TRADE & INDUSTRIAL POLICY STRATEGIES

Responses to the electricity oversupply

SUMMARY

Since 2011, Eskom has experienced a sharp decline in demand, while the electricity-intensity of the South African economy has fallen by a quarter from 2005 to 2017. This briefing note analyses the factors behind the fall in demand and, on that basis, a range of strategic responses. It concludes that it would be unsustainable in economic, environmental and social terms to fall back on the historic solution of boosting demand by subsidising new investment in metal and coal refineries.

Instead, Eskom has to develop a new business model that takes into account current realities – in particular the decline in metals refining due to higher electricity costs and the end of the commodity boom, as well as efforts to reduce greenhouse gas emissions. These realities mean Eskom will have to adapt to more or less stagnant electricity demand for the foreseeable future. To that end it should adopt smaller-scale and more flexible generation technologies.

To promote future growth also requires that electricity supply be far more closely aligned with industrial policy. That would entail substantial modifications in current processes for determining tariffs and the allocation of electricity. The aim would be to prioritise projects that support industrial deepening and inclusive growth, which in turn would sustain Eskom over the longer run.

THE PROBLEM

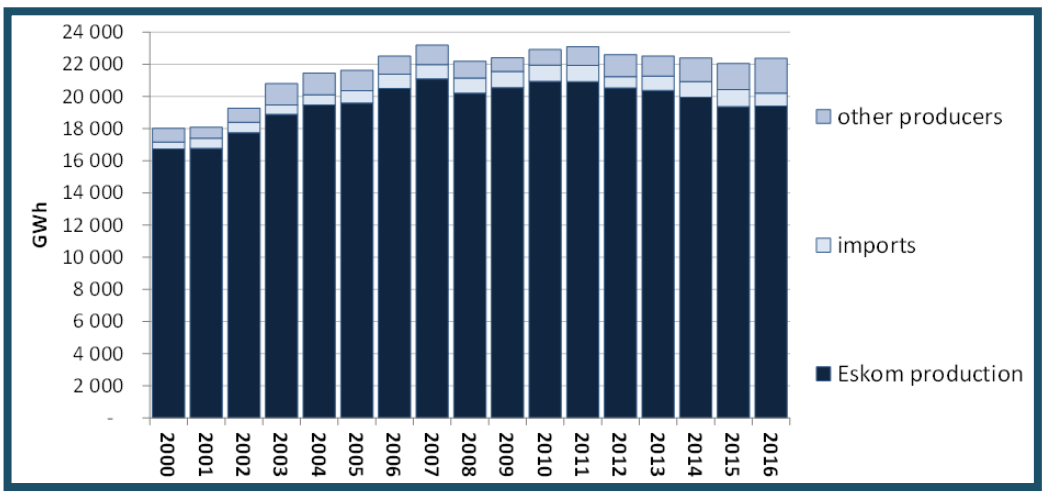
As Graph 1 shows, Eskom's sales of electricity declined by 7,4% from 2011 to early 2017. The decline contrasted with growth of 26% from 2000 to 2007 as well as the strong recovery from the sharp fall during the 2008/9 global financial crisis. Total electricity production, including non-Eskom sources (mostly renewables) fell more slowly, by 3,6% from 2011 to early 2017. That compared to 25% growth from 2000 to 2007.

FACTORS BEHIND FALLING DEMAND FOR ELECTRICITY

The decline in electricity demand since 2011 has been driven by:

- The effects of the 2008/9 global financial crisis and the end of the commodity boom in 2011, which were particularly severe for electricity-intensive heavy industry, and
- Business efforts to reduce dependence on coal-based electricity both in response to the rapid increase in Eskom tariffs and to cut greenhouse gas emissions.

Graph 1: Average monthly electricity used in SA by type and source, year to March 2016



Source: Calculated from Statistics South Africa. Electricity generated and available for distribution. 201703. Excel spreadsheet. Series on monthly electricity generated and available for distribution, not seasonally adjusted. Downloaded from www.statssa.gov.za in May 2017.

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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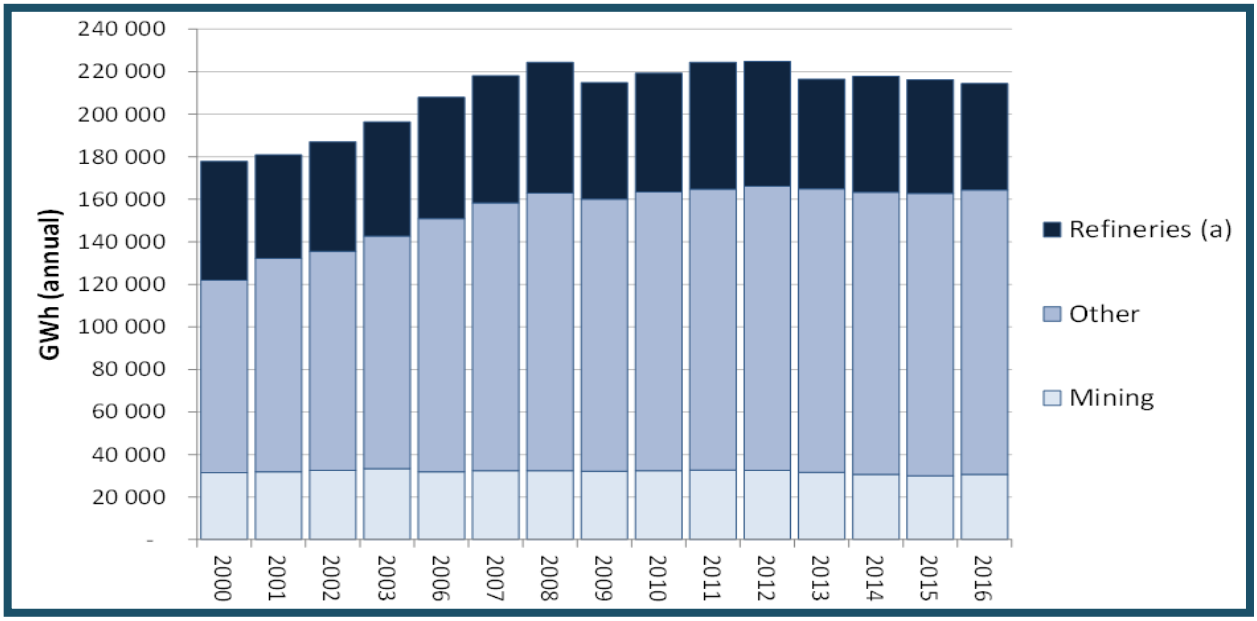
The impact of these trends on Eskom sales was aggravated because the company did not respond adequately to rising concerns about climate change, which drove a shift to renewable energy and gas. Moreover, it doubled the price of electricity in real terms, which accelerated the decline of electricity-intensive technologies.

