South African Electricity Supply Industry – overview and recent developments

Barry MacColl
General Manager
South Africa’s Energy Challenges

- Keeping the lights on – powering the economy
- Security of supply for a growing economy – since 1994 the economy has grown by 79% and the power capacity by <17%
- Reduction of Carbon footprint
- Energy Poverty and access – 3.5m gap
- Affordability and competitiveness – and protection of the poor
- Local environmental impacts – land, water, air quality
- System stability
- Financing and entry of new players (IPPs)
- Delivering on the Integrated Resource Plan (IRP)
Integrated Resource Plan 2010
Consultation process and policy considerations

First round of consultation process (30 days for comments, hearings in Jun)

Parameters
- Inputs on demand-side (forecasts, energy efficiency)
- Inputs on supply side (generation options, committed programmes)
- Economic variables

Before second round of consultation process (October 2010)

Scenarios tested
- "Base Case"
- "Emission Limit"
- "Carbon Tax"
- "Regional Development"
- "Enhanced DSM"

→ Emission Limit 2.0 to be pursued further

Main changes
- Increased nuclear costs by 40%
- Included learning rates (mainly affects PV, CSP, wind)
- Disaggregated solar technologies

Second round of consultation process (90 days for comments, hearings in Nov, Dec)

Scenarios tested
- "Adjusted Emission" (based on Emission Limit 2.0)
- "High Efficiency"
- "Low Growth"
- "Risk Averse"
- "Peak Oil"
- "Earlier Coal"

After consultation process (February 2011)

Policy choices

Revised Balanced Scenario (RBS)

Multi-criteria decision making

Policy-Adjusted IRP
Policy-Adjusted IRP (Capacity)

Total additional new capacity (without committed) until 2030 in GW

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity in GW</th>
<th>Share of total new GW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>8,4</td>
<td>42%</td>
</tr>
<tr>
<td>CSP</td>
<td>1,0</td>
<td>9%</td>
</tr>
<tr>
<td>Wind</td>
<td>8,4</td>
<td>17,8</td>
</tr>
<tr>
<td>Coal</td>
<td>6,3</td>
<td>15%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>9,6</td>
<td>23%</td>
</tr>
<tr>
<td>Hydro</td>
<td>2,6</td>
<td>6%</td>
</tr>
<tr>
<td>Gas - CCGT</td>
<td>2,4</td>
<td>6%</td>
</tr>
<tr>
<td>Peak - OCGT</td>
<td>3,9</td>
<td>9%</td>
</tr>
<tr>
<td>Renewables</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Energy share in 2010: \( \sum = 260 \text{ TWh} \)
- Coal: 90%
- Nuclear: 5%
- Hydro: 5%
- Gas - CCGT: 0%
- Peak - OCGT: < 0,1%
- Renewables: 0%

Energy share in 2030: \( \sum = 454 \text{ TWh} \)
- Coal: 65%
- Nuclear: 20%
- Hydro: 5%
- Gas - CCGT: 1%
- Peak - OCGT: < 0,1%
- Renewables: 9%

Source: IRP 2010
The names of the 17 preferred bidders out of a total of 93 submissions in round three of the Renewable Energy Independent Power Producer Procurement (REIPPP) programme were announced earlier this year. This brings the total number of utility-scale renewable energy projects in progress to 64 with many window one projects in advanced stages of construction and a handful already feeding into the grid.

The total megawatt value of bids submitted in window three amounted to 6 023 MW whilst the available allocation for this window was 1 473 MW. The round also saw aggressive price decreases across all the technologies with an average of 74 c/kWh achieved for wind down from 1.14 R/kWh in window one, 99 c/kWh for solar photovoltaic (PV) down from 2.75 R/kWh in window one and 1.64 R/kWh for concentrated solar power (CSP), down from 2.69 R/kWh in window one.

Window three saw the addition of biomass (16 MW) and landfill gas (18 MW) projects to the REIPPP mix with the provinces of kwaZulu-Natal and Gauteng now boasting their entry into the REIPPP programme. Linear Fresnel CSP technology also makes its debut in the South African context.
Impressive Progress on REIPPP

REIPPP Megawatts to Date

The REIPPP programme first targeted 3 725MW of renewable energy power to be online by 2015. In December 2012, the DoE announced a further allocation of 3 200MW of renewable energy power to be online by 2020.

