Market performance enquiry into the offer revision rule

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Version control

Version	Date amended	Comments
Public version	21 September	All reference to disaggregated analysis removed

Market Performance enquiries, reviews and investigations

The Electricity Authority (Authority) may carry out an enquiry, review or investigation as a result of monitoring the industry or the market, or at the request of an external party. The Minister of Energy and Resources may also ask or direct the Authority to look into an issue.

An enquiry, review or investigation looks at the circumstances giving rise to an out of the ordinary event, including the actions of participants. An enquiry, review or investigation may result in suggestions for Code amendments, market facilitation measures, or in a finding that no further action is needed. In all of these cases the Authority usually publishes a report of its findings.

At the same time as it carries out a market performance enquiry, investigation or review, the Authority's compliance team may investigate whether there has been a breach of the Code, Act or Regulations. The two processes may run concurrently, but may not always be completed at the same time.

Enquiries, reviews and investigations represent three stages in an escalating process, with increased effort and significance attached to each one.

Market Performance Enquiry (Stage I): At the first stage, the Authority carries out analysis using existing data and resources. The purpose of an enquiry is to better understand circumstances, observed through routine monitoring, that appear to require closer inspection. The Authority will usually announce it is carrying out an enquiry.

If the results of the enquiry show that the circumstances are unlikely to have any implications for the Authority's statutory objective–to promote competition in, reliable supply by, and efficient operation of, the electricity industry for the long-term benefit of consumers–the Authority is unlikely to take further action. The Authority will publish the results of its enquiry which may consist of an enquiry paper, or a short note, on the results on the website.

Market Performance Review (Stage II): The Authority will initiate a review if, at the end of a Stage 1 enquiry, it does not have enough information to understand the issue but it appears to be significant to promote competition in, reliable supply by, and efficient operation of, the electricity industry for the long-term benefit of consumers. The Authority makes requests for information to relevant service providers and industry participants. There is typically a period of iterative information-gathering and analysis. The Authority will announce it is undertaking a review, and publish the results.

Market Performance Investigation (Stage III): At this stage, the Authority may exercise statutory information-gathering powers under section 46 of the Electricity Industry Act 2010 (Act) to acquire the information it needs to investigate an issue in depth. The Authority will announce early in the process that it is undertaking an investigation and indicate when it expects to complete the work. The Authority will publish reports of Stage III investigations.

Executive summary

Part 13 of the Electricity Industry Participation Code 2010 (Code) states that generators cannot revise or cancel offers later than two hours before the start of the relevant trading period, or thirty minutes before the start in the case of embedded generators. There are two exceptions to this rule: if there is a bona fide physical reason, or if the system operator has issued a formal notice of a grid emergency. In these situations, generators can revise or cancel their offers. This is referred to as a revision or cancellation 'within gate closure'.

Clause 13.19 of the Code states that generators may revise or cancel their offers only for bona fide physical reasons within gate closure. Clause 13.21 states if a generator revises or cancels an offer within gate closure, it must report the revision or cancellation to the Authority.

The Authority does not physically check these offer revisions and cancellations, as that is not possible without having independent monitors on site. However, the Authority does check the reasons given to ensure that they are understandable and consistent with the Code. Therefore some other approach is needed to monitor generators' conduct.

This is a report on the Authority's market performance enquiry into the requirement that generators only revise or cancel offers if they have a bona fide physical reason.

Authority staff applied a statistical approach to investigate offer changes and cancellations from 26 May 2014 to 31 December 2015. This was to determine if there is an association between spot prices and generators claiming a bona fide physical reason, to justify revising or cancelling an offer within gate closure. The methodology used is Canonical Correlation Analysis (CCA) for the aggregate data and boxplot charts for individual examples.

The conclusions of the enquiry are as follows:

- there is no correlation between the spot price and trading quantity changes in general
- there are examples where generators have lowered offer quantities when there have been lower than usual prices—these examples are identified in the report. However, Authority staff cannot make any conclusions about behaviour from this analysis due to the limited sample size.

Authority staff intend to regularly repeat this analysis with updated data and to use it to gain insights on market conduct, and as a filter to determine the cases where the Authority's compliance team could make follow-up inquiries into particular bona fide offer revisions and cancellations.

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Introduction

1.1 The Authority's statutory objective is to "promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers." Section 16(1)(g) of the Electricity Industry Act (Act) allows the Authority "to undertake industry and market monitoring, and carry out and make publicly available reviews, studies, and inquiries into any matter relating to the electricity industry". This enquiry into generators' offer revisions and cancellations concerns the reliability part of the statutory objective.

1.2 Generators submit offers to sell electricity on the spot market. According to Part 13 of the Code, generators cannot revise or cancel offers later than two hours before the start of the relevant trading period, or thirty minutes before the start in the case of embedded generators, unless:

(a) there is a bona fide physical reason; or

(b) the system operator has issued a formal notice of a grid emergency.