From 2011 to 2016, the metals refineries plus Sasol accounted for around a quarter of electricity sales, but some 95% of the fall in its demand. The share of the mining value chain in Eskom's total production dropped from 49% in 2000 to 37% in 2016 (Graph 2).

The end of the commodity boom was central to the decline in the use of electricity for metals and coal refining. As Graph 3 shows, metals prices reached a 30-year high around 2011, but then fell back to more normal levels. It seems unlikely that a similar increase in prices will occur in the coming decade or so.

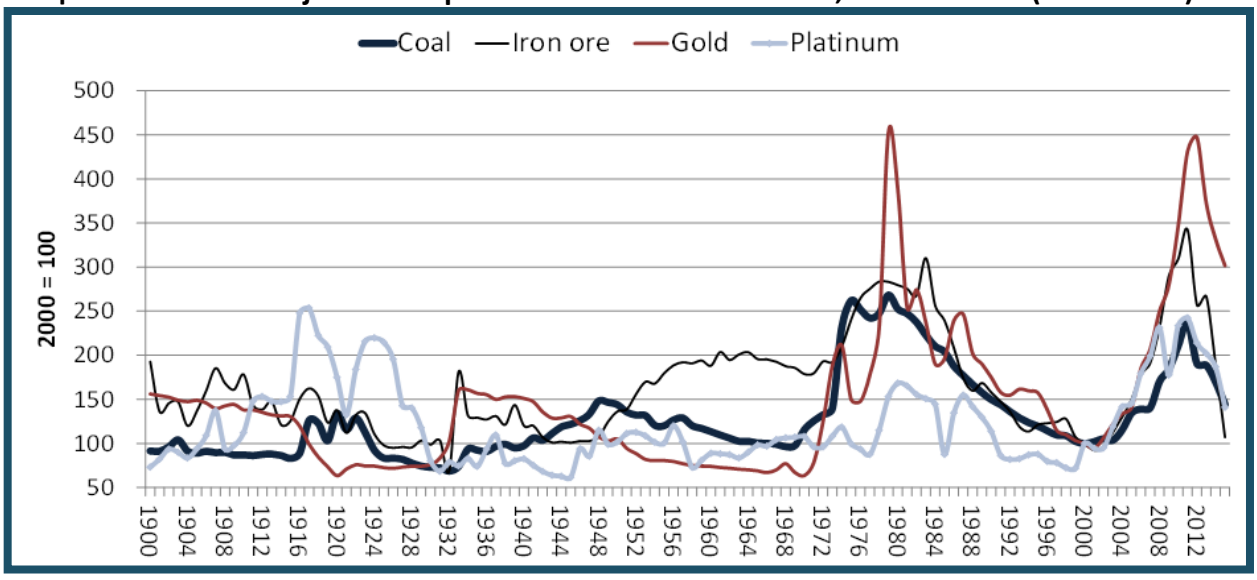
Crashing metals prices contributed to falling production in the refineries. As Graph 4 (page 3) shows, for the past five years shrinking electricity use by the refineries largely tracked falling metals production.

Graph 2: Eskom annual sales of electricity to refineries (a), mines and other users



Notes: (a) Eskom distinguishes between "industry", which refers only to large, energy-intensive plants outside of the mines that it supplies directly, and other enterprise customers that are supplied through municipal governments. Refineries and smelters account for most of the companies covered under "industry," but there are also some paper plants. Annual figures for 2004 and 2005 are not available because Eskom changed its financial year in that period. Source: Calculated from Eskom, Annual and Integrated Reports for relevant years. Figures on sales by type of consumer.

Graph 3: Indices of major metals prices in constant U.S. dollars, 1900 to 2015 (2000 = 100)



Source: Calculated from Jacks, D.S. 2016. Chartbook for "From Boom to Bust." February. Downloaded from www.sfu.jacks.ca in June 2016. Update of David S. Jacks. 2013. "From Boom to Bust: A Typology of Real Commodity Prices in the Long Run," NBER Working Paper 18874.

From 2011 to 2016, the refineries reduced their electricity consumption by 16%. In the same period, iron and steel production shrank 7% by volume.

