Analysis of 2019-20 response to Individual Reserve Capacity Requirement

A 2020 Wholesale Electricity Market Electricity Statement of Opportunities supplementary analysis

The Individual Reserve Capacity Requirement (IRCR) financially incentivises Market Customers[1] to reduce consumption during peak demand periods and hence reduce their exposure to Reserve Capacity costs. At the time of peak demand for the 2019-20 Capacity Year, 75 Customers[2] reduced consumption, resulting in a total reduction of 140 megawatts (MW) .

This IRCR analysis is supplementary to the *2020 Wholesale Electricity Market (WEM) Electricity Statement of Opportunities* (ESOO)[3]. This analysis investigates Customers' response to the IRCR mechanism during the peak demand[4] day and Hot Season[5] of the 2019-20 Capacity Year in the South West interconnected system (SWIS).

1. Analysis of response to IRCR

The IRCR allocates the cost of Reserve Capacity to Market Customers. AEMO assigns an IRCR to each Market Customer based on the peak demand usage from its Customer base in the previous Hot Season.

Typically, the IRCR is a quantity (in MW) and determined based on the median consumption of each metered load in a Market Customer's portfolio during the 12 Peak SWIS Trading Intervals from the previous Hot Season[6].

The IRCR is used to allocate the cost of Capacity Credits acquired through the Reserve Capacity Mechanism to Market Customers. As a result, the IRCR financially incentivises Market Customers and Customers to reduce their consumption during peak demand periods and consequently reduces their exposure to capacity charges.

2019-20 peak demand

AEMO conducted analysis on a sample of the largest 500 customers in the SWIS to determine a representive response to the IRCR mechanism, for the 2019-20 Capacity Year peak demand day, including estimated reduction in Customers' consumption and numbers of Customers who responded to reduce their consumption (IRCR response).

Peak demand for the 2019-20 Capacity Year was 3,919 MW, occurring on 4 February 2020, during the 17:30 to 18:00 Trading Interval. AEMO's analysis compared each Customer's consumption during this Trading Interval with consumption during the 17:30 to 18:00 Trading Interval on non-peak demand days, to determine whether a targeted reduction in consumption occurred during the peak demand Trading Interval. Results are presented in Table 1.

Table 1 IRCR response during the 2019-20 summer peak demand

Date	Peak demand (MW)	Trading Interval of peak demand	Estimated reduction in consumption (MW)	Estimated number of Customers reducing consumption out of the sample
4 February 2020	3,919	17:30 - 18:00	140	75 (15 %)

[1] A Rule Participant who is registered as a Market Customer under clauses 2.28.10, 2.28.11 or 2.28.13 of the Wholesale Electirlcity Market Rules (WEM Rules). A Market Customer represents a person who sells or intends to sell electricity to Customers.

[2] A person to whom electiricty is sold for the purpose of consumption.

[3] At https://aemo.com.au/-/media/files/electricity/wem/planning_and_forecasting/esoo/2020/2020-wholesale-electricity-market-electricity-statement-of-opportunities.pdf?la=en.

[4] The peak demand is identified as the highest operational demand calculated for a Capacity Year. Operational demand refers to network demand met by utility-scale generation and excludes demand met by behind-the-meter photovoltaic (PV) generation. Operational demand is measured in MW and averaged over a 30-minute period. It is reported on a "sent-out" basis and calculated as the highest Total Sent Out Generation (TSOG) x 2 to convert non-loss adjusted megawatt hour (MWh) to MW for a Trading Interval.

[5] Hot Season is defined in the WEM Rules as the period commencing at the start of the Trading Day beginning on 1 December and ending at the end of the Trading Day finishing on the following 1 April. References in this analysis in relation to the definition of Hot Season refer to the 2019-20 Hot Season; 1 December 2019 to 1 April 2020.

[6] These 12 Peak SWIS Trading Intervals means the three Trading Intervals with the highest TSOG on each of the four Trading Days with the highest maximum demand in that Hot Season, as published by AEMO in accordance with clause 4.1.23A of the WEM Rules, where the maximum demand for a Trading Day is the highest TSOG for any Trading Interval in that Trading Day. The IRCR of a Non-Temperature Dependent Load is based on the meter data of the four Peak SWIS Trading Intervals in a relevant Trading Month determined and published by AEMO under clause 4.1.23B of the WEM Rules. Current and historical 12 peak SWIS Trading Intervals are at http://data.wa.aemo.com.au/#peak-intervals.

