Medium Term Scenarios for Electricity Supply/Demand Balance

The Sustainable Energy Seminar

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Time magazine of 12 January 2009 claimed that it does not seem as if the

• “most obvious,
• perfectly clean,
• remarkably cheap,
• surprisingly abundant and
• immediately available renewable energy resource”

is properly embraced yet in the world (and particularly in South Africa.)
This resource
• “has outstanding potential to reduce carbon emissions that threaten the planet,
• and unlike coal and petroleum, it doesn’t pollute;
• unlike solar and wind, it doesn’t depend on the weather,
• unlike nuclear, it doesn’t raise uncomfortable questions on radioactive waste storage,
• It doesn’t take a decade to build and
• it has been proven.”

This energy source is called ENERGY EFFICIENCY!
The Case for Energy Efficiency

Security of Supply Challenges

Energy Efficiency is a Common Solution

Financial Challenges

Renewables’ major challenge is on the financials

Environmental Challenges
• 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 baseload power stations come on line.

• The recent economic slowdown has provided temporary relief
  • However electricity demand has recovered to 2008 levels

• There is no clear industry acceptance on the extent of the problem
  • There still seems be some level of apathy amongst key stakeholders
  • Lack of urgency from policy/decision makers to deal with the problem
  • New Inter-Ministerial Committee structure may be better equipped to deal with the challenges
  • Joint Emergency Response and Business Continuity technical task team set up recently between business/industry/Eskom/DoE to support IMC
SUPPLY VS DEMAND ANALYSIS
The demand projection **excludes the effects** of:
- Demand Side Management
- Co-Generation
- Solar Water Heating

**Price elasticity** will have a delayed impact on demand 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 allowed for **new connections ≥20 MVA**.
### Key Assumptions

**Supply**

#### ESKOM Build

<table>
<thead>
<tr>
<th>Year</th>
<th>Grootvlei</th>
<th>Komati</th>
<th>Medupi</th>
<th>Kusile</th>
<th>Ingula</th>
<th>Sere</th>
<th>MSBLP</th>
<th>Nuclear</th>
<th>Regional</th>
<th>DoE OCGT</th>
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- **Base Load Coal Energy Availability Factor**: Scenario’s of 86% and 84%
- **Expensive Base Load Station Load Factor**: 50%
- **Open Cycle Gas Turbines Gross Load Factor**: 6%
- **Energy Utilisation Factor**: 95%
## Medupi

### Project Summary
- Greenfields Project – Lephalale (Limpopo Province)
- **6 Unit** Coal Fired Power Station
- Planned capacity **4,764MW**

### Financial & Economic Impact
- Projected project cost to completion ~**R125.5bn**
- Estimated 95% impact on Lephalale town GDP
- ~ 70% contracts awarded

### Project Schedule
- Construction commenced March 2007
- First Unit planned to be handed over April 2012
- Subsequent Units at 8 month intervals thereafter
- Last Unit planned for handover during August 2015

## Kusile

### Project Summary
- Greenfields Project – Delmas (Mpumalanga Province)
- **6 Unit** Coal Fired Power Station
- Planned capacity **4,800MW**

### Financial & Economic Impact
- Projected project cost to completion ~**R141.5bn**
- Estimated 25% impact on Delmas town GDP
- ~ 41% contracts awarded

### Project Schedule
- Construction commenced Mid 2008
- First Unit planned to be handed over June 2014
- Subsequent Units at 8 month intervals thereafter
- Last Unit planned for handover during October 2017

## Ingula

### Project Summary
- Greenfields Project – Ladysmith (KwaZulu Natal Province)
- **4 Unit** pumped storage power station
- Planned capacity **1,352MW**

### Financial & Economic Impact
- Projected project cost to completion ~**R21.8bn**
- Estimated 1% impact on Ladysmith town GDP
- ~ 75% contracts awarded

### Project Schedule
- Construction commenced Mid 2006
- First Unit planned to be handed over January 2013
- Subsequent Units at 3 month intervals thereafter
- Last Unit planned for handover during November 2013

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**SOURCE:** Eskom Build Programme; 30 April 2010 Project Assurance Reports
Return to Service

Projects Summary
► Refurbishment and return to service of previously moth-balled coal fired power stations in Mpumalanga.
  ► Camden (8 units – total 1,600MW),
  ► Komati (9 units – 1,000MW),
  ► Grootvlei (6 units - 1,200MW)

Financial and Economic Impact
► Projected RTS cost to completion ~ R26.8bn

Project Schedule
► All 8 units at Camden power plant are now in commercial operation
► 2 units, each rated at 125MW, have been commissioned at Komati power station. Last unit (unit 1) planned for handover August 2012.
► 3 units, each rated at 200MW (total 600MW) have been commissioned at Grootvlei. Last unit (unit 6) planned to be completed end August 2010.

