

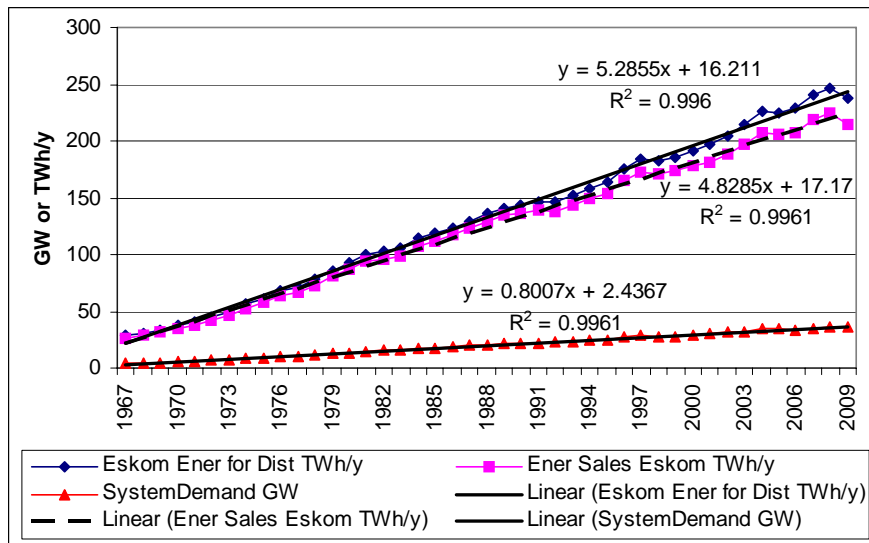
Effects of load forecast, rural electrification and interruption costs on IRP 2010

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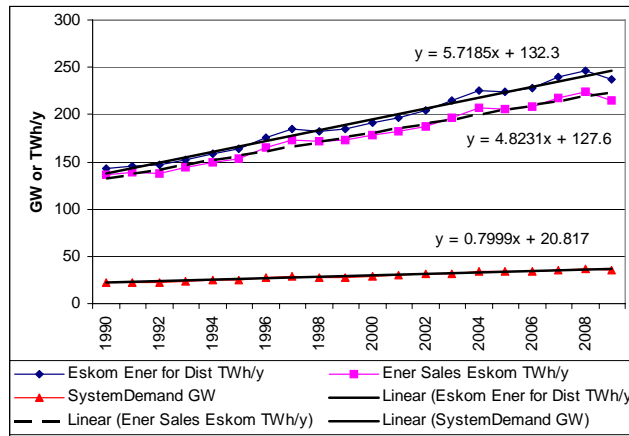
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Not an authorised expression of university policy.
Based on a research paper in preparation for publication.

43-year electricity demand and consumption



20-year: electricity available and sales



Add each year:

Energy 5.7 TWh
Sales 4.8 TWh

Demand 800 MW

16% of the energy increase each year is losses (technical losses + theft)

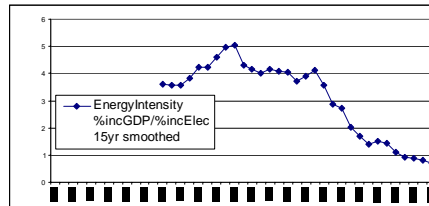
Electrification in South Africa

- Worldwide 1.5bn people lack access to electricity: 25%
- In SA, the same percentage of households lack access to electricity.
- During the 1990s municipalities and Eskom showed feasibility of 450'000 new connections/year.
- 1990 to 2002, household access increased from 36% to 72%. Increased peakiness of daily demand profile.
- Electrification not mentioned in IRP2010.
- Has further electrification been abandoned?
- Solar Water Heating (DSM) also changes load profile.

Impact of GDP

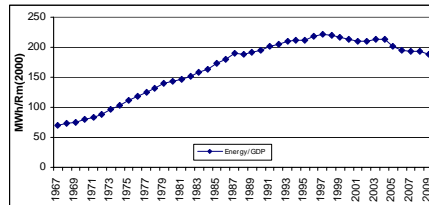
- IRP says Energy Intensity (EI= $\frac{\% \text{incGDP}}{\% \text{incElecSales}}$) is most important parameter of electricity growth, and forecasts move from EI=3:2 to EI=2:1.
- Historical data shows no such relation for SA.

Smoothed EI (as defined) over previous 15 years:

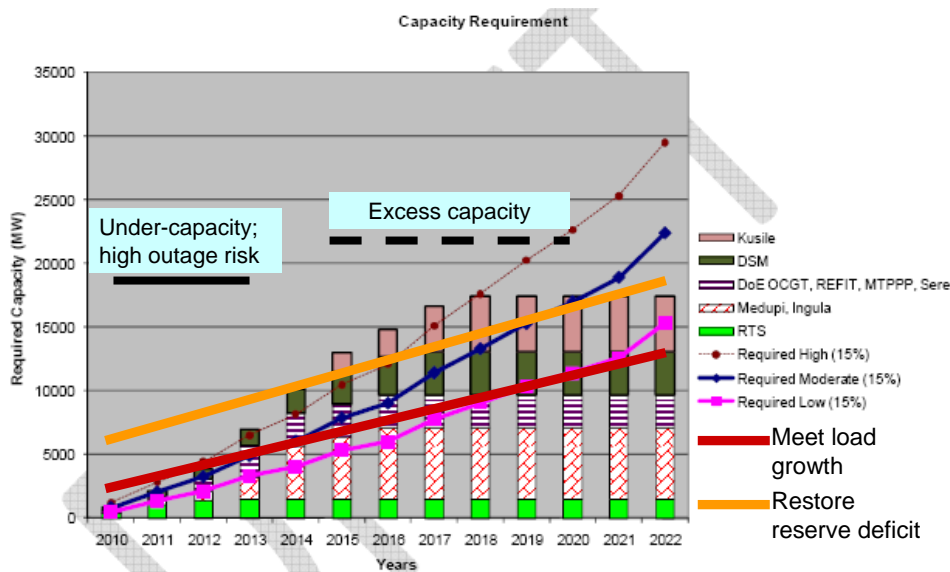


Energy needed per unit of GDP is falling.

- Was change deliberate policy?



Additional electricity demand capacity needed



Cost of interruptions

- Cost of unserved energy is given as R75/kWh, IRP sensitivity tested to R150/kWh.
- Old figure (2006?); inflate by 25% for 2010.
- Is utility cost, ignores customers' interruption cost (CIC).
- Our work shows CIC is:
 - not linear with duration,
 - high and variable, but average could be used for plan,
 - a significant part of total cost of interruptions.
- Energy needed per unit of GDP falling, so CIC increasing in economic terms.
- Probably need interruption cost around R200-250/kWh, but more work needed to substantiate this.

Optimum energy mix

- Optimum energy mix matches load magnitude and profile to costs of supply.
- Cost of energy from OCGT is so high that it can only be considered for short peaks and avoiding interruptions – not for operating many hours per year.
- System economics indicate:
 - Wind energy without storage is available randomly ~30% of the time.
Value = avoided coal cost + carbon credit, since all other plant needed to supply when wind not available. REFIT for wind is excessive.
 - Reliable solar energy with storage to meet evening peak demand is worth WEPS price + carbon credit.

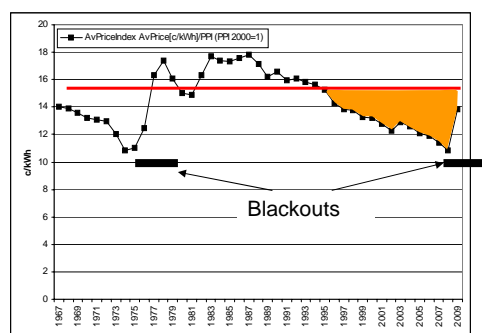
Impact of tariffs on demand and consumption

Tariffs excluded from the plan, but drive customer response and load:

- Poor consumers and theft are subsidised by others.
- Small domestic consumers have low LF but contribute significantly to cost of supplying demand.
- Larger households encouraged to adopt SWH; reduces their LF, electricity consumed, contribution to subsidies.
- Industry and commerce will carry cost of subsidies to increasing extent, or adopt alternative energy supply.
- Long run tariffs must reflect costs.

Historical price c/kWh

- Average price, adjusted by PPI
- Assume good long term price: 15.5 c/kWh (base = PPI in 2000)
- Accumulated deficit since 1995
- Needs capital injection (R137bn in 2009 money)
- Long term price stability needs moderate future tariffs, otherwise system will become unstable
- Financial strategy is essential part of IRP



Conclusions

- IRP2010 :
 - contains unrealistic energy and demand projections, RE targets and interruption costs;
 - inappropriately costs some electricity sources, and
 - fails to recognise effects of tariffs.
- These establish scenarios unlikely to lead to optimum energy plans and operations.
- Poor modelling of the electricity industry also leads to poor decisions about institutional structure, distribution planning, R&D, tariffs, etc.
- IRP2010:
 - contains much valid material,
 - could be an important policy and planning document (and process),
 - but errors and omissions detract substantially from its value.