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An estimated reduction of 140 MW occurred from 75 Customers (15% of the sample) during the 2019-20 peak demand Trading Interval, indicating that the IRCR mechanism is working as expected in incentivising reduced consumption during high demand periods.

The ability of a Customer to target reduced consumption during periods of high demand is dependent on their ability to predict such periods; this is discussed further in Section 2.

2019-20 Hot Season

The IRCR response analysis presented in Table 1 was repeated for each of the 12 Peak SWIS Trading Intervals. The estimated reduction in consumption for these Trading Intervals is shown in Table 2.

Table 2 IRCR response during 12 Peak SWIS Trading Intervals, 2019-20 Hot Season

Trading Date	Trading Interval	Estimated reduction in consumption (MW)	Estimated number of customers reducing consumption from the sample
12 December 2019	17:30 – 18:00	147	72
	18:00 – 18:30	141	70
	18:30 – 19:00	142	74
3 February 2020	17:30 – 18:00	102	61
	18:00 – 18:30	120	62
	18:30 – 19:00	121	66
4 February 2020	17:30 – 18:00	140	75
	18:00 – 18:30	140	71
	18:30 – 19:00	138	72
14 February 2020	17:00 – 17:30	125	70
	17:30 – 18:00	125	73
	18:00 – 18:30	123	75

Analysis of the 12 Peak SWIS Trading Intervals shows:

- Reduction in consumption were registered during all 12 Peak SWIS Trading Intervals, and the number of Customers responding during each Trading Interval ranged from 61 to 76 Customers.
- The estimated reduction in consumption ranged from 102 MW (3 February 2020, 17:30 – 18:00) to 147 MW (12 December 2019, 17:30 – 18:00).

It is estimated that approximately 32 Customers (6.4% of the sample) reduced consumption in all of the 12 Peak SWIS Trading Intervals, and 122 customers (24.4%) reduced consumption in at least one of the 12 Peak SWIS Trading Intervals throughout the 2019-20 Hot Season.

Consistent IRCR responses across all the 12 Peak SWIS Trading Intervals indicates the IRCR mechanism continues to incentivise Customers to reduce consumption during high demand periods.

2. Predicting peak Trading Intervals

The following sections examine the weather factors of the 12 Peak SWIS Trading Intervals and load forecasts for the 2019-20 Hot Season[7].

Weather factors

The occurrence of peak demand Trading Intervals is largely dependent on weather.

Figure 1 summarises weather attributes of the four Trading Days with the highest maximum demand in the 2019-20 Hot Season (four Trading Days).

It shows rankings of these weather variables against the remaining non-peak Business Days in the Hot Season[8] on the horizontal axis, to illustrate relationships between weather variables and high demand.

[7] The 12 Peak SWIS Trading Intervals for the 2019-20 Hot Season are published by AEMO, at http://data.wa.aemo.com.au/#peak-intervals.

[8] Weather attributes for the four Trading Days with the highest maximum demand are ranked out of the total number (82) of Business Days in the Hot Season. This excludes Saturdays, Sundays, and public holidays. This is because demand is correlated with the day-of-week, and lower demand is generally observed on holidays and weekends, as commercial energy demand historically drives higher demands on Business Days.

