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ELECTRICITY SUPPLY vs DEMAND SCENARIOS FOR THE MEDIUM TERM

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1. EXECUTIVE SUMMARY

It has been clear from events towards the end of 2007 and into 2008 that there is an inadequate supply-demand balance in South Africa. The global economic downturn during the second half of 2008 gave some temporary respite to the electricity system, but demand has already picked up to the 2008 levels and is growing, whilst we are not adding significant new generation plant to the system until Medupi's first unit is planned to be coming on line in 2012. Different measures have been used to describe the level of system inadequacy with the most common being the net reserve margin; the percentage of generation capacity over the highest demand in a year. The problem is not only dealing with shortages over the peak periods but over several hours in the day. What is required to address this imbalance is to introduce additional high load factor supply side options as well as to reduce energy demand across all hours through energy efficiency and conservation.

It must also be acknowledged that this crisis has provided the country with an opportunity to deal positively with energy efficiency in a decisive manner.

- It allows the country to re-look at how to use each kilowatt efficiently and productively.
- It will accelerate innovation on demand side management and energy productive technologies.
- It provides a platform to focus on climate change mitigation.
- It provides an opportunity to make appropriate decisions on the new build programme.
- It will have a positive impact on slowing the upward momentum on electricity prices

2. CURRENT REALITY

In recent years, South Africa's electricity supply system has come under severe pressure:

- Due to limited new generation capacity, the power system reserve margin has reduced to unacceptable levels

- The availability of generation plant has reduced because of the requirement to run them harder and the lack of space for essential maintenance

The power system will remain under pressure until new base load power stations come on line. The recent economic slowdown has provided temporary relief, however electricity demand has recovered to 2008 levels. There seems to be no clear industry view on the extent of the problem, resulting in some level of apathy amongst key stakeholders and a lack of urgency from policy/decision makers to deal with the problem. The NERT process did not make any progress, whilst the situation is getting worse.

The creation of an Inter Ministerial Committee structure on Energy may be better equipped to deal with the challenges and resulting from the detailed work required from Work Groups 4 and 6, a joint Emergency Response and Business Continuity technical task team has recently been set up between business, industry, Eskom, AMEU, and Government (DoE) to support the IMC process. Their first report on the assessment of the challenge has been produced, and it now needs to progress to the next phase of "engagement and development".

3. DEMAND vs SUPPLY ANALYSIS

In order to understand the challenge ahead, analysis of the supply and demand projections over the medium term has been done. This analysis is very dependant on the assumptions made on key variables over the period.

a. Key Assumptions – Demand (Peak demand and energy consumption)

- The demand projection excludes the effects of:
  - Demand Side Management
  - Co-Generation
  - Solar Water Heating
- Price elasticity will have a delayed impact which will not significantly reduce demand over the critical next 3 years
- Demand is based on a GDP ranging from 3 to 5% for the period 2010 to 2014
- There is an additional recovery of demand in 2010 due to smelters ramping up to full capacity after the economic recession
- Unconstrained growth is allowed for new connections $\geq$20 MVA

b. Key Assumptions – Supply

The table below shows the planned timing of supply capacity additions.

	ESKOM Build						Country Options									Total New Build	System Capacity
	Grootvlei	Komati	Medupi	Kusile	Ingula	Sere	MSBLP	Nuclear	Regional	DoE OCGT	OCGT	MTPPP1	REFITT Wind	REFITT Other	Other		
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
2009	570	202	0	0	0	0	0	0	0	0	0	0	0	0	0	772	44157
2010	380	303	0	0	0	0	0	0	0	0	0	168	0	175	30	1056	45213
2011	0	404	0	0	0	0	0	0	0	0	0	168	200	150	55	977	46190
2012	0	0	738	0	0	100	0	0	0	1020	0	84	200	0	0	2142	48332
2013	0	0	738	0	666	0	0	0	0	0	0	0	0	0	0	1404	49736
2014	0	0	1476	723	666	0	0	0	1858	0	0	0	0	0	0	4723	54459

Table 1 – Generation Supply Options

Further assumptions on the above are:

- Base Load Coal Energy Availability Factor on the big ten coal fired stations : Scenario's of 86% and 84%
- Expensive Base Load Station (Grootvlei, Camden, Komati) Load Factor : 50%
- Open Cycle Gas Turbines Gross Load Factor : 6%
- Energy Utilisation Factor : 95%

c. Medium Term Outlook

The assumptions listed above were predominantly used as the basis for the Eskom MYPD2 price application and can be summarized in the Figure 1 below. The shaded area indicates the sales projection with and without the impact of DSM and Solar Water Heating shown separately. The line graphs indicate the theoretical annual energy supply availability for the 86% and 84% Energy Availability Factors. The system adequacy metrics used in the analysis are shown in Table 2.