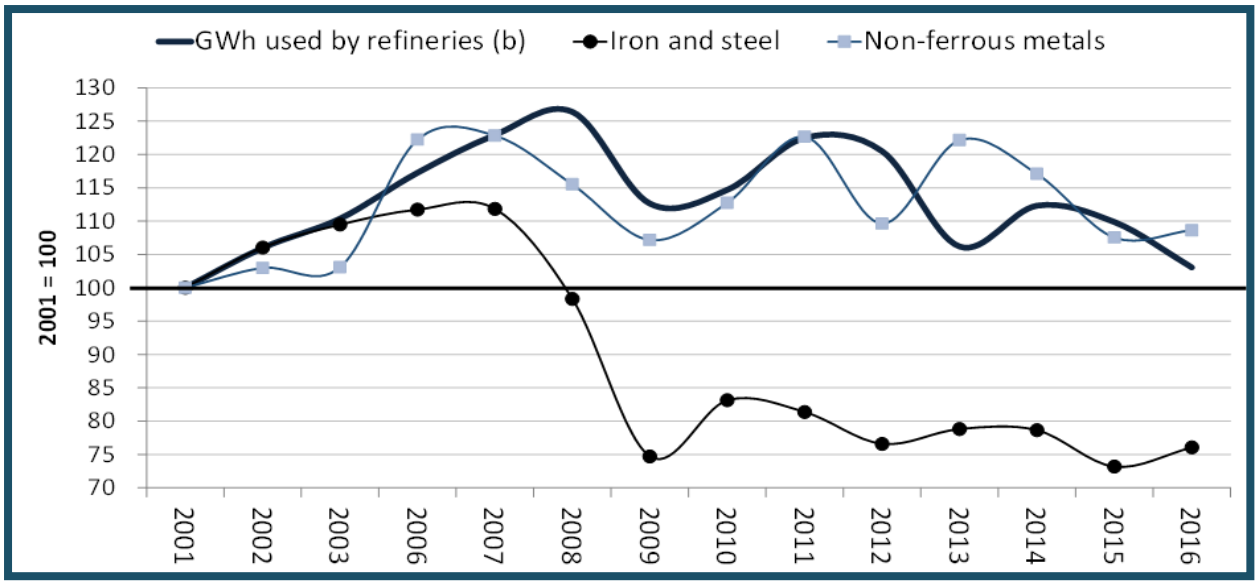
The decline in metals production was linked to a second factor behind Eskom's falling sales: the extraordinary increase in its prices from 2008. From 2008 to 2012, Eskom's prices doubled in real terms. From 2012 to 2016, they climbed another 25% above inflation (as measured by CPI). (Graph 5)

Refineries as a group saw a below-average increase in their electricity costs because the aluminium smelters received special concessions in 1990. These concessions aimed in large part to boost electricity demand because Eskom had overcapacity at the time.

In 2016, the average price paid by refineries was 78% of the average tariff for other customers, down from around 85% in the early 'aughts. The data only give the average for the refineries as a group, but the benefits went mostly to the aluminium smelters. (Graph 6, page 4)

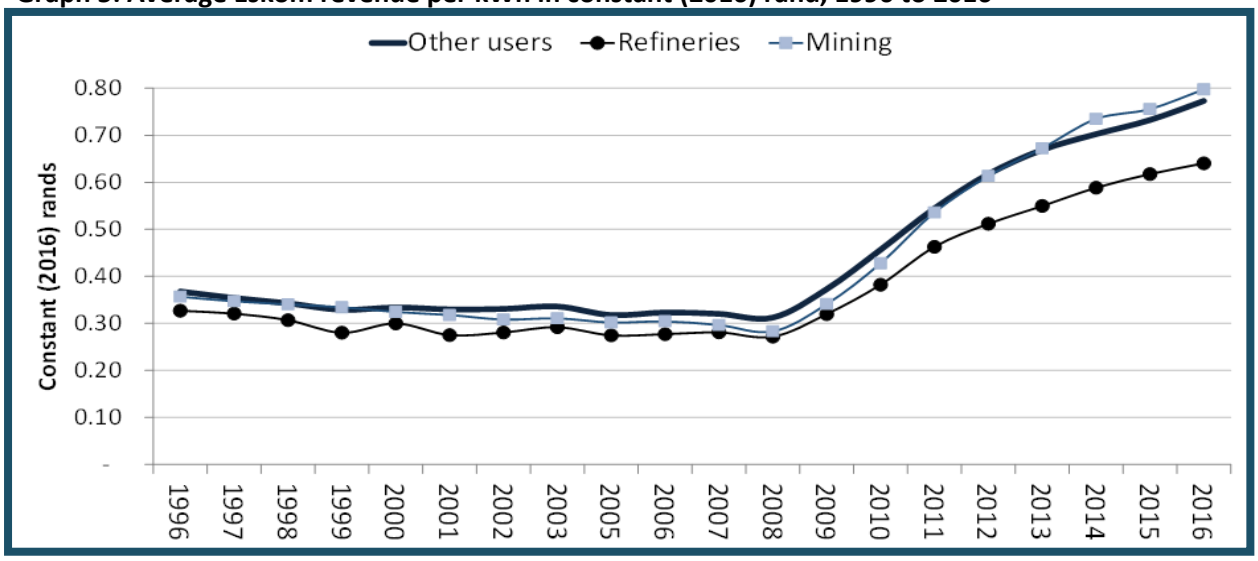
As the price of electricity rose, consumers of all kinds reduced their usage. The result was that electricity

Graph 4: Volume of production (a) in iron and steel and non-ferrous metals compared to electricity usage by refineries (b)



Notes: (a) Average of monthly figures for calendar years. (b) Eskom distinguishes between "industry", which refers only to large, energy-intensive plants outside of the mines that it supplies directly, and other enterprise customers that are supplied through municipal governments. Refineries and smelters account for most of the companies covered under "industry," but there are also some paper plants. Annual figures for 2004 and 2005 are not available because Eskom changed its financial year in that period. Source: For electricity use, calculated from Eskom, Annual and Integrated Reports for relevant years. Figures on sales by type of consumer. Volume of production from Stats SA. Manufacturing Production and Sales from 1998. 201703. Series on volume of production for iron and steel and non-ferrous metals. Excel spreadsheet. Downloaded www.statssa.gov.za, May 2017.