1.3 Also, under clause 13.18 of the Code a generator must submit a revised offer quantity if its ability to generate is expected to change by more than 10 MW or 10 per cent of the total quantity offered (whichever is smaller).

1.4 Under clause 13.21 of the Code, generators notify the Authority of any offer revisions or cancellations, and the reasons for the revisions or cancellations. The Authority checks compliance with clauses 13.18, and 13.19 of the Code.

1.5 This paper describes a method for the Authority to monitor the offer revisions and cancellations with available information, given the reality that there is no way to validate the reasons for offer revisions and cancellations without having an independent person that understands the plant at the site to do this.

1.6 The approach taken in this paper is to determine whether there is a correlation between the spot price and offer revisions and cancellations—in other words our research question is "are generators using bona fide offer revisions and cancellations to revise or cancel offers to avoid generation at low prices?" We address this question by determining whether generators are revising offers downwards when the spot price is low, more often than pure chance would suggest they should be. The obvious purpose of such generator behaviour could be to reduce offered volume and increase the spot price.

We use price data from the market and quantity data from the offer revisions and cancellations

1.7 We use the information about actual electricity spot prices, forecast electricity prices and pre-dispatch prices and explore the relationship between these various measures of price and the revised quantities submitted as offer revisions and cancellations.

1.8 While we have data back to October 2011, a field for offer revision types was only added to the data on 26 May 2014. These types are bid, energy offer, and reserve offer. Consequently we investigate energy offer revisions and cancellations from 26 May 2014 to 31 December 2015.

1.9 Real-time prices give participants information on expected final prices. The system operator calculates real-time prices every five minutes for each node, which can be used as a forecast of the final price at each node. In this analysis we use the average of the six real-time prices for each half-hour trading period.

1.10 We also use the pre-dispatch prices—the short non-response schedule (NRSS) and the short price-responsive schedule (PRSS). The prices used in this enquiry are the last schedules run prior to the trading period in which a generator revises or cancels an offer.

1.11 Any offer revision or cancellation details the original quantity and the revised quantity ("change from" and "change to"), the offer revision type and the time and trading periods affected. In this analysis we use "change from", "change to" and the difference between these two quantities to be the amount of the revised or cancelled generation offer.

1.12 There are eleven generators in the data—Alinta Energy, Contact Energy, Genesis Energy, King Country Energy, Meridian Energy, Mighty River Power (now Mercury Energy), Nga Awa Purua Joint Venture, Norske Skog Tasman, Nova Energy, Trustpower, and Tuaropaki Power.

1.13 To analyse the relationship, we split the data into the groups of the combination of:

(a) year – 2014 or 2015

(b) quarter

(c) day of the week – weekend or weekday

(d) trading period – peak or off peak

(e) grid injection point (GIP).

1.14 We define peak time as the trading periods from 7 am to 7 pm. These combinations are shown in Table 1 below.

Table 1: Combination of conditions for each GIP

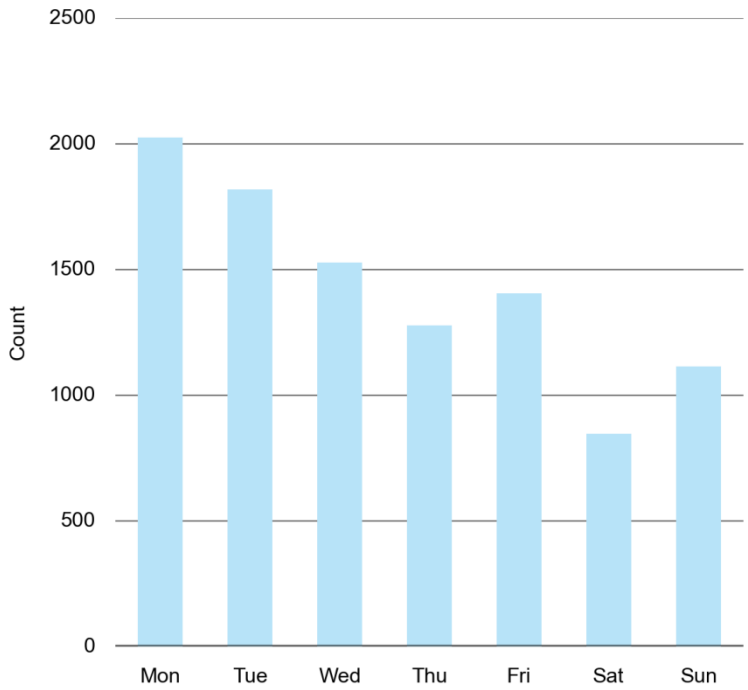
Year 2014 or 2015	weekday peak	weekday offpeak	weekend peak	weekend offpeak
Quarter 1	✓	✓	✓	✓
Quarter 2	✓	✓	✓	✓
Quarter 3	✓	✓	✓	✓
Quarter 4	✓	✓	✓	✓

