Murdoch study advocates for WA as ideal location for commercial scale renewable energy demonstration projects

4 Main Points from the Main Report

The single most important determinant electricity demand on the largest WA electricity network, the South West Inter-connected System (SWIS), is the daily temperature. Summer maximum temperatures can range from the mid-twenties to the mid-forties, resulting in daily peak demand fluctuations from below 2,000 MW and above 4,000 MW. The short-term nature of peak demand in the SWIS is illustrated by the last 800 MW (or 23% of the total generation capacity) being utilised only 3% of the time.

The SWIS exhibits a high inter-annual variability highly dependent on temperature and associated air-conditioning load growth exacerbated by robust population growth. The SWIS electricity demand is forecast to continue growing at around 120 MW each year. Electricity consumption and maximum demand are forecast to grow at 2.2% and 3.2%, respectively per year over the period 2007/08 to 2016/17. In winter, peak demand is also strongly influenced by the weather, but is primarily determined by heating requirements. As electricity competes directly with gas and other energy sources for heating in WA, there is a lower peak electricity demand compared to summer cooling loads that are almost exclusively supplied by electricity. Winter peak demand is forecast to be almost 4000 MW by 2018, which is only 60% of the forecast summer peak demand in that same year. In addition to seasonally dependent demand changes, the SWIS overnight loads are markedly lower than daytime loads. This extreme seasonal, inter and intra-day demand variability provides an excellent baseline to explore new technology investments, demand side management techniques, and electricity market options.

One promising option is new large scale solar (thermal or photovoltaic) electricity power stations that generate electricity at times that strongly correlate with peak demand on the SWIS. In contrast to wind where the most prospective sites are exploited first, solar electricity marginal costs are likely to continually decrease as the resource does not suffer from the same constraining limits. Furthermore, unlike the complex correlation with wind and temperature, in practical terms there is a clear relationship between average solar generation and temperature in WA. Some regions of the SWIS are more prospective than others for large solar demonstration plants. For example, there is a better match between the solar resource with peak loads in Geraldton compared to Kalgoorlie.

International experience has shown that when variable renewable electricity generation penetration approaches 20%, additional frequency control ancillary services (FCAS) are required. When this penetration reaches 30%, the total cost incurred by market participants is generally around 2% of the retail price of electricity, as conventional generators run at less than full output or are idle. In 2008/09 the SWIS recorded only 5.0% of electricity was sourced from renewables, mostly from wind farms. In GWh terms for the period, renewable energy sold by retailers on the SWIS totalled 755 GWh, while regional grids totalled 81 GWh, and other systems were an estimated 143 GWh. These figures demonstrate that in addition to the successful roll-out of large wind energy investments, solar systems show great promise at adding huge capacity at times when we need it most. This is in addition to the vast wave, geothermal, and significant landfill gas resources that all provide base-load electricity to easily meet a 20% renewable electricity target for WA by 2020, contributing to a diverse, secure, and clean electricity industry for the state.
References


