery, and Eskom has since 2008 made significant progress towards stabilising the power system. It has rebuilt coal stockpiles, added some new capacity to the grid and put a Demand Side Management programme which has achieved savings in electricity usage. It has also brought some capacity from Independent Power Producers (IPPs) in to the grid³.

Keeping the lights on has been a priority for Eskom since 2008, one which is included in its shareholder compact with government, since 2008. But until large new increments of supply are added to the grid once Eskom’s large new coal-fired power stations, Medupi and Kusile, start to come online, keeping the lights on cannot be taken for granted. Eskom has become adroit at managing a ‘tight’ power system, and is recognised by its international peers for this – especially given that other developing countries with inadequate supply, such as China and India, have had blackouts⁴. A pre-requisite has been very close co-ordination and alignment between the System Operator and Eskom’s Generation division. Also, increasingly, Eskom has relied on the strong relationships which it has built up, particularly since 2008, with its large mining and industrial customers.

The issue which has come to the fore, increasingly, is maintenance. Eskom’s power stations require an ever-increasing amount of routine maintenance, because most of them are in their mid-life, and because they have been run hard over the past few years to compensate for the shortage of capacity. However, doing that planned maintenance requires that units be taken out of service for shorter or longer periods of time, and in a situation of constrained supply, there often has not been the space to take units off, while also meeting demand, and keeping some capacity in reserve to cater for any unplanned events. In effect, in recent years, Eskom has kept the lights on in part by deferring non-essential or non-priority maintenance, with the System Operator and the Generation division working closely together to juggle requirements.

This is clearly not a sustainable strategy, and Eskom has made it a priority since 2011 to comply with its own maintenance schedule and address the backlog

which has built up. That requires running at higher levels of risk, with less in reserve to protect the system. And it means making more use of costly diesel-fired generating capacity⁵, as well as of options such as paying large customers to switch off.

It envisages that dependence on coal would fall from 90% to 65% by 2030, while renewables increase their share of the mix from 0% to 9% and nuclear's share from 5% to 23%, and it sees the private sector coming in to build 30% of the new capacity.

Lower demand would do much to reduce risk to the system, which is why Eskom has intensified its energy efficiency campaigns and, together with government, is calling for a 10% saving in electricity usage. One of the lessons of 2008 is that keeping the lights on is not a challenge that can be addressed by Eskom alone. Many of the measures required to curb demand and boost supply depend on support from government, whether in the form of policy or regulatory interventions, or in approvals from the

government, in its role as Eskom's shareholder. At the same time, reducing demand and making it more predictable requires support from customers. Political support and alignment are therefore essential to keeping the lights on, as are relationships with customers and other stakeholders.

Beyond Kusile

If keeping the lights on in the short to medium term is one challenge, doing so in the longer term is another. South Africa left it too late once before to start building the new power infrastructure it was going to need. There is, hopefully, more determination this time, on the part of government and the industry, not to let that happen again.

The government's Integrated Resource Plan 2010 to 2030 (IRP), which was promulgated in May 2011⁶, puts a framework in place for the first time that sets out the scale and mix of the new electricity capacity required over the next two decades. The plan would more than double the capacity of the system, and change the energy mix, and the mix of players, dramatically. It envisages that dependence on coal would fall from 90% to 65% by 2030, while renewables increase their share of the mix from 0% to 9% and nuclear's share from 5% to 23%, and it sees the private sector coming in to build 30% of the new capacity.

The IRP attempts to balance South Africa's various imperatives, for security of supply, affordability, economic growth and cutting its carbon footprint. It provides some certainty on what choices are being made and what the path will be for the industry in future, in terms of who will build and what will be built. It also gives an indication of where the electricity price should be to cover the cost of the investment in new capacity – which could be more than double the level at which electricity is priced currently.⁷

The issue now is implementation. Beyond Kusile – which should be completed in 2018 – there are no new committed build projects. That poses the risk that if decisions on new capacity in terms of the IRP are not taken soon, South Africa could again leave it too late to build. The IRP plans, for example, for substantial nuclear capacity to start coming on to the grid by 2023, and given the long lead times for nuclear build programmes, decisions will be required during 2012/2013.