Graph 5: Average Eskom revenue per kWh in constant (2016) rand, 1996 to 2016



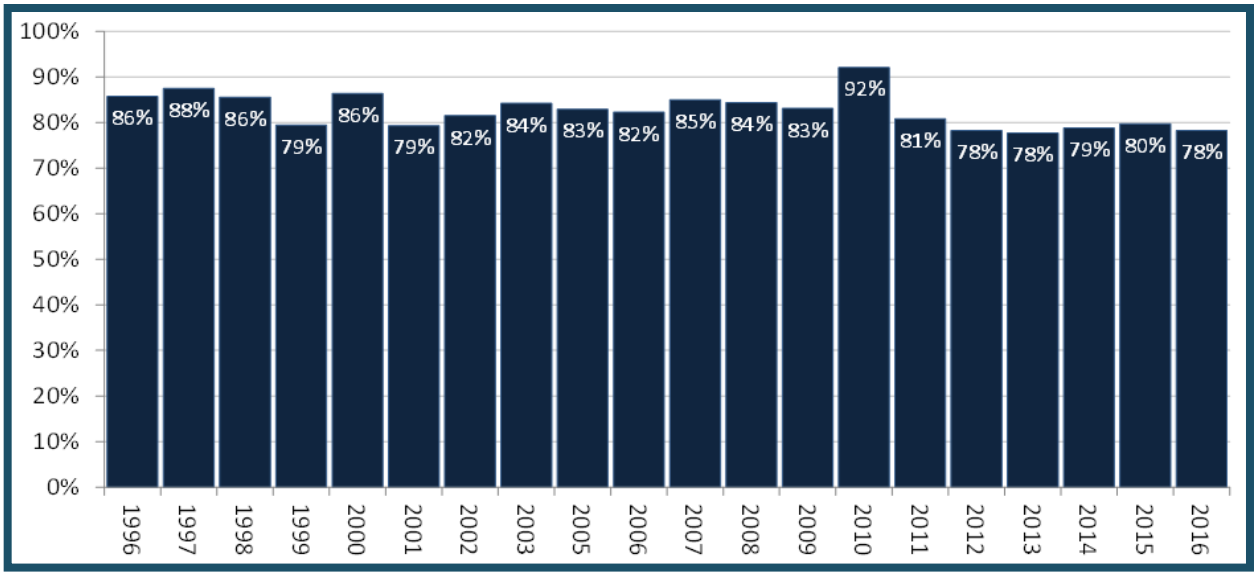
Source: Calculated from Eskom Annual and Integrated Reports for relevant years. Figures on sales by type of consumer. Deflated with CPI.

use fell even when the GDP was growing. As Graph 7 shows, through 2008 the GDP and electricity demand were closely correlated. From 2008, however, as electricity prices increased while metals production dropped, total electricity sales remained virtually unchanged. In this period, Eskom demand dropped by 0,5% a year although the GDP grew annually by 1,6%.

As a result of the trends, the energy intensity of the GDP dropped markedly from the early 'aughts. From 2003 to 2016, the number of gigawatt hours required to produce a billion rand of the GDP (in constant 2016 terms) fell from 90 to 67. That represented a 26% fall over 13 years. (Graph 8, page 5)

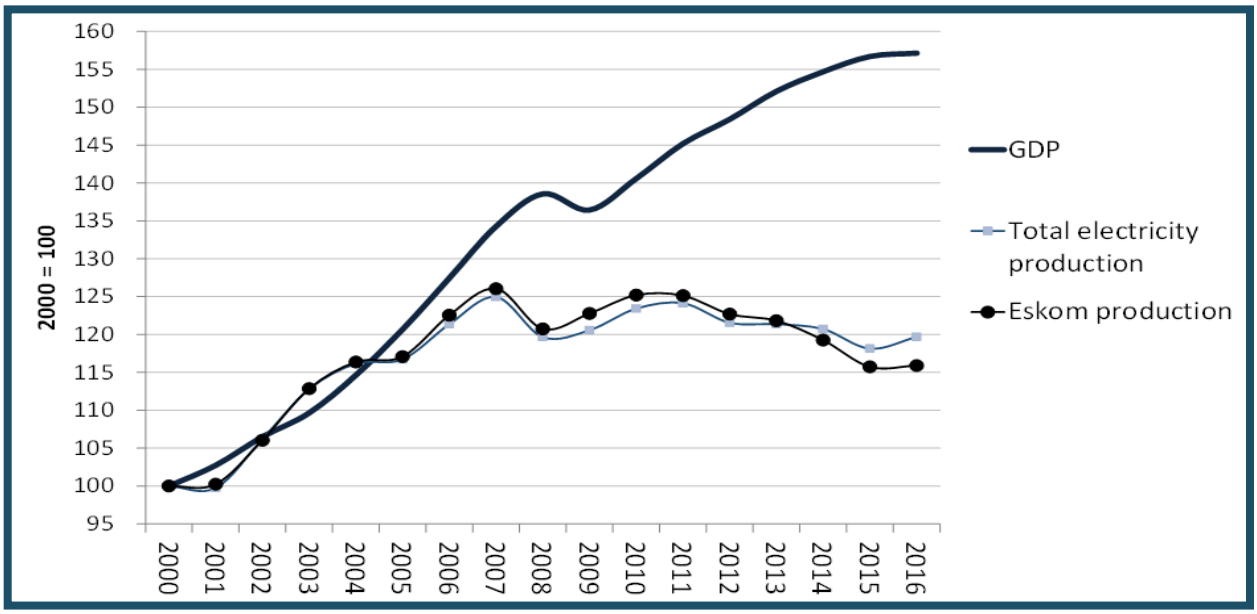
The impact of the electricity price hikes on demand is particularly visible in the steel industry. Overall, as Graph 9 (page 5) shows, steel production using electric furnaces fell by 50% from 2007 to 2015. In contrast, other kinds of steel production shrank 20%. As a result, electric steel production accounted for 75% of the total fall in steel output, although it made up just 40% of the total in 2015. Among others, ArcelorMittal South Africa (AMSA) has closed down its electric-arc lines and the number of iron and steel foundries has fallen by around a third since 2008. In addition, Sasol shifted to imported natural gas both to reduce costs and to generate its own cleaner electricity, replacing Eskom's coal-fired energy.