Adequacy Metric		Threshold	Detail
AM1: UE GWh	Unserved Energy (UE)	< 20 GWh per annum	The amount of energy in a year that could not be supplied due to system supply shortages.
AM2: GLF(OCGT)	OCGT Load Factor	< 6% per annum	The Gross Load Factor (GLF) of the combined OCGT plant in operation in a year.
AM3: EL1 GWh	Emergency Level 1 Energy	< 400 GWh per annum	The energy supplied in a year by generators operating above their continuous rating under instruction during supply emergencies. Interchangeable with OCGT generation.
AM4: GLF(EBLS)	Expensive Base Load Stations (EBLS) Load Factor	< 50% per annum	The Gross Load Factor (GLF) of the combined expensive Base-load Stations (typically Camden, Grootvlei and Komati) in a year.

Table 2 – Adequacy Metrics

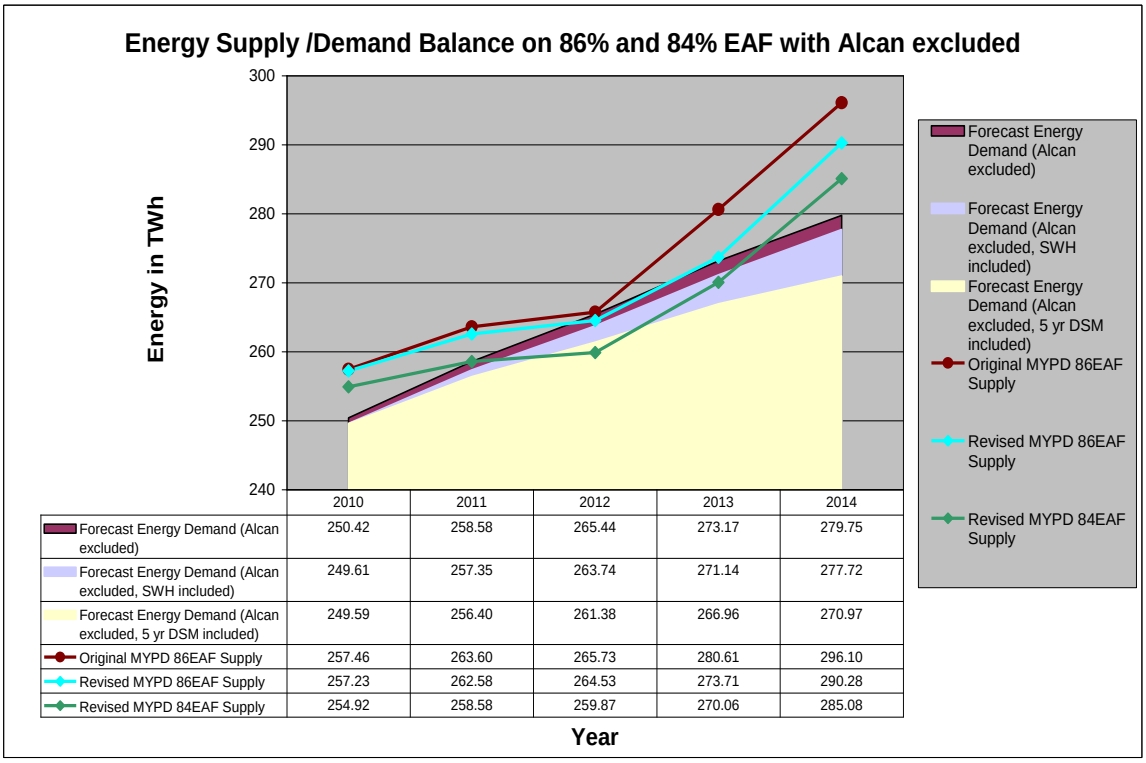
It is already clear from this analysis that the security of supply risk is high, peaking in 2012. What make matters worse, is that for this scenario to materialize, a lot of things have to go right. A number of contingencies have therefore been considered and additional scenarios developed to cater for some of the obvious risks facing the industry and to build some form of buffer to cope with unforeseen circumstances.