Decisions on implementation are needed to clarify the eventual shape of South Africa's electricity supply industry, and so attract new investors. Achieving the objectives of the IRP, then, depends on early and clear decisions being taken on implementation of the plan and on ensuring that related areas of policy – such as tariff regulation – are aligned with the plan. It will depend too on a viable funding model. Putting a funding plan in place to ensure that Eskom's current new build programme could be completed has required extensive support from government, in the form of equity and guarantees, as well as tariff increases. Costing the IRP, and putting models in place to finance the public sector part of it in particular, will be key to its implementation.

Opening up the Industry to New Players

Implementing the IRP should, finally, start to bring in the new industry players on a significant scale, in line with what, at least in theory, has been government policy for some time. Even though Eskom was given the mandate to build new power stations in 2004, the government did not entirely retreat from its late 1990s intent to bring the private sector into electricity generation. The intention was that IPPs should build 30% of South Africa's new generation capacity. However, this received little attention until the 2008 power crisis.

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There is a perception that Eskom (and its shareholder) are averse to competition, and there may well have been an element of truth to that in the past. At the time when there was a surplus of power, there was certainly little incentive for Eskom to court competitors to its own under-utilised fleet. But even once it was clear that South Africa was going to need significant new investment in generation, price was a sticking point.

But if Eskom ever was averse to competition, the tightness of the power system has changed that, and Eskom has, increasingly, sought to sign up whatever non-Eskom generating capacity is available, from independent producers such as Sasol, as well as from those municipalities which had retained some generating capacity of their own.

However, Eskom is empowered only to sign short or medium contracts with private or municipal producers. Anything beyond that must be within the framework of the IRP and is subject to decisions by government. A first step to stimulating investment in new, non-Eskom generation has been taken with the Department of Energy's procurement of a first tranche of renewable energy from new independent producers. Eskom's role will be to connect the producers to the national grid and to buy the power from them, at rates which have been agreed by the Department but which the regulator will allow Eskom to pass through in the electricity tariff⁸

The big increments of new independent power still lie in the future. However, there has been a concern in policy circles that IPPs could prove reluctant to invest in South Africa because of Eskom's dominant position in generation combined with its control of the System Operator and the transmission network. As the System Operator, so the argument goes, Eskom would seek to dispatch its own power stations before those of independent producers.

At present, it is hard to see that happening, given how constrained is the supply of electricity and how keen the System Operator would be to draw on any extra megawatts private producers could offer. However, IPPs will have to commit to long term investment decisions, so the question of how the industry will be structured in the long term, in a future in which electricity could be in ample supply, is pertinent. The Department of Energy has acted on its concerns about Eskom and IPPs with the introduction of an Independent System and Market Operator (ISMO) Bill, which will ultimately unbundle the System Operator and the buying office from Eskom and house them in a new state-owned entity, which will also take over Eskom's large mining and industrial customers.

For the country, the issue is how to open up the industry to new players, who can bring new funding, technology and skills, and set new benchmarks for industry performance – but in a way that supports security of electricity supply.

Any change would have to be carefully timed and managed to mitigate the risks. There are legal and financial issues too which will have to be clarified. Eskom, meanwhile, has set up a single buying office, which will buy from IPPs, as a first step towards the ISMO and is engaging with the government on the details and the sequencing of the proposed industry reform.

For investors and potential investors in the electricity supply industry, Eskom included, clarity and certainty about policy and regulation will be key to long term investment decisions. For the country, the issue is how to open up the industry to new players, who can bring new funding, technology and skills, and set new benchmarks for industry performance – but in a way that supports security of electricity supply.

Cleaner, Greener Power

The IRP, as we've seen, also provides the framework for the industry to diversify its energy mix in order to meet South Africa's objective to reduce its carbon footprint. The IRP sets ambitious targets for non-emitting new renewables and nuclear capacity, which together make up almost two thirds of the new capacity which the IRP sees being built by 2030.

In addition to the programme which the Department of Energy has launched to bring in substantial new investment from private renewable energy producers, Eskom has embarked on its own renewable energy projects, in wind and solar power, and aspires to do more. Eskom, which is Africa's only nuclear operator⁹, has also made it clear it would like to be part of the major nuclear new build programme which the IRP envisages. There is also substantial potential for more 'green' power in the Southern African region, given the resources of natural gas and hydro power in countries such as Zambia, Mozambique, DRC and Namibia. South Africa and its neighbours would benefit from the expansion of the regional grid, in terms of both security of supply and of lower carbon emissions.