Graph 6: Eskom revenues per kWH from sales to refineries compared to sales to all other customers



Source: Calculated from relevant Eskom. Annual and Integrated Reports for relevant years. Figures on sales by type of consumer.

Graph 7: Indices of the GDP in volume terms and annual electricity production



Source: For GDP, calculated from South African Reserve Bank. Interactive dataset. Series on GDP in constant rand. Downloaded from www.resbank.co.za, May 2017. For electricity, calculated from Stats South Africa. Electricity generated and available for distribution. 201703. Excel spreadsheet. Series on monthly electricity generated and available for distribution, not seasonally adjusted. Downloaded from www.statssa.gov.za in May 2017.

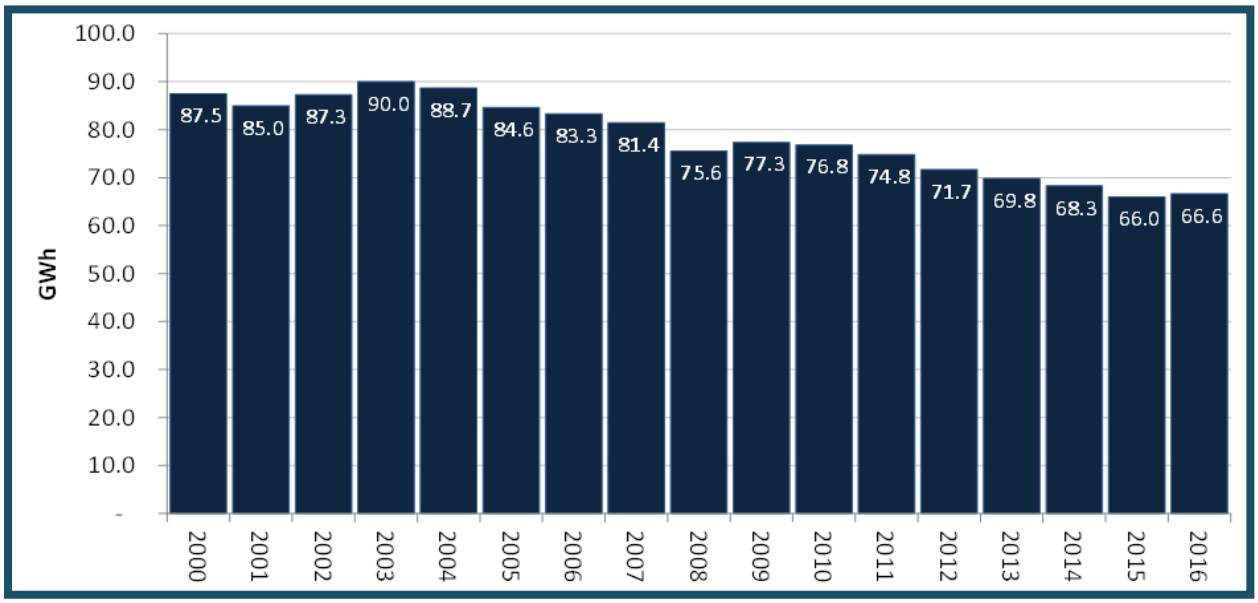
These developments mean that the decline in demand for electricity is now rooted in significant technological shifts. By extension, even a reduction in tariffs would not see an immediate jump in demand. Rather, electricity sales would increase substantially only if companies undertook new energy-intensive investments – which seems unlikely unless metals prices recover much more than at present.

The extraordinary increase in electricity prices had three roots: higher coal prices during the commodity boom, efforts to incentivise renewable energy, and inefficiency at Eskom. In the interim, renewables have become sufficiently low cost to compete with coal, although they cannot provide energy consistently throughout the day.

Evidence of inefficiency at Eskom includes the following.