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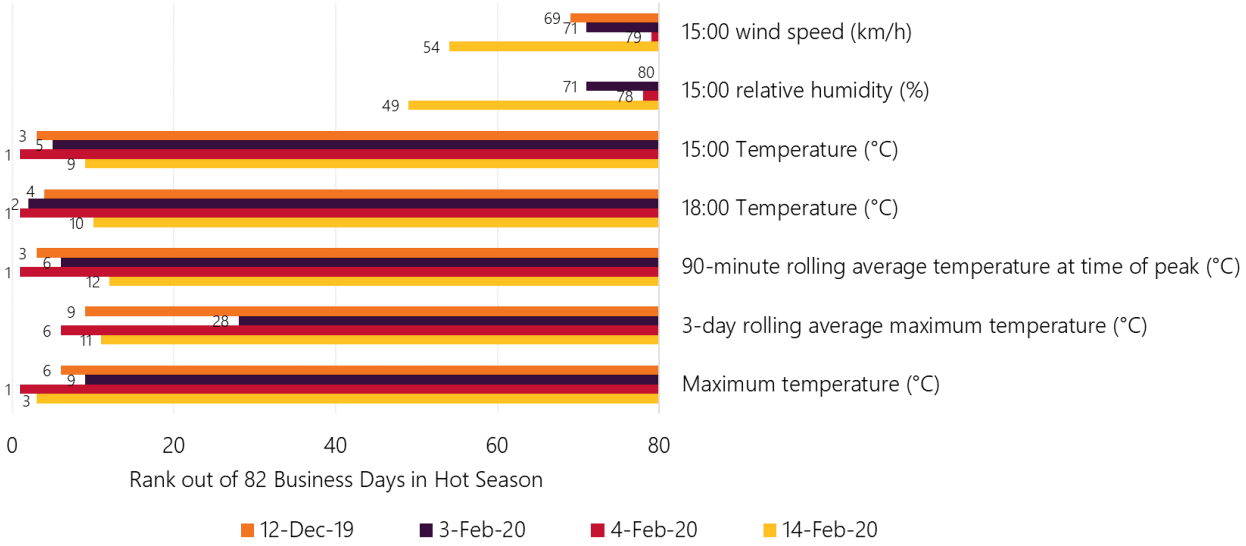
Figure 1 Weather attributes of the four Trading Days with the highest maximum demand in 2019-20 Hot Season



Source: AEMO and Bureau of Meteorology (BOM).

With most data skewed towards the left of Figure 1, it can be observed that:

- All four Trading Days had high 15:00, 18:00, and daily maximum temperatures. These Trading Days ranked in the top 10 out of 82 Business Days in these categories.
- The 90-minute rolling average temperatures[9] at the time of daily peak demand have a significant correlation with ocurrances of peak demand, with all four Trading Days ranking in the top 12 for this category.
- Three of the four Trading Days followed consecutive days of high temperatures, indicated by high rankings (top 11) in three-day rolling average temperature[10].
- All four Trading Days have low rankings (bottom half) in afternoon relative humidity and wind speeds.

Other variables investigated include morning temperature, daily minimum temperature, cloud cover and behind-the-meter PV generation during times of peak demand. Trends in the rankings of these variables for the four Trading Days were not clearly observed, and they were therefore not included in Figure 1.

Load forecasts[11]

AEMO publishes the 'Historical Load Forecast' report[12] at 07:30 on each Trading Day[13], providing Load Forecast values for up to and including the Trading Day.

The analysis below presents AEMO's historical Load Forecasts on the Trading Days that apply to the 12 Peak SWIS Trading Intervals for the 2019-20 Hot Season.

[9] 90-minute rolling temperature refers to the average of maximum temperature during the peak Trading Interval of each day and the two preceding Trading Intervals.

[10] Three-day rolling average temperature refers to the average of maximum temperatures on the specified day and the two preceding days.

[11] Load Forecasts in this Section 2 are based on the Load Forecasts published by AEMO in accordance with clause 7.2.1 of the WEM Rules. This is based on total market load, which is measured using SCADA data on a 'sent-out' basis and adjusted for network losses. This is not the same as TSOG, which is non-loss adjusted metered data.

[12] Available at http://data.wa.aemo.com.au/#historical-load-forecast. AEMO also publishes the 'Load Forecast' (for the upcoming Trading Day and the following Trading Day, at http://data.wa.aemo.com.au/#load-forecast) and 'Extended Load Forecast' (beyond the next two Trading Days and up to the seventh Trading Day, at http://data.wa.aemo.com.au/#extended-load-forecast) at 07:30 on each Trading Day. While these Load Forecasts could further assist Customers in their decision making process regarding when to trigger an IRCR response, they are subject to greater uncertainty than the reported 'Historical Load Forecast'.

[13] A Trading Day is a period of 24 hours commencing at 8:00 AM on any day.

