



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)**

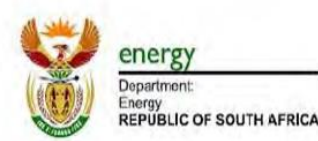


Reality Check

Three key topics:

- Load forecasts
- Capacity requirements
- Energy mix

Other details justify comment, but time is limited.



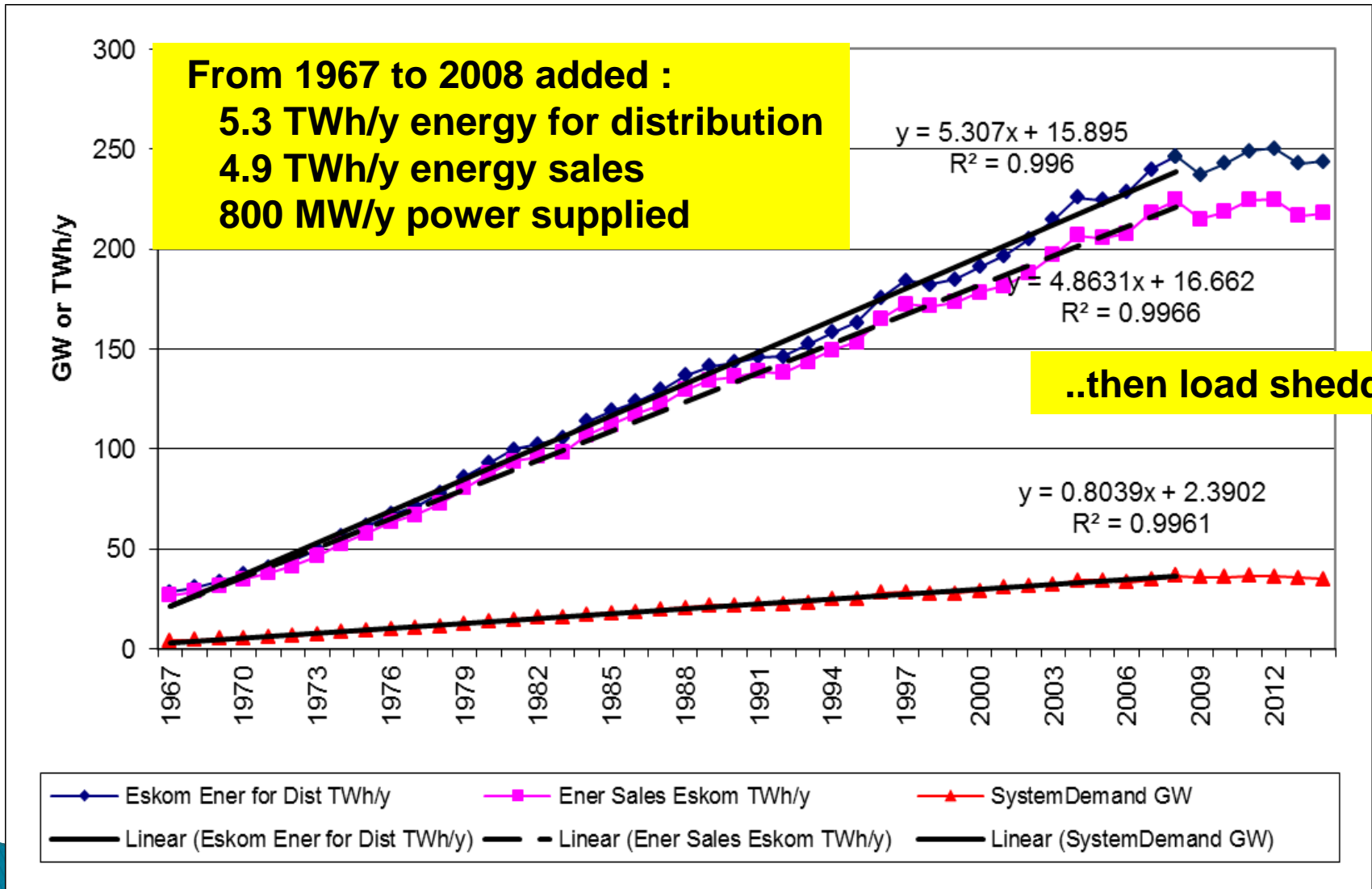
INTEGRATED RESOURCE PLAN
UPDATE
ASSUMPTIONS, BASE CASE RESULTS AND OBSERVATIONS
REVISION 1

November 2016

This IRP update documentation has been released for consultation purposes only.
Final IRP update will be published once the consultation process and policy adjustment has been concluded.