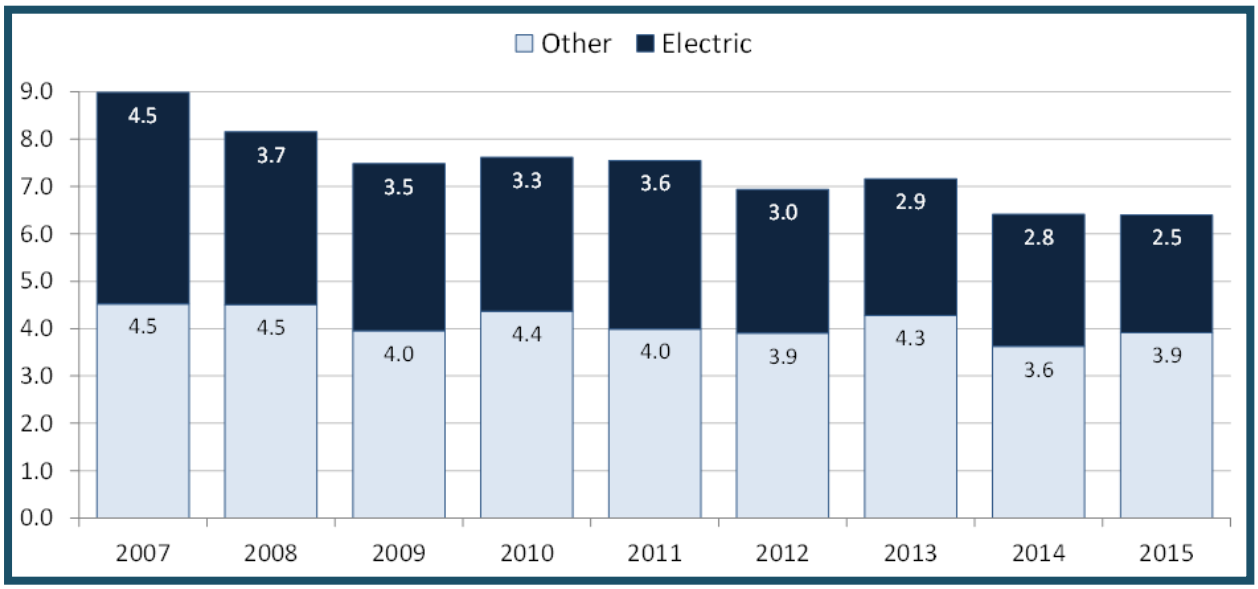
- Recent information points to significant over-payment for coal in part due to corruption in procurement processes. As a result, Eskom could not take advantage of the stabilisation of coal and diesel prices in recent years. In rand terms, as Graph 10 (page 6) shows, coal prices soared from 2006 to 2008, but they declined slightly from 2013. Nonetheless, electricity prices have continued to rise substantially faster than inflation.

Graph 8: GWh per billion of GDP in constant (2016) rand (a)



Note: Deflated using GDP deflator rebased to 2016. Source: For GDP, calculated from South African Reserve Bank. Interactive dataset. Series on GDP in constant and current rand. Downloaded from www.resbank.co.za in May 2017. For electricity, calculated from Statistics South Africa. Electricity generated and available for distribution. 201703. Excel spreadsheet. Series on monthly electricity generated and available for distribution, not seasonally adjusted. Downloaded from www.statssa.gov.za in May 2017.

Graph 9: Production of steel by electric and oxygen refineries



Source: Calculated from, South African Iron and Steel Institute. Crude steel production. Data in Excel format. Downloaded from www.saisi.co.za in May 2016.

- Staffing levels rose by 33% from 2008 to 2014 even as total generation fell by 2%. As a result, Eskom's total employment climbed from 35 000 in 2008 to 48 000 in March 2016. Despite the growth in employment, the maintenance section had a vacancy rate of around 30% in 2014.
- Compensation for the chair and directors climbed from R49 million in 2011/2 to R75 million in 2015/6. The average for executive directors came to R10 million each in 2015/6, up from R8 million two years earlier.
- Eskom has contracts with Hillside and Bayside smelters that link the price of electricity to the aluminium price in London translated into rand. Since metal prices dropped from 2011, it has effectively subsidised the smelters to the tune of R10 billion a year.
- Eskom's debt costs have increased, in part as a result of revenue shortfalls and in part because of delays and cost overruns in completing major capital projects. Construction delays are the norm for major electricity plants everywhere, but Eskom failed to plan for them. Inadequate revenue, carrying debt for investment longer and, in the case of dollar-denominated debt, the depreciation of the rand meant higher debt costs. In 2011, Eskom paid R8 billion in interest; in 2014, it paid R13 billion; and in 2016, it paid R23 billion. The ratio of debt to equity climbed from 1,68 in 2009/10 to 2,27 in 2014/5. The debt/equity ratio fell to 1,67 in 2015/6 because government converted a R60 billion loan to equity and injected R23 billion in equity – effectively providing a subsidy and enabling Eskom to borrow more from other sources.
- Maintenance has been inadequate and often of poor quality. Cash shortages in themselves have led to underfunding of maintenance. As noted, the maintenance division suffered from vacancies for years. Eskom officials say that procurement of key inputs has been delayed due to cash-flow problems. Moreover, Eskom's procurement procedures do not ensure adequate oversight of contractors, leading to delays and poor work on major projects. In part, this reflects the split between responsibility for procurement and operations.