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Figure 2 Daily forecast and actual peak demands throughout the 2019-20 Hot Season

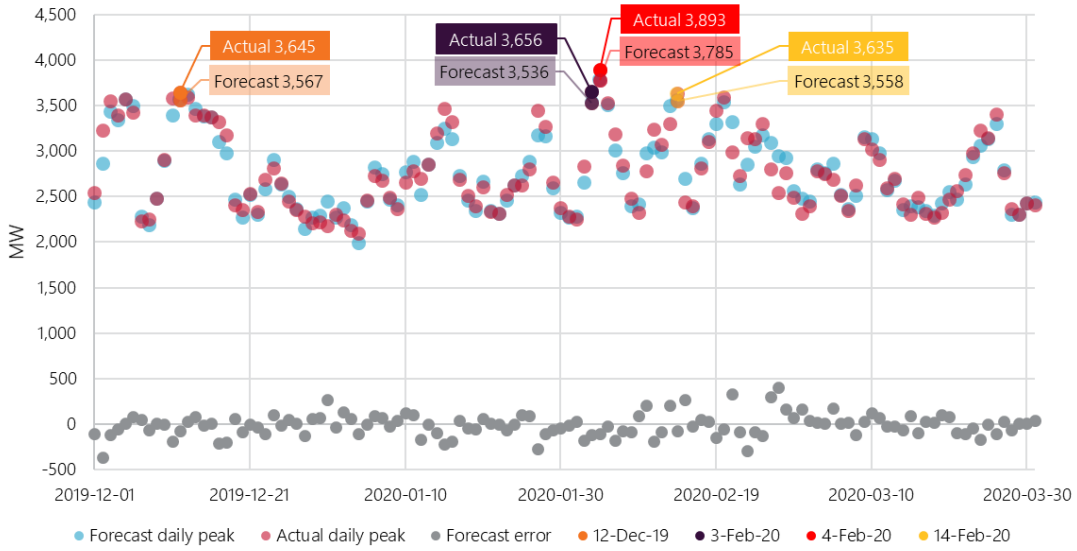

Figure 2 shows the forecast load peak demand and actual load peak[14] on each of the four Trading Days, alongside other daily peaks in the Hot Season:

- The four Trading Days had daily peak demand Load Forecasts ranked in the top seven out of 122 daily peak forecasts in the 2019-20 Hot Season, providing early indications of likely high or peak demand days.
- For example, on 4 February 2020 the forecast daily peak demand was 3,785 MW. Although the forecast was lower than the eventuating peak (3,893 MW), the forecast value was higher than any previously observed demand during the 2019-20 Hot Season[15]. The Load Forecast provided early indication of a likely peak demand day.
- Similarly, on 12 December 2019, the forecast daily peak demand value (3,567 MW) was higher than all but two of the previously observed daily peaks during the Hot Season[16].
- For 3 February 2020 and 14 February 2020, 7:30 forecast demand values indicated daily peaks were going to be among the top seven daily peaks compared to the preceding days in the 2019-20 Hot Season.

Figure 2 shows that in general, forecast errors are centered around zero across the 2019-20 Hot Season. Factors contributing to these variances included temperature forecast error, humidity forecast error, variability in large industrial load operation, and forecast modelling error. The volatility of the forecast errors across the Hot Season was largely associated with variances in temperature forecasts, generally resulting in larger differences in energy consumption driven by the operation of cooling loads such as air-conditioners.

Future analysis

AEMO will provide information around observed IRCR response patterns, including a comparison of historical IRCR responses, in future analysis. AEMO welcomes stakeholders' feedback on this analysis and suggestions for future refinements.

[14] Actual load peaks are based on the Metered Generation data as published in the 'Load Summary' report, available at http://data.wa.aemo.com.au/#load-summary.

[15] Prior to 4 February 2020, the highest observed operational load during the 2019-20 Hot Season was 3,656 MW on 3 February 2020, during the 18:30 to 19:00 Trading Interval.

[16] Prior to 12 December 2019, the highest observed operational load during the 2019-20 Hot Season was 3,588 MW on 11 December 2019, during the 18:30 Trading Interval.