The charts below give an overview of the data

1.15 This section presents summary information of the data and subsequent sections present the analysis.

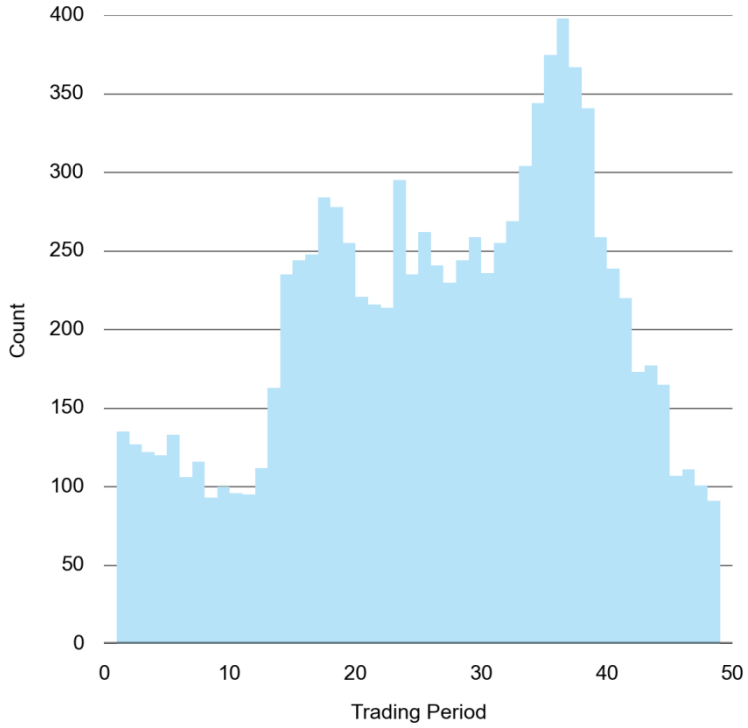
1.16 We omit generators with single plants from the following analysis because we consider identifying the reliability of a single plant as confidential. We include Trustpower, Contact Energy, Meridian Energy, Mighty River Power, Genesis Energy, and Todd Energy in the analysis.

Figure 1: Counts of trading periods that offer revisions and cancellations have affected by day of week



1.17 Figure 1 shows the count of trading periods affected by offer revisions and cancellations, split between the days of the week. Monday and Tuesday have the most trading periods affected by offer revisions and cancellations.

Figure 2: Distribution of trading periods affected by offer revisions and cancellations



1.18 Figure 2 shows the distribution of affected trading periods over 48 trading periods. Offer revisions and cancellations tend to affect peak periods.

Methodology

1.19 We used two methods to test whether participants' use of a 'bona fide physical reason' for revising or cancelling an offer was related to market conditions:

(a) Method 1 (Overall analysis): CCA tests for a general association between price and offer revisions and cancellations. From this test we can determine if there is any systematic relationship between offer revisions and cancellations, and price. However, the results do not preclude isolated incidents of participants misusing a bona fide physical reason for revising or cancelling an offer.

(b) Method 2 (Detailed analysis): Boxplot analysis studies specific participants over various time periods to examine specific periods in more detail; which would be obscured by the higher level CCA tests.

The overall analysis did not find evidence that the bona fide physical reason offer rule is being systematically taken advantage of to avoid generating when prices are low

1.20 We used CCA to determine the relationship between the two sets of variables: one set of variables are quantities "change from", "change to" and the quantity difference "diffQ"; the other set of variables are prices; real time prices, pre-dispatch prices and final prices.

1.21 The idea of canonical correlation is—given two sets of variables—to find the linear combination of one set of variables that is most highly correlated with a linear combination of the other set. We call the linear combination of variables *canonical variates*. In other words, each canonical variate is a composite measure of price or quantity at each GIP and we further investigate the most correlated price and quantity pairs. Correlations between pairs of canonical variates are called canonical correlations.

1.22 We test whether the canonical correlations are statistically different from zero for each set of canonical variate pairs. This is equivalent to testing whether the two canonical variates are statistically related to one another—we would expect to find a relationship if generators were making offer revisions and cancellations in response to price.

1.23 We chose pairs of canonical variates using a likelihood-ratio test so the first canonical pair is the pair of linear combinations of the two sets of variables (quantities and prices) that is the most highly correlated. The second canonical pair is the second most highly correlated etc. This ordering is determined by a likelihood-ratio test, the results of which are set out below in Table 2. Note that this is an optimisation test, so identifies the best pairs.