Based on November draft issued by Dept of Energy.

50-year electricity demand and consumption



5-sector energy forecasts to scale

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.

Commerce and Manufacturing:
FS=450 TWh

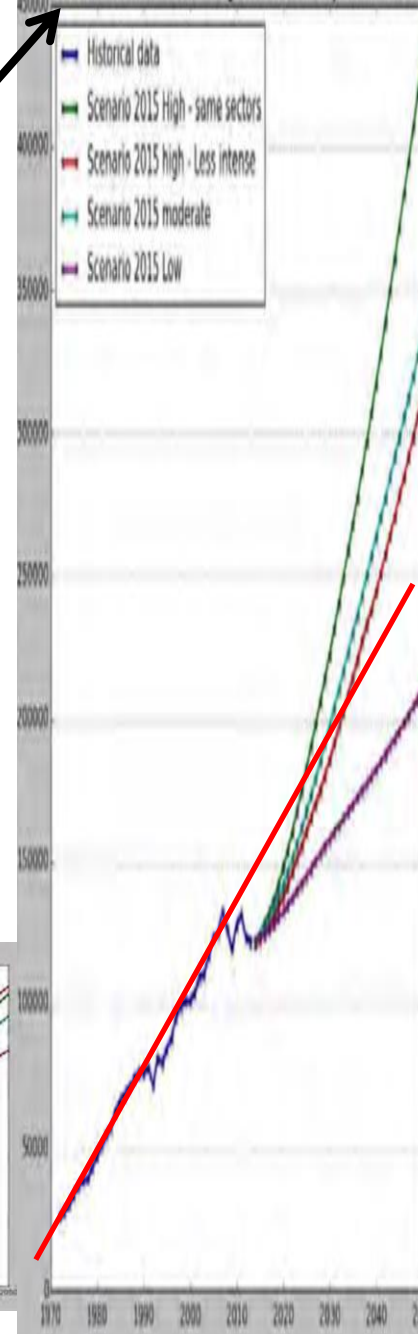
Domestic:
FS=100 TWh

Mining:
FS=50 TWh

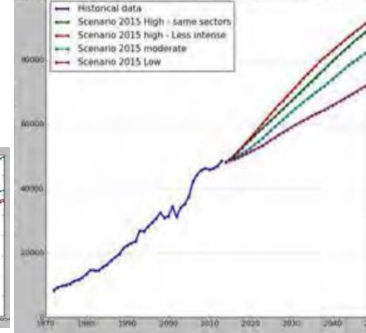
Transport:
FS=18 TWh

Agriculture:
FS=12 TWh

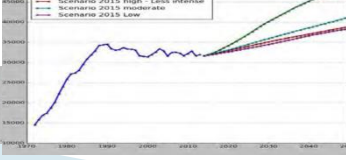
Commerce & manufacturing annual consumption in GWh