Source: DoE presentation

<table>
<thead>
<tr>
<th></th>
<th>MW in window 1</th>
<th>MW in window 2</th>
<th>MW in window 3</th>
<th>MW remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>632</td>
<td>417</td>
<td>435</td>
<td>1 041</td>
</tr>
<tr>
<td>Wind</td>
<td>634</td>
<td>563</td>
<td>787</td>
<td>1 336</td>
</tr>
<tr>
<td>Concentrated Solar Power</td>
<td>150</td>
<td>50</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Small Hydro (less than 40MW)</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>121</td>
</tr>
<tr>
<td>Landfill Gas</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Biomass</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>43</td>
</tr>
<tr>
<td>Biogas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>TOTALS</td>
<td>1 416</td>
<td>1 044</td>
<td>1 456</td>
<td>2 808</td>
</tr>
</tbody>
</table>

http://www.energy.org.za/reippp/78-reippp-window-three
Access to GCCA report

Request for a GCCA-2012 document must be submitted as follows:

- Go to Eskom website [www.eskom.co.za](http://www.eskom.co.za)
- Go to the following sub-sections: “Media room/Publications” to find the “GCCA Report” option
- Complete the details as requested and submit to the email address
- Organisation / Entity will be entered in database
- Copies can be either sent electronically or posted (CD or book)
- Only one copy per organisation / entity
Renewable Prices Dropping Fast (1 USD = 12,4 ZAR)

The Update process

IRP 2010 - THREE PHASE UPDATE PROCESS

**Start**
Approved IRP 2010

**Phase 1**
5 update steps
Updating IRP 2010 by replacing assumptions with new information and facts

1. New EPRI costs
2. New 80:10:10 outage plans for existing fleet
3. CSIR Green Shoots Forecast
4. Life extension & FGD retrofitting of existing fleet included as options
5. Only Renewables Round 1 & 2, DOE Peaker are forced; Other determinations incl Nuclear relaxed

**Phase 2**
Demand Forecast Trajectories (Scenarios)

(System Operator)
SO Moderate Forecast
- 5.4% GDP growth to 2030; 2.8% Ave annual electricity demand growth to 2030 (and 2.4% to 2050)

Green Shoots
- Electricity demand lower than forecasted; but economic activity only marginally different
  - 5.4% GDP growth to 2030; 2.7% Ave annual electricity demand growth to 2030 (and 1.9% to 2050)

Weathering the Storm Forecast
- 2.9% GDP growth to 2030; 1.8% Ave annual electricity demand growth to 2030 (and 1.3% to 2050)

(System Operator)
SO Low Forecast
- 4.5% GDP growth to 2030; 1.9% Ave annual electricity demand growth to 2030 (and 1.5% to 2050)

**Phase 3**
Test Cases

- Big Gas
- Fuel Price Sensitivity
- Nuclear Cost Sensitivity
- Learning Curve Sensitivity
- Rooftop PV
- Solar Park
- Carbon Tax
- Regional Hydro
Update Technology Cost Assumptions

Inflation:
- PF Coal (with FGD): 2,655
- FBC Coal (with FGD): 2,234
- IGCC: 3,682
- Nuclear: 5,554
- OCGT: 590
- CCGT: 863
- Wind: 2,156
- CSP (Parabolic, 9 hrs): 7,599
- PV crystalline (fixed tilt): 3,106

IRP 2010:
- PF Coal (with FGD): 17,785
- FBC Coal (with FGD): 14,965
- IGCC: 24,670
- Nuclear: 37,205
- OCGT: 3,955
- CCGT: 5,780
- Wind: 14,445
- CSP (Parabolic, 9 hrs): 50,910
- PV crystalline (fixed tilt): 20,805

IRP Update:
- PF Coal (with FGD): 21,572
- FBC Coal (with FGD): 21,440
- IGCC: 29,282
- Nuclear: 45,074
- OCGT: 4,357
- CCGT: 6,406
- Wind: 15,394
- CSP (Parabolic, 9 hrs): 61,176
- PV crystalline (fixed tilt): 19,250

Overnight capital costs (R/kW)
Peak demand paths indicating incremental large investment requirements
Wind and PV under different scenarios

- Continue with the current renewable bid programme with additional annual rounds (of 1000 MW PV capacity; 1000 MW wind capacity and 200 MW CSP capacity)
- Pursue small hydro and land-fill gas at competitive rates
Recent Developments
The Government uses the term and establishes their own...

Cabinet sets up electricity ‘war room’

December 11 2011 at 11:41am
by Maxtho

Pretoria - Cabinet has devised a five-point plan to deal with the electricity crisis and set up a “war room” to implement it. Minister in the Presidency Jeff Radebe announced on Thursday.

All attempts were being made to ensure the tight energy situation was overcome, he told journalists in Pretoria following Cabinet’s regular Wednesday fortnightly meeting.

“A technical team war room for the implementation of the five-point plan is constituted with immediate effect”

Radebe said power utility Eskom would be signing a memorandum of understanding with the Strategic Fuel Fund and the Transnet Port Authority on Thursday to ensure the fuel situation needed for the generation...
The War Room mandate has been established as a response to the current electricity challenges faced by the country.

The War Room has a **mandate to work with government** in order to assist **Eskom to overcome its operational challenges** through the Cabinet-approved **five-point plan**. The elements of the five-point plan are as follows:

- Eskom emergency measures – 30 days
- Cogeneration
- Gas imports
- Coal independent power producers (IPPs)
- Demand-side management

- On 10 December 2014, Cabinet approved a five-point plan to address the current electricity challenge.
- **Eskom welcomes government support** in dealing with the constrained power system challenges.
- Eskom was tasked with focusing on the following, subject to finances and governance processes:
  - Expediting the recovery programme at Majuba and Duvha and other repair work and reducing partial load losses
  - Improving the quality and effectiveness of maintenance
  - Expediting bringing the Medupi and Kusile units online
  - Improving the quality of coal to produce electricity
  - Securing funding to enable the use of the OCGTs during the remainder of the MYPD3 period, on the understanding that the OCGTs are used as a last resort to avoid load shedding
  - A plan to identify potential savings in the procurement of diesel
  - Renewal of the existing cogeneration contracts
  - Obtaining additional cogeneration capacity
  - Renewal of the existing demand market participation contracts
  - Pursuing additional demand-reduction mechanisms, including power buy-backs
Five-point action plan

The five-point action plan approved by Cabinet (December 2014) is as follows:

1. Immediate measures (improve maintenance and operational practices)
2. Cogeneration
3. Gas for power generation and additional sources of supply
4. Other independent power producers (IPPs)
5. Demand-side management

Other focus areas include financial and procurement issues, skills development, regulatory issues, long-term issues with short-term implications (for example, energy mix), and communications.
Government’s War Room structures

Cabinet

Deputy President

Deputy President Advisory Panel

Interministerial (Monthly)

Composition:
- Deputy President
- Eskom: CE, FD
- Government: Ministers

Technical War Room (Weekly - Friday)

Composition:
- Eskom: CE, FD

War Room Secretariat (Weekly - Thursday)

Composition:
- Eskom: Marion Hughes, Louis Maleka
- Government:
  - Dr Sean Phillips: DG Office of the Presidency
  - Ompie Aphane: DDG Dept. of Energy
  - Gcina Hlabisa: Dept. of Public Enterprises
  - Malcolm Simpson: National Treasury (Programme Management)
  - Ashraf: Office of the Presidency
Shortfall in supply to meet demand
We are at war – little wriggle room and system under threat
Objective of the RFI

The objective of this RFI is to gather information on the potential for more and innovative demand reduction/shifting and/or supply initiatives. The immediate focus is on rapid implementation of “demand response” capabilities. The national medium to longer term objective is to have available a range of supply/demand options that will ensure a “more economic grid” and consequently assist in containing electricity prices whilst ensuring security of supply.

This RFI is a stand-alone information-gathering and market-testing exercise to solicit information from providers of demand response and/or distributed generation solutions (the “Respondent”) and is intended to inform and assist the IPP Office with further deliberation and development of a national demand response strategy.
Small Scale Renewable Integration is coming!

Consultation Paper

Small-Scale Embedded Generation:
Regulatory Rules

PUBLISHED ON 25 FEBRUARY 2015

Issued by
The National Energy Regulator
526 Madiba Street
Arcadia, Pretoria
0007

THANK YOU

Barry MacColl
General Manager – Research, Testing & Development
Eskom

Email barry.maccoll@eskom.co.za