Transmission

Project Summary
► Transformers – 20 600 MVAs:
  • 765kv (Planned: 12,000 MVAs)
  • Cape Grid (Planned: 1,500 MVAs)
  • Northern Grid (Planned: 3,500 MVAs)
  • Central Grid (Planned: 3,600 MVAs)
► Transmission Lines – 3,977.5 Km:
  • 765kv (Planned:1,689.9 km)
  • Northern Grid (Planned: 1,253.6 km)
  • Cape Grid (Planned: 621 km)
  • Central Grid (Planned: 413 km)

Project Schedule (Projected completion dates)
► 765kv: (Mar 2012)
► Northern Grid: (Nov 2016)
► Central Grid: (Sept 2012)
► Cape Grid: (Dec 2012)

Other

Projects Summary - Refurbishment
► Major refurbishment of existing and operational power stations in Mpumalanga, comprising Duvha, Matla, Kriel and Arnot (300MW capacity increase)

Project Summary - Tubatse
► Greenfields 1,500MW pumped storage scheme near Steelpoort (Limpopo Province)
► Project on hold subject to funding being obtained

Project Summary – Majuba Rail
► Rail infrastructure for coal supply for the operational Majuba power station in Mpumalanga
► Awaiting revised schedule – as per the outcome of the World Bank decision.

Project Summary – Sere
► Greenfields pilot windfarm project on the West Coast (WC province)
► Awaiting revised schedule – as per the outcome of the World Bank decision.

SOURCE: Eskom Build Programme; 30 April 2010 Project Assurance Reports
Medium term outlook – MYPD2 Baseline

Energy Supply /Demand Balance on 86% and 84% EAF with Alcan excluded

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy in TWh</th>
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* Multi-Year Price Determination, December 2009
Additional contingencies to MYPD2 Baseline

• 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 current **5TWh annual energy surplus**, the system remains “tight”. It will therefore be appropriate to ensure that this “buffer” be maintained and planned for into the future
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.

Sufficient contingency will reduce the risk to the systems and build buffer to manage future pressure on the system.
Defining the Problem
Quantification of the Energy Gap

MYPD2

Demand: Reference
Supply: 84% EAF

Additional Contingencies

Demand: Reference
Supply: 84% EAF Delay

Initial Gap (TWh)

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
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Additional Buffer

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Defining the Problem
Nature of the problem: Energy vs Demand

Energy Availability rather than Capacity is the challenge!
Energy vs Demand

Eskom Power System Hourly Demand

Very flat profile during the day indicating energy rather than peak demand problem (Tuesdays selected)

Note: Winter profile is more peaky
Implications if the Gap is not closed

National Implications

- 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
Proposed Solutions to close the GAP

- Most Supply-side solutions are being pursued, but they are
  - Too late
  - Expensive
  - Not enough money allowed for in the approval of Eskom’s price application (MYPD2)
- Demand-side solutions are more readily available in the
  - Short term
  - Less expensive
  - Strong business case
- Strong case for both as they complement each other
The Impact of Price Elasticity

**What is Price (&Income) Elasticity**
- Price elasticity of electricity demand measures the sensitivity of consumption to changes in price
- Income elasticity of electricity demand measures the sensitivity of consumption to changes in income

**Key Findings**
- Electricity demand is fairly inelastic to price changes in the short term, but will see a longer term impact
- Electricity demand is sensitive to short term changes in income/commodity prices

**Likely Impact on Eskom**
- 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

**Resolution**
- There is a high level of uncertainty regarding the impact of price elasticity
- It should not be seen as a “bankable” solution for the critical period in 2012/13
- The long term implications need to be carefully monitored

*Refer to study performed by Eskom Treasury, 2009
| Options                                      | Savings : Energy | Savings : Demand | Easy Implementation | Bankability | Economic Implications | Eskom Control | Cost to Eskom | External Dependencies | Risks                                      | Focus                                                                 |
|----------------------------------------------|------------------|------------------|---------------------|-------------|-----------------------|---------------|---------------|-----------------------|-------------------------------------------|
| Mass Market DSM                              | ●                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         | Energy Efficiency and behavioural change initiatives provide deep energy solutions |
| Individualised Customer Energy Management   | ●                | ●                | ●                   | ●           | ●                     | ☢             | ●             | ●                     | ●                                         |                                                                 |
| DSM (Solar Water Heating)                    | ☢                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         | Predominantly Demand Response initiatives with secondary energy efficiency benefits |
| Communications (incl Power Alert)            | ☢                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         |                                                                 |
| Internal Energy Efficiency                   | ●                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         |                                                                 |
| Demand Market Participation                  | ●                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         |                                                                 |
| Utility Load Manager                         | ☢                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         |                                                                 |
| Advanced Metering Infrastructure             | ☢                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         |                                                                 |
| ECS : Energy Conservation Scheme             | ●                | ●                | ●                   | ●           | ●                     | ●             | ●             | ●                     | ●                                         | Risk Mitigation solution                  |

- **Favourable**
- **Problematic/Negative Impact**
- **Intermediate**
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).

There is growing support that ECS be positioned as a “safety net” for the industry.

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.
Key Messages

- 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.
Thank you

“The cheapest kWh is the one that you don’t use!”