GETTING DEMAND WRONG

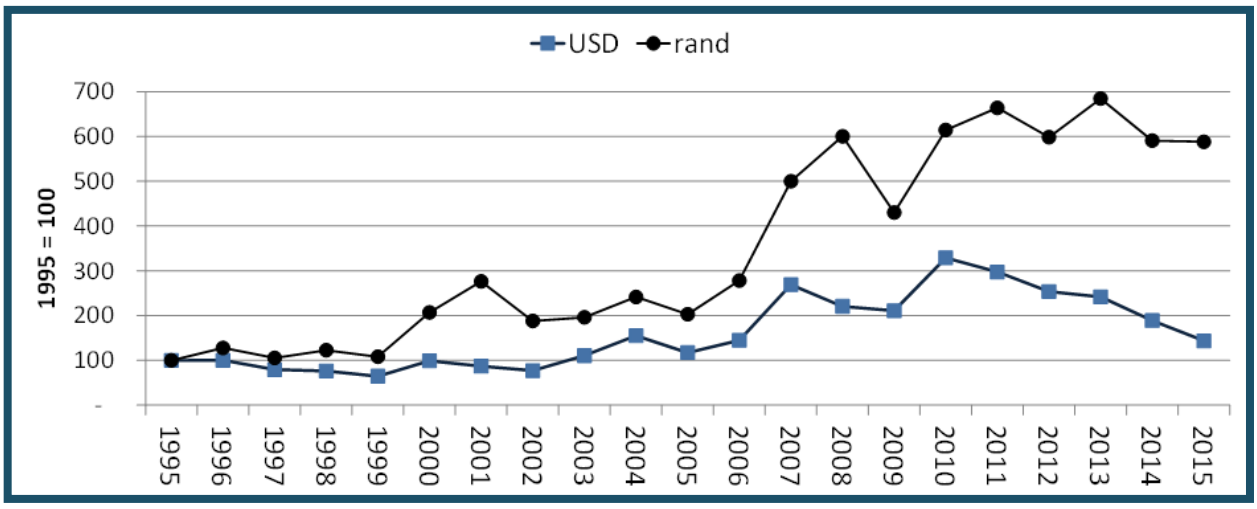
The problem of falling sales is aggravated by the tendency of both Eskom and its regulators to assume that demand will pick up in the near future. That belief ignores both the likelihood of slow growth in metals exports at least for the next few years as well as the strength of national and business strategies to reduce energy intensity.

In 2016, Eskom's scenarios for estimating electricity demand incorporated growth rates ranging from 3,2% a year to 0,4% a year. The increase in sales for these scenarios ranges from 5600 GWh to 48 000 GWh a year. For comparison, from 2011 to 2016, total electricity demand *declined* by 0,9% a year, and Eskom sales fell even faster. That is, for the past five years electricity demand has gone down – but even Eskom's low scenario assumes at least a modest increase in electricity consumption.[1]

Eskom is in good company. In the update to the Integrated Resource Plan in November 2016 the Department of Energy still expected relatively rapid growth in electricity demand, by 2,5% a year. It appears that scenario was selected in 2012, at the start of the fall in electricity use. NERSA appears to be using an average increase of 2,1% in peak demand from 2010 to project through 2025, although its own data show that in fact demand declined from 2012 to

[1] *See Eskom. 2017. Medium-Term System Adequacy Outlook. Downloaded from www.eskom.co.za in May 2017. Page 6.*

Graph 10: Index of coal price in December (1995 = 100) in US dollars and in rand



Source: Figures for monthly South African coal price in rand and U.S. dollars from Index Mundi, downloaded in February 2016.

2016. As a result, its projections for 2017 start 20% above actual demand in 2016. (Graph 11)

The failure to incorporate the shift toward a less electricity-intensive economy into its plans, combined with over-optimism about GDP growth, has significant (and potentially costly) implications. For instance, by 2021, if electricity use continues to shrink at the rate of the past five years, Eskom will need 20 000 GWh a year – around 10% – less than in its low scenario, and 50 000 GWh less than in its moderate scenario. Even if electricity use simply stopped declining, South Africa will need 5600 GWh less than in Eskom's low scenario and 30 000 GWh less than in its moderate scenario.

In sum, the fall in demand arises essentially from shifts in the global economy combined with the sharp increase in prices from 2008. In this context, Eskom has tended to over-invest because of excessively optimistic assumptions about growth in demand.

RESPONDING TO DECLINING DEMAND

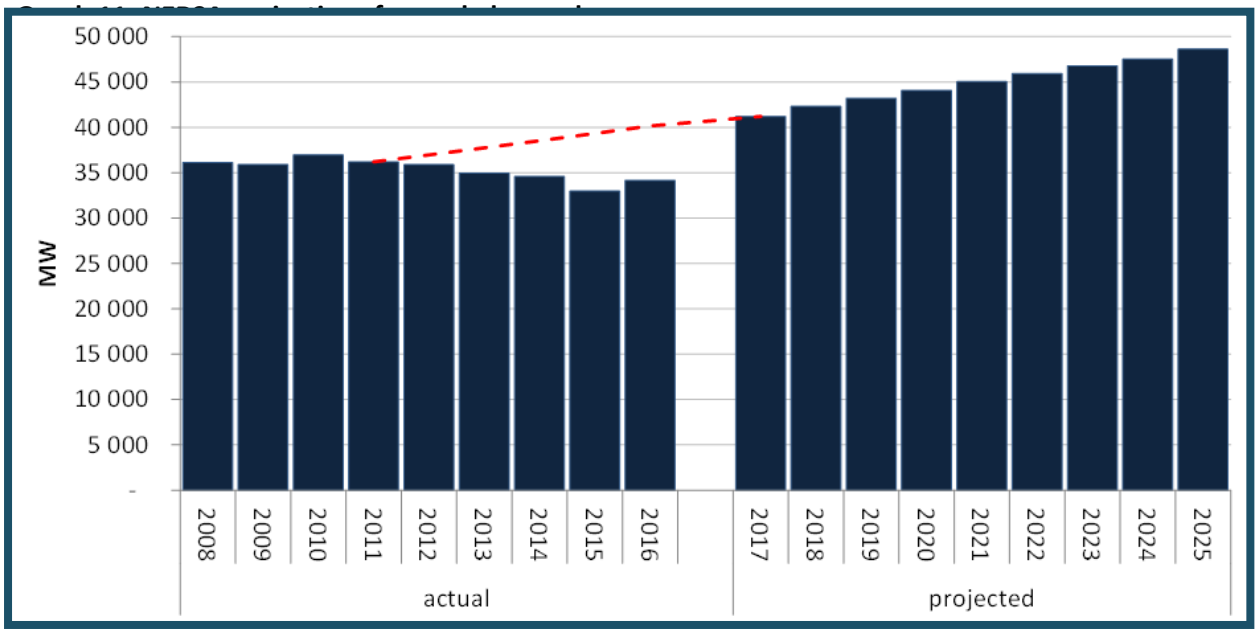
Responses to the decline in electricity demand have to be sustainable in economic, socio-political and environmental terms. That is, they have to be judged against their impacts:

- On the economy and society, not just on Eskom, and
- In the longer term – that is, over the next five to 10 years.