1.24 Table 2 shows the likelihood-ratio test results. Only the first two pairs of canonical correlations (the first pair of price canonical variate P1 and quantity canonical variate Q1; and the second pair of price canonical variate P2 and quantity canonical variate Q2) are significantly different from zero. The remaining canonical correlations are not statistically different from zero. Thus, we focus on

the first two canonical variate pairs in the following analysis. Each of P1, P2, Q1 and Q2 are linear combinations of the original data at each GIP.

Table 2: Likelihood-ratio test results which show there are two pairs where the canonical correlations are not zero

Test of H0: The canonical correlations in the current row and all that follow are zero				
Likelihood Ratio	Approximate F Value	Num DF	Den DF	Pr > F
0.98843684	5.49	12	11294	<.0001
0.99733264	3.02	5	5648	0.0100

1.25 Table 3 shows the correlations between trading quantities and prices of the first canonical variate pair P1 and Q1, and the second canonical variate pair P2 and Q2, from the CCA. This analysis compares each measure of quantity from the data with a price canonical variate (P1 and P2), and each measure of price with a quantity canonical variate (Q1 and Q2).

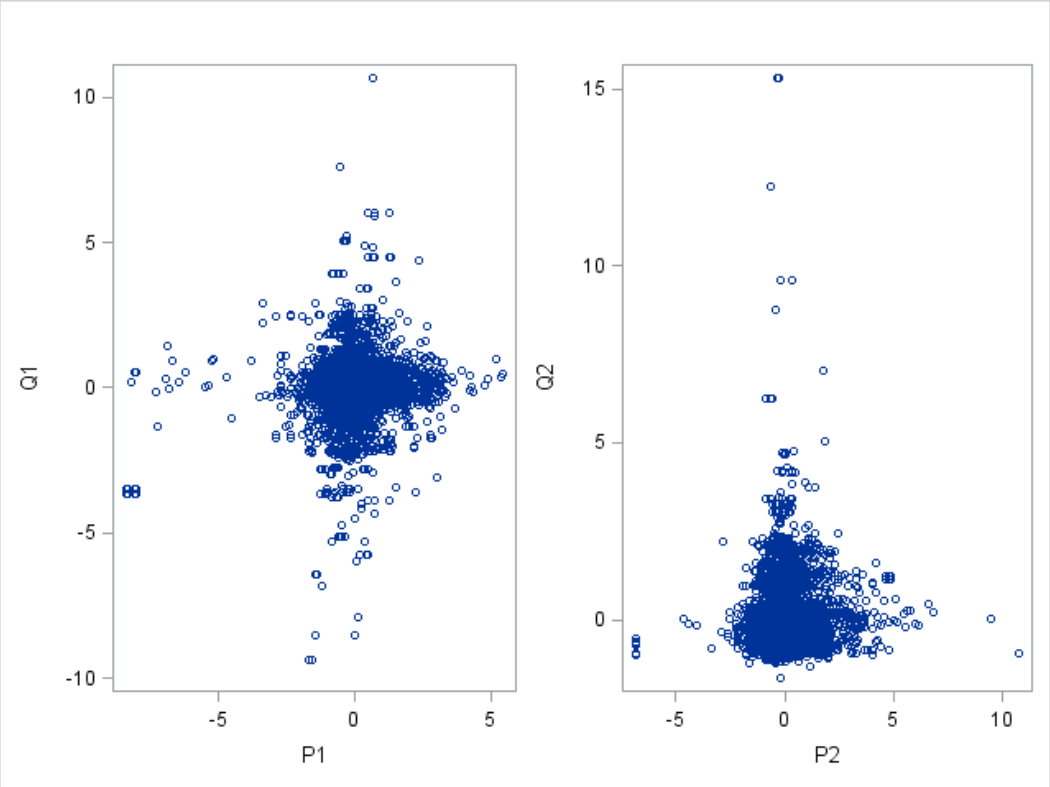
1.26 The correlations between the two sets of variables are very weak. Most of the correlations are less than 0.05. For example, the correlation between trading quantity difference (diffQ) and P1 is 0.089, which is weak. A meaningful relationship would have a correlation of at least 0.50, and ideally 0.80.

Table 3 Correlation of original variables with canonical variables

Correlations Between the quantity measurements and the Canonical Variables of the price measurements		
	P1	P2
from	0.0066	0.0515
to	0.0488	0.0442
diffQ	0.0890	-0.0172

Correlations Between the price measurements and the Canonical Variables of the quantity measurements		
	Q1	Q2
nrs	-0.0348	0.0269
prs	-0.0361	0.0272
fivemins	-0.0331	0.0402
fivemins1	0.0313	0.0140
fp	-0.0384	0.0431
fp1	0.0503	0.