Domestic annual consumption in GWh

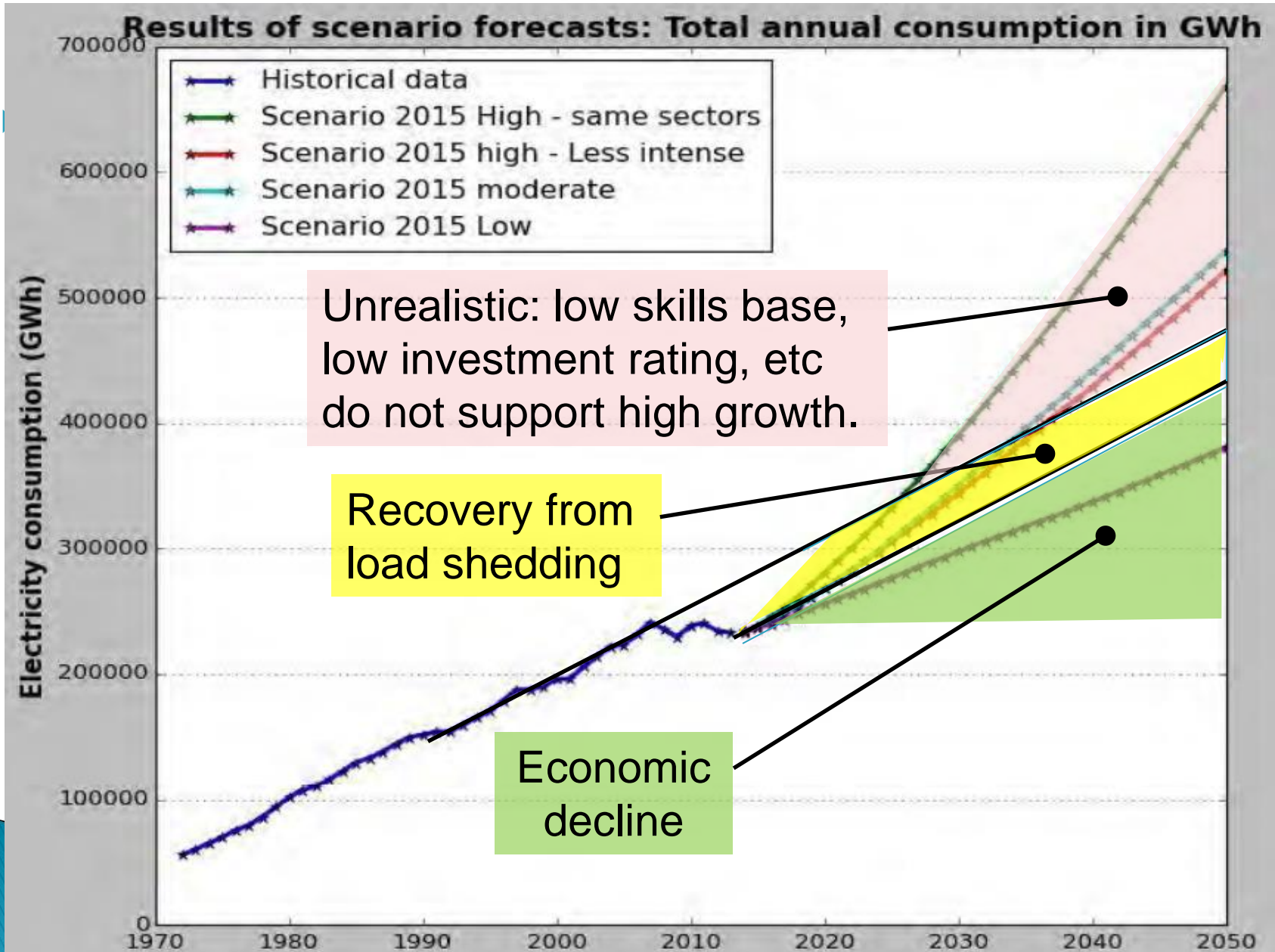


Mining annual consumption in GWh



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Overall energy forecast bands



Recovery Scenario

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.

Energy forecast into power

The Annual Load Factor (ALF) reflects the ratio of energy to maximum power demand. ALF in RSA for 50 years consistently about 0.75.

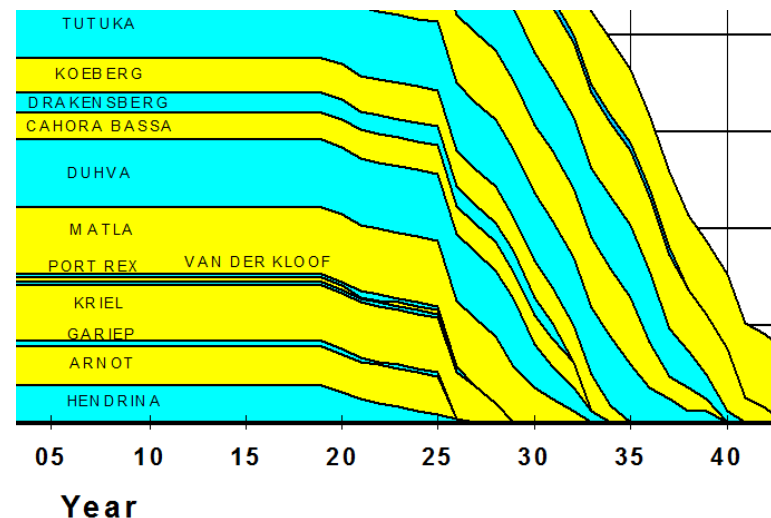
- Annual demand in Recovery Scenario increases by 800 MW/y.**
- Adding 17.5% for contribution to Operating Reserve needs annual capacity increase of 940 MW/y.**
- project Full Recovery from 35 GW demand (41 GW capacity) in 2007**
- project Partial Recovery from 35 GW/41 GW in 2015**

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

Recovery Scenario	Partial	Full
Base year for projection	2015	2007
Capacity [GW] required in 2017	43	51
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).**

Adequacy and Reliability

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.**

Conclusions

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.**