The key challenge is to find responses that will help South Africa build a more equitable, sustainable and dynamic economy. We analyse the following options for responding to the electricity surplus.

- Eskom could provide cheap electricity as an incentive to attract highly energy-intensive smelters and refineries, on the model used in the 1990s. This strategy aims to boost Eskom revenues by shifting the economy back toward capital- and energy-intensive metals production, mostly for export without further fabrication.
- Eskom, the Department of Energy and the Department of Trade and Industry (the dti) could align electricity provision with industrial policy by ensuring that the pricing, access and quality of electricity for new projects, as well as procurement for new Eskom investments, promote industrial deepening. This approach would require the dti and the Department of Energy to dedicate sufficient capacity to share information, drive fast-track interventions to support industrial-policy initiatives, and deal with shortcomings and blockages as they arise. That in turn suggests the need for a high-level and well-capacitated forum on industrial policy and electricity supply.
- Eskom could expand exports to the southern African region, which would require substantial improvements in transmission lines as well as measures to manage the risks around non-payment.
- Eskom and government could review current investments based on a realistic projection for demand, and structure investments to mitigate the risks of over- as well as under-investment.

Table 1 on page 8 assesses the benefits, costs and risks of each of these options. The analysis in the table suggests that promoting energy-intensive industry so as to absorb excess generation is risky, high-cost and socially as well as environmentally undesirable. It would avoid putting South Africa on a balanced, sustainable and equitable growth path. Instead it would bolster the mineral-energy complex that over the past century fuelled dependence on uncertain commodity markets as well as aggravating inequality, exclusion and climate change.



Source: NERSA. "System Adequacy Outlook." Issue 12. 4 January 2017. Pp 2-3.

Table 1: Costs, benefits and risks of options for responding to the oversupply of electricity

	Benefits	Costs	Risks
Subsidise smelters to enhance demand	Rapid increase in Eskom revenues. Easy for Eskom to implement. Could lead to some very large investments in financial terms.	Subsidies to a few large smelters would necessitate higher prices for other users. Experience shows that energy-intensive refineries generate few jobs either directly or indirectly. The projects would lock SA into high levels of greenhouse gas emissions.	Limited appetite for heavy industry since commodity boom ended. Possibility of sanctions if SA continues as a major greenhouse gas emitter. Miscalculation of subsidies has in the past led to higher subsidies to companies than expected, resulting in effective cross-subsidisation by other users.
Align electricity provision with industrial policy	Accelerated industrialisation would have socio-political benefits as well as bolstering electricity demand in the long run. Would help legitimate fiscal subsidies for electricity provision.	Would require re-prioritisation of electricity provision and pricing, including lower prices for some industries (starting with steel). Would not reverse move toward reduced electricity intensity and renewables, or quickly increase Eskom revenues. Both the dti and the Department of Energy would have to put in capacity to manage co-operation.	Failure to align measures adequately due to disagreements or lack of capacity, and/or Eskom does not implement them. Demand for high subsidies from all industries. Diversification away from mining value chain would accelerate reduction in electricity intensity and consequently further slow growth in demand for electricity.
Increase regional exports	Would address a key constraint on regional development. Might be able to pull in investments for grid from BRICS bank.	SA would likely have to assist in upgrading transmission across the region, which is expensive and requires substantial capacity.	Countries might not pay if they fall into economic or political crisis. Economic slowdown in region could dampen demand. Cost of delivered electricity might be too high to expand exports. Eskom/regional utilities do not have technical capacity to improve and maintain grid.
Restructure investments to maximise flexibility	Would make it easier to respond to unexpected fluctuations in demand.	Does not deal with current over-production, just avoids making it worse.	Underestimation of demand could lead to under-investment in coming years and consequent higher costs and shortages.

Taken together, the other options would go some way toward mitigating the over-production problem while contributing to broader development. Closer alignment between industrial policy and electricity supply would have the greatest long-run benefits for South Africa. It would, however, require substantial modifications in processes for determining tariffs and the allocation of electricity so as to prioritise projects that support industrial deepening and inclusive growth.

Taken together, these options point to the need to develop, and cost, a new business model for Eskom that would contribute to more balanced industrialisation. Key elements of a more appropriate business model would include:

- Recognition that expanding coal-based electricity is not a long-term solution unless some version of clean coal becomes available. To date, this technology has proven expensive and hard to manage.
- The energy intensity of the South African economy will decline as industrialisation progresses, which in turn means demand for electricity will not increase rapidly even if economic growth picks up.
- South Africa cannot develop in isolation from its neighbours, and electricity development has to take that reality into account.
- Eskom's decisions have to be more carefully evaluated in terms of the impact on economic and social development, rather than bound principally by Eskom's bottom line. That in turn means that Eskom has to be far more transparent about its income and investments as well as its sales.

Ultimately, the electricity industry reflects the increasing disconnect between Eskom's 20th Century model and the realities of South Africa's economy in the 21st Century. Shifting to a less energy-intensive, less coal-dependent economy is not a choice, but an imperative resulting from global economic and climate trends. These realities will shape Eskom's development going forward, profoundly affecting both its technological and its financial circumstances. We cannot simply turn the clock back to the 1990s.