However, while bringing in non-emitting renewable or nuclear power plants must clearly be a significant part of a strategy to reduce the electricity industry's carbon footprint over time, it cannot be the only part of such a strategy.

Coal is likely to remain the dominant source of electricity for South Africa for the foreseeable future. Crucially, it is cheaper than any of the alternatives currently, and South Africa does not have the resources of natural gas or water which are

used to provide baseload power in other countries. However, much can be done to reduce the carbon footprint of the coal fleet, new and existing. Significantly, the new power stations which Eskom is building will be much more efficient than the old ones, using technology which will significantly reduce their carbon emissions per unit of energy produced.¹⁰ They will also be more efficient in terms of water usage – and especially for a water-scarce country like South Africa, addressing climate change is importantly also about adaptation to the impact of climate change in areas such as water.

Again, however, climate change is just one of the issues for the electricity supply industry to address and it is a question of balancing this with considerations of affordability and security of supply.

Switching Some of the Lights Off

One of the quickest and most effective ways for the industry to reduce carbon emissions would simply be to reduce demand for electricity. Energy efficiency must therefore be an important component of any strategy to address climate change. More immediately, however, it is, as we've seen, crucial to enable a reliable supply of electricity in the next few years while supply is constrained.

South Africa is an unusually energy intensive country and there clearly is scope to reduce electricity usage without compromising economic growth prospects. Indeed, sustained energy efficiency could contribute to better growth prospects, especially if it means that South Africa could afford to build less new capacity, or at least build it more slowly, in years to come. In that sense, the outlook for the electricity supply industry is as much about what South Africa will demand as about the industry's ability to supply.

NOTES

- 1 The United Nations Secretary General has announced a goal of providing energy access for all by 2030 and South Africa has supported that. Access to electricity in South Africa has increased from under 25% in the early 1990s, when the electrification programme began, to over 75%, but that still leaves more than 3 million households which do not yet have access.
- 2 For an analysis of the 2008 crisis from inside Eskom, see Chettiar, M, K. Lakmeeharan and R.G. Koch "A Review of the January 2008 Electricity Crisis in South Africa: A Problem a Decade in the Making." Paper P001 presented at Cigre 2009, Sixth Southern Africa Regional Conference Paris: Cigre <http://www.cigre.org>. Also see Joffe, H.
- 3 Coal stocks have been rebuilt from 12 days on average in 2008 to over 40 days; approximately 2500 MW of new capacity has been commissioned since 2008; and almost 1000 of capacity from independent power producers (municipal and private) was signed up on short to medium term contracts during 2011/2012. The Demand Side Management programme achieved savings of 2 700 MW.
- 4 See Loni Prinsloo "SA grid not bad, for a third world state" Sunday Times Business Times 22 January 2012
- 5 The cost of power generated by these plants depends on the price of diesel but in early 2012 is more than 10 times the cost of coal-fired power generation
- 6 Republic of South Africa INTEGRATED RESOURCE PLAN FOR ELECTRICITY 2010-2030 Government Gazette No.34263, 6 May 2011
- 7 The Integrated Resource Plan estimates the cost per unit of electricity under the scenario it has chosen, in 2010 terms, at up to 112 cents per kilowatt hour. The National Energy Regulator (Nersa) approved average tariff for electricity in the 2011/2012 financial year is 53 cents, rising to 62 cents in 2012/13.
- 8 Though the renewable energy is much more expensive than coal-fired or nuclear power, it will remain only a small part of the mix for some time to come and therefore has little impact on the blended price which Eskom charges for electricity.
- 9 Eskom's 25 year old Koeberg power station accounts for about 6% of its total capacity,
- 10 Relative emissions (CO₂ per MWh (megawatt hour) sent out) are highest in Eskom's older, return to service power stations (Camden, Grootvlei and Komati) at over 1.2 tons CO₂ per MWh sent out. The average for the existing Eskom fleet in the last financial year was 1.04 tons CO₂ per MWh sent out. By contrast, Medupi and Kusile will emit only 0.75 to 0.78 ton per MWh sent out.