- The following are key supply and demand assumptions that on aggregate will ensure sufficient contingency – over and above what was allowed for in the MYPD2:
    - Allow for extended delivery dates of Eskom base load stations : assume delivery dates of 2013 and 2015 for Medupi and Kusile respectively
    - Plan for an energy availability factor of 84% (rather than 86%) to allow for sufficient space for maintenance
    - Apart from MTPPP, exclude all other non-Eskom generation options in the period until 2014
    - Postponement of the 1020MW DoE OCGT from 2012 to 2014
    - The MYPD2 sales assumptions allow for sufficient contingency and remains as-is
    - Maintaining the current 5TWh annual energy buffer into the future

- Demand Management solutions need to provide sufficient contingency in the supply / demand forecast to mitigate risk associated with:
    - Reduced performance levels of current generation plant
    - Possible delays in the delivery of the new large power stations (Medupi & Kusile)
    - Higher than anticipated demand
    - Possible delays in the delivery of non-Eskom generation options

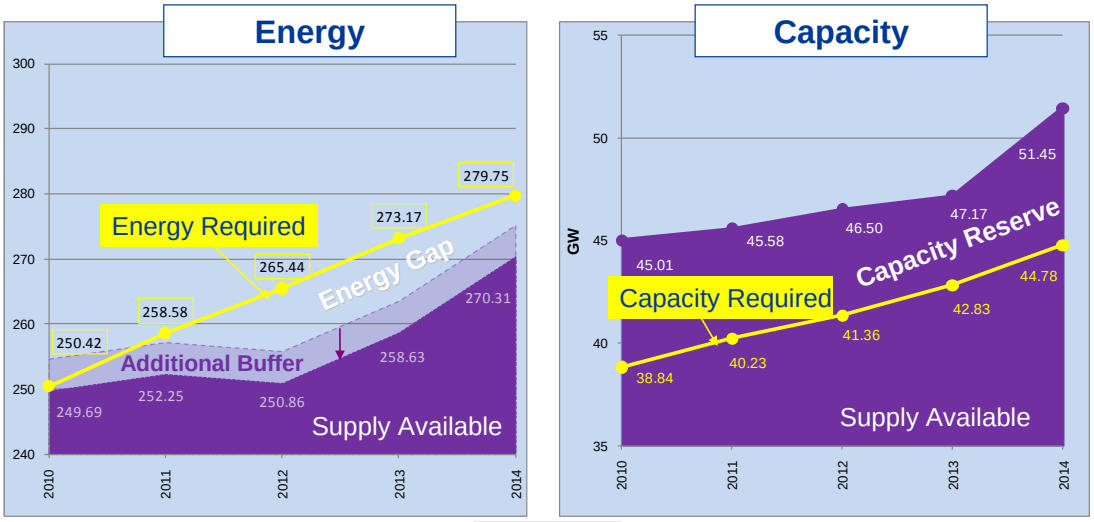
- In addition, the contingency will ensure opportunities for:
    - Additional space for maintenance of generation plant
    - Minimising the overall cost to the consumer by avoiding excessive usage of OCGT's
    - Growth in electricity consumption, including large new projects

- Although there is a 5TWh energy surplus in the current year, the system nevertheless remains extremely "tight". It will therefore be appropriate to ensure that this "buffer" be maintained and planned for into the future.



	2010	2011	2012	2013	2014
Forecast Energy Demand (Alcan excluded)	250.42	258.58	265.44	273.17	279.75
Forecast Energy Demand (Alcan excluded, SWH included)	249.61	257.35	263.74	271.14	277.72
Forecast Energy Demand (Alcan excluded, 5 yr DSM included)	249.59	256.40	261.38	266.96	270.97
Original MYPD 86EAF Supply	257.46	263.60	265.73	280.61	296.10
Revised MYPD 86EAF Supply	257.23	262.58	264.53	273.71	290.28
Revised MYPD 84EAF Supply	254.92	258.58	259.87	270.06	285.08

Figure 1 – MYPD2 Analysis



	2010	2011	2012	2013	2014
Gap	-1.7%	0.5%	3.6%	3.5%	1.6%
+Buffer	0.3%	2.4%	5.5%	5.3%	3.4%

Initial Gap (Reserve)

2010	2011	2012	2013	2014
15.9%	13.3%	12.4%	10.1%	14.9%

Energy Availability rather than Capacity is the challenge!

Figure 2 – Gap Analysis based on additional contingencies

d. Defining the problem

The graphs in Figure 2 show the result of the contingency analysis and clearly indicate an energy availability problem rather than a capacity problem in the short term. The availability of the Open cycle Gas Turbines and agreements with large customers gives Eskom more flexibility to deal with peak demand challenges, but a shortage of energy can only be managed through the addition of base load generation or an overall reduction in consumption.

4. IMPLICATIONS IF THE GAP IS NOT CLOSED

- The electricity supply system will be under severe pressure, posing a risk to **Security of Supply**
- Using open cycle gas turbines to mitigate the risk is expensive, ultimately increasing the **price of electricity**
- It will **not be possible to connect large customers**, negatively affecting economic development
- South Africa's **sustainability**, **reputation** and **competitiveness** will be negatively affected
- Pressure to **reduce supply to neighbouring countries** could have negative political implications
- Further **reputational damage** to government and the electricity industry
- **Lost opportunity to unlock economic efficiencies** through more efficient use of electricity

5. PROPOSED SOLUTIONS

Most supply-side solutions are currently being pursued, but they are too late or too expensive. Demand-side solutions are more readily available in the short term, are less expensive and there is a strong business case for energy efficiency and energy conservation strategies to be implemented urgently. The ideal solution is of course a complementary approach to leverage both supply and demand strategies.

