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Differences in projected costs of load following

In the WEM rules, the cost of load following is calculated as the sum of a capacity cost and an availability cost. Capacity costs are calculated directly from capacity auction prices in the SWIS. The calculation of availability costs, however, is more complex.

In the report "Assessment of FCS and Technical Rules", ROAM used two methods to project the future availability costs of load following:

First method - Existing Rules

Western Power publishes the costs of load following on an annual basis. Using the published availability cost of providing load following in 2008-09, ROAM projected forward the cost of providing the load following service to future years using the existing equations in the rules[1]. By these equations, the availability cost scales linearly with the magnitude of the load following requirement. All other variables were assumed to remain constant, including MCAP (the market price in each trading interval). This captures increases in costs due to the increase in the load following requirement only (since all other variables remain constant).

Second method - Dispatch modelling

A dispatch model was used to directly determine the costs of providing the load following service. Two simulations were run; one with Verve plant providing load following, the second with no load following service provided. The availability cost of load following was then calculated as the difference in cost for Verve plant between the two scenarios, minus any additional revenue that they may have recovered from running load following plant[2].

$$\text{Availability cost}_{LF} = (\text{Gencost}_{LF} - \text{Gencost}_{NLF}) - (\text{GenVol}_{LF} - \text{GenVol}_{NLF}) \times \text{MCAP}$$

These two methods gave answers that differed by a large margin. For example, in Scenario 2, the availability cost of load following in 2029-30 was calculated to be ~$25 million by the first method, but ~$230 million by the second method[3]. This difference is not an error, but rather provides important insight. The difference occurs for two reasons:

Primary reason - Assumptions in the rules regarding spinning reserve

In the existing WEM rules, the following process is used to calculate costs of load following. Every few years, dispatch modelling is performed to calculate the costs of load following and spinning reserve (similar to the "second method" described above, except that spinning reserve is also included). This modelling is used to calibrate two factors: Margin_peak and Margin_offpeak. These

[1] Minor corrections were applied to the existing rules to make this projection possible. Two minor errors were identified. The first involved adding a term to account for load following provided by contract (non-Verve plant). The second involved allowing for the situation where the load following requirement exceeds the spinning reserve requirement.
[2] This was calculated as the difference in Verve's generator volumes (MWh) between the two scenarios, multiplied by the price in each trading interval.
[3] The availability cost is summed with a capacity cost to calculate the total cost of load following. Capacity costs for Scenario 2 were calculated to be ~$30 million in 2029-30.

two factors are then used to calculate availability costs of load following and spinning reserve according to the following equations (summed over every trading interval).

$$\text{Availability cost}_{LF} = 0.5 \times \text{Margin}_{\text{peak/off-peak}} \times \text{MCAP} \times (0.5 \times \text{Requirement}_{LF})$$

$$\text{Availability cost}_{SR} = 0.5 \times \text{Margin}_{\text{peak/offpeak}} \times \text{MCAP} \times (\text{Requirement}_{SR} - 0.5 \times \text{Requirement}_{LF})$$

This method calculates the cost of providing load following and spinning reserve simultaneously (in a single dispatch model run), and then assumes that the relative costs of these two services is proportional to the relative sizes of the two requirements. Since at the moment the load following requirement is much smaller than the spinning reserve requirement, this yields load following costs that are much smaller than spinning reserve costs. In addition, half of the cost of load following is attributed to spinning reserve, since plant providing load following service simultaneously provides spinning reserve.

For example, in 2008-09, Western Power published a total availability cost of $28.1 million[4]. $3.4 million of this (11%) was attributed to load following, compared with $24.7 million (89%) for spinning reserve. This is due to a 60 MW load following requirement, half of which is attributed to spinning reserve (since load following plant simultaneously provides a spinning reserve service). By comparison, the spinning reserve requirement is likely to be close to 220 MW in peak times (70% of the capacity of Collie).

Importantly, the 'first method' used by ROAM (projecting forward costs using the existing rules) perpetuates this distribution of costs between spinning reserve and load following. By comparison, the dispatch modelling (the second method) did not. In the dispatch modelling exercise (the second method) the cost of load following was calculated independent of the cost of spinning reserve. The cost of load following alone in 2009-10 calculated via the dispatch model was calculated to be $30.7 million. This is very close to the total availability cost (spinning reserve plus load following) as published by Western Power for 2008-09 ($28.1 million). This indicates that the majority of the total availability cost is due to load following, with a minimal contribution from spinning reserve. This is supported by the fact that a very small number of periods in the dispatch model would have required additional spinning reserve beyond that available at zero cost or from the existing load following service (even though spinning reserve was not being modelled explicitly in this exercise).

The discrepancy between the costs calculated via the two methods therefore indicates that the methodology in the WEM rules for dividing costs between spinning reserve and load following is likely to be significantly flawed. The load following service is likely to be more arduous to provide, requiring constant dispatch of fast response plant above minimum loads with constant adjustment. This is particularly expensive during overnight periods when the MCAP is low and OCGT plant is dispatched far out of merit order. By comparison, spinning reserve is provided at zero cost in many periods, particularly overnight when many generators are ramped down to minimum load (Western Power state in their 2008-09 report that the amount of spinning reserve generally exceeded the requirement).

Secondary reason - Differences in input assumptions

There were some differences in input assumptions between the two methods, and the cost calculation is sensitive to these. The most significant differences included:

[4] Western Power, Ancillary Service Report 2009, prepared under clause 3.11.11 of the Market Rules by System Management - 28 May 2009.

- ***Gas prices*** - In the first method existing gas prices and contracts were continued. In the second method, gas prices were assumed to be the following. Verve: $3/GJ, rising to $9/GJ from 2015. Existing IPPs: $4/GJ. New entrant IPPs: $6/GJ, rising to $9/GJ from 2015.
- ***Carbon price trajectory*** - a -5% carbon price trajectory was included in the second method, whereas no carbon price was assumed for the first method.

These will increase the cost to Verve plant, but also simultaneously increase the MCAP. Since increasing MCAP increases revenue recovered by Verve plant, this offsets some of the increase in availability cost (refer to previous equation). This limits the impact of changes in these variables.

Dispatch modelling for Scenarios 1, 3 and 4

In the report "Assessment of FCS and Technical Rules", ROAM provided costs calculated via the first method for all four scenarios. By contrast, the dispatch modelling method was applied to Scenario 2 only. This is because the first method was determined to provide more insight into changes that may be required in the WEM Rules (three distinct flaws were identified via this process).

Although it is possible to provide dispatch modelling calculations for the remaining three scenarios, it is unlikely that this will provide much further insight and understanding. Inconsistencies and areas of the Rules that require immediate attention have been identified, and are unlikely to be further enlightened through the analysis of more scenarios. ROAM recommends that the insights from this study are used to refocus attention on areas that need to be addressed as a priority, and areas where further important questions remain.

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