36 views of electricity peak demand – a visual tour of recent developments and uncertainties' in NSW Network peak load

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Overview

NSW electricity network's peak demand as seen a major transformation over the last decade, moving from seemingly inevitable steady growth to decline, stagnation and uncertainty. Substantial network investments were made on forecasts for new capacity which would potentially be used for only a few hours a yea and no may no be needed for a decade or moer. This coincided with a period of falling energy consumption and hence increasing pressure on average electricity prices worldwide and has left as environment of uncertainty and heightned risk.

This paper looks at peak demand issues from a range of perspectives to promote debate and analysis of the underlying issues and implications including a shift from deterministic to probabilistic planning approaches. Of particular interest are the recent shifts between winters to summer peaking in NSW, energy efficiency developments, new technologies and embedded generation and implications for capacity requirements. Using a range of national, state, local and customer data sets, perspectives on peak demand include:

- The recent history of peak load forecasting and forecasting errors
- Current forecasts and the treatment of uncertainty
- Peak demand and NEM pool prices – correlations and disparities
- Cross-sectional winter and summer day time peak demands at local zone level
- Residential customer household load profiles, consumption and appliance usage
- Geographic plots of load
- Historical timelines of maximum and minimum peak loads
- Peak load and temperature correlations
- Probibility of excedence and scenario estimates
- Diversity of peaks impacts across elements in the electricity system

The paper's title is a allusion to Hokusai's "Thirty-six Views of Mount Fuji".

Methods

The analysis makes use of interval metered data sources made available through increased customer and system level metering. The paper has a heavy emphasis on visualisation of peak demand issues in the analysis of trends and uncertainty and in turning big data sets into tractable knowledge. Underlying many of these methods are support for a shift from deterministic to probabilistic planning approaches for infrastructure investments.

Results

Results are presented as historical, forecast, cross-sectional and locational/spatial graphs and graphics of electricity peak load. Each of the 36 views represnts a different aspect of the issue explored through the data and its presentation – in some cases with individual views displayed from different angles.

Conclusions

The paper concludes that the issues underlying peak demand are more rich and complex than is generally recognized and provides comment on potential future policies and approaches to address peak demand analysis. It makes recommendations about improving the treatment of uncertainty and presentation of forecasts.

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