Many opinions have also being expressed about the potential impact of price increases. Eskom Treasury therefore requested a detailed analysis on this issue and the main findings were:

- Electricity demand is fairly inelastic to price changes in the short term, but there will be a longer term impact
- Electricity demand is also sensitive to short term changes in income/commodity prices, which may negate the impact of price changes

The likely impact on Eskom is:

- The MYPD2 price increases could reduce demand for electricity, but probably not immediately and will most likely be delayed beyond the critical period of 2012/13

- Favourable economic conditions could result in a quick increase in demand prior to the critical period, neutralising the impact of price elasticity
- Price elasticity will not provide demand reductions over and above the current demand management initiatives such as DSM
    - Initiatives such as DSM are enabling mechanisms to realise the price elasticity reductions

Electricity price sensitivity can therefore not be seen as a "bankable" solution for the critical period of 2011 to 2013.

The following table 2 shows the high level solutions analysis for the two categories of Demand Management, i.e. Energy Management and Demand Response.

Options	Savings : Energy	Savings : Demand	Easy Implementation	Bankability	Economic Implications	Eskom Control	Cost to Eskom	External Dependencies	Risks	Focus
Mass Market DSM	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Intermediate	Favourable	**Energy Efficiency** and behavioural change initiatives provide deep energy solutions
Individualised Customer Energy Management	Favourable	Favourable	Intermediate	Favourable	Favourable	Intermediate	Intermediate	Intermediate	Favourable	
DSM (Solar Water Heating)	Intermediate	Intermediate	Problematic/Negative Impact	Favourable	Favourable	Intermediate	Intermediate	Intermediate	Intermediate	
Communications (incl Power Alert)	Intermediate	Intermediate	Favourable	Intermediate	Favourable	Intermediate	Favourable	Problematic/Negative Impact	Favourable	
Internal Energy Efficiency	Intermediate	Intermediate	Favourable	Favourable	Favourable	Favourable	Intermediate	Favourable	Favourable	
Demand Market Participation	Intermediate	Favourable	Favourable	Intermediate	Favourable	Favourable	Problematic/Negative Impact	Favourable	Favourable	Predominantly **Demand Response** initiatives with secondary energy efficiency benefits
Utility Load Manager	Problematic/Negative Impact	Favourable	Intermediate	Favourable	Favourable	Favourable	Problematic/Negative Impact	Problematic/Negative Impact	Intermediate	
Advanced Metering Infrastructure	Intermediate	Favourable	Problematic/Negative Impact	Favourable	Favourable	Favourable	Problematic/Negative Impact	Problematic/Negative Impact	Intermediate	
ECS : Energy Conservation Scheme	Favourable	Favourable	Intermediate	Favourable	Intermediate	Problematic/Negative Impact	Favourable	Problematic/Negative Impact	Problematic/Negative Impact	**Risk Mitigation** solution

Favourable Problematic/Negative Impact Intermediate

Table 3 – Demand Solutions

6. REMAINING GAP

If all the Demand related solutions are successful, there will still be a remaining gap over the next 3 to 5 years. The only remaining workable solution that has the ability to close the gap with the least impact on the economy is the Energy Conservation Scheme (ECS). The ECS will provide the appropriate pricing signal for investment in energy efficiency and supply options with customers, such as co-generation, self generation and renewable generation. There are however significant challenges to overcome and it is essential that government and key stakeholders such as customer

representative bodies, AMEU and Eskom work together to make smooth implementation possible.

The detailed analysis of the issues and implications is outside the scope of this paper.

7. KEY MESSAGES

The key massages emanating form this analysis are:

- South Africa has moved from a period of abundant, cheap electricity to a situation of looming shortages of supply and rising electricity prices
- The shortage of electricity will probably last for at least 5 years and urgent decisions need to be taken to address this potential crisis
- All generation options have largely been identified and are expensive, however need to be pursued for MT and LT solutions
- Demand management options, specifically energy conservation and efficiency is the least cost, best environmentally friendly short term solution to address a number of challenges facing South Africa
    - Creation of space for generation maintenance and new connections
    - More time available for new generation decisions
    - Positive impact to contain electricity price increases
    - Positive impact on the environment
- All South Africans need to focus on energy efficiency to contribute to the solution
- All the demand management solutions currently pursued will not close the gap, and urgent attention by decision makers and key role players are required to develop a workable Energy Conservation Scheme for the industry