Senergy Econnect report (2009), *The Treatment of Intermittent Generation in the SWIS Capacity Market*

Report summary

The Office of Energy commissioned Senergy Econnect to analyse the relationship between renewable energy resources and electricity demand in the state's main electricity grid. The analysis was undertaken in the context of informing capacity credit allocations to intermittent generators.

Analytical approach (and limitations)

The Reserve Capacity Mechanism drives investment in new generation capacity in order to ensure the reliability of the electricity system. This analysis in this study serves to help quantify the interaction between intermittent generation and system load using available intermittent energy resource and generation data.

The study relies upon capacity credit allocation options present in or proposed for the market. Electricity system reliability is most at risk at times of highest load, when generator failure puts the system at greatest risk of load shedding. Allocation methods derived from rule-of-thumb reliability criterion were also considered.

Further whole-of-system analysis is required to evaluate the contribution intermittent generators make to the reliability of the electricity system. The study is not a review of the Wholesale Electricity Market's Reserve Capacity Mechanism, nor are network-related constraints or issues considered.

Intermittent generators may have implications for other aspects of the Reserve Capacity Mechanism. For example, an increase in the load-following component of the reserve margin may be required to manage the variability of wind generation. The costs of load-following capacity may be significant but are not considered here.

Capacity credits revenue

Capacity credits provide an additional revenue stream to new generation that rewards capacity availability. Capacity credits contribute in the order of ten per cent of the potential revenue stream of intermittent generation projects.

A greater focus on generation in peak load periods could marginally increase payments to wind generation and double capacity credits revenue for solar thermal generation. Conservative approaches to allocating credits for intermittent generation could substantially reduce revenue.

Overview by energy source

<u>Wind</u>
The correlation between intermittent generation and times when load is highest is an important determinant of the likely contribution variable generator makes to system reliability. Intervals when the load is highest give an indication of when the system is likely to be most at risk of load-shedding.

Demand for air-conditioning as a result of extreme hot weather episodes is a major determinant of peak electricity loads in the SWIS. Overall, wind generators in coastal areas exhibit a small positive correlation with high electricity loads (ie the top 0.5 to 1.5 per cent), although results vary by site. Variability (and hence reliability) also varies between wind sites.

Wind is a highly variable energy resource. This volatility is evident over relatively small interval selections. Wind generation during a small number of extreme hot weather episodes that have occurred over the last few years demonstrate the potential for large variations in output between trading intervals at peak times. However, further work would be necessary to establish a systematic correlation with extreme high loads, ie in the 1 in 10 year timescale incorporated into the market rules.

As independent sources of wind generation are added to the wind generation fleet, the likelihood of relatively low levels of generation is reduced. This is because of the likelihood some generators will be operating at high levels when others are not. The 90 per cent reliable level of generation across the fleet of wind farms in the SWIS is double the equivalent level of generation for each wind farm individually.

The reliability improvement could be undermined (or enhanced) by weather pattern correlations between wind sites. However, no material correlations were evident between existing wind farms over trading interval periods or the various Bureau of Meteorology wind mast locations distributed around the SWIS. This outcome may not hold in the future if new wind farms are located in close proximity to existing wind farms.

Solar thermal generation

Solar thermal generation has a strong correlation with peak load intervals. This is under-recognised by the current capacity credit allocation approach. Further, solar radiation is highly reliable during summer peak load intervals when the sun is sufficiently high in the sky. Incidences of cloud obstruction are low.

However a substantial portion of peak load intervals also occur towards the end of the day or in the early evening. Longitude influences alignment of insolation with SWIS peak loads, with a substantially better match in Geraldton compared to Kalgoorlie. System loads (and, hence, likely system risk) may be marginally higher on average during peak load intervals occurring in daylight hours, depending upon location. Any such benefit would not be reflected in the allocation methods quantified in this study.

Storage capacity can moderate the effect of cloud cover and allow a solar thermal facility to generate during high early evening loads, making it a more reliable generation resource.

Landfill gas

Landfill gas has a comparatively stable output that exhibits no correlation with load. Rule allocation options assessed in this study have a relatively small impact.

SEDO
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