IRP 2016 Reality Check
Comments in Cape Town – 13 December 2016

CT Gaunt
Dept. of Electrical Engineering, University of Cape Town
(Not an authorised expression of university policy)
Reality Check

Three key topics:

• Load forecasts
• Capacity requirements
• Energy mix

Other details justify comment, but time is limited.

Based on November draft issued by Dept of Energy.
50-year electricity demand and consumption

From 1967 to 2008 added:
- 5.3 TWh/y energy for distribution
- 4.9 TWh/y energy sales
- 800 MW/y power supplied

..then load shedding
Reality check:

- Forecast dominated by sales in one sector
- C&M 1973-2008 growth rate = Scenario 2015 Low = 3.0 TWh/y
- All other sectors growing more slowly.
Unrealistic: low skills base, low investment rating, etc do not support high growth.

Recovery from load shedding

Economic decline
Assumes lost growth / suppressed demand (2008-2016) can be Partially or Fully regained.

Recovery Scenario requires:

• End of load shedding – in all forms
• Stable electricity pricing
• Higher ratio of production-to-consumption use of energy
• Increased productivity (skills) of population
• Attention to other deficiencies: water, transport, etc

IRP Base Case (High demand, less energy intense) is within Recovery Scenario until 2035; thereafter exceeds it.
The Annual Load Factor (ALF) reflects the ratio of energy to maximum power demand. ALF in RSA for 50 years consistently about 0.75.

- Annual demand in Recovery Scenario increases by 800 MW/y.

- Adding 17.5% for contribution to Operating Reserve needs annual capacity increase of 940 MW/y.

- Project Full Recovery from 35 GW demand (41 GW capacity) in 2007

- Project Partial Recovery from 35 GW/41 GW in 2015
Retiring old plant

End of life established by:

- Ageing equipment too costly to refurbish
- Local coal deposit exhausted
- New environmental constraints or taxes
- Political change, such as by imperfect energy markets or decree

Power Station age profile in 1999
New-Build Requirement

<table>
<thead>
<tr>
<th>Recovery Scenario</th>
<th>Partial</th>
<th>Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base year for projection</td>
<td>2015</td>
<td>2007</td>
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<tr>
<td>Capacity [GW] required in 2017</td>
<td>43</td>
<td>51</td>
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Example projection, by 2035:

- demand growth 2017-2035 [GW] 17
- 2017 existing capacity retired [GW] 14
- New-build required [GW] 31 (1.7 GW/y)

But new-build 2021-2035 projects 3.3 GW/y

Assumption: total capacity addition with ALF=75%

Base Case assumes ALF=68% increasing to 69.5%
On the Energy Mix

Reality check of Base Case shows it is inconsistent.

- Power and energy mix in Figs 10 and 11 difficult to read, but do not add up to 100%.

In 2050:

- 20 GW of new-nuclear (top of pg 27) is 14.9% of installed capacity (Fig 10), so capacity is 134 GW; this capacity estimate is consistent for the other sources.

- Pg 26: 85.8 GW demand plus 20% operating reserve requires installed capacity of 103 GW.

- ~30 GW of renewable capacity is planned as non-firm (zero capacity value).
Practical risks of interruptions in systems with high renewables penetration have become evident during 2016:

- New York State
- Illinois State
- South Australia.

Base Case does not assess COUE, even though dispatchable power may not meet demand:

- Coal, nuclear, gas and hydro supply 100% of power demand in 2050; renewables – if available – supply only operating reserve.
- Displacement of conventional output by intermittent renewables increases LCOE and the total cost.
Load forecasts based on statistical analysis are inconsistent with experience.

Base Case new-build capacity 2021 to 2035 is high.

Base Case IRP is internally inconsistent and fails to include load shedding costs.

Many other details can be questioned.

Major omissions:
- No reference to industry structure and its effects on costs, tariffs and responsibility for adequacy.
- Least cost approach to energy mix is inadequate for intermittent sources; must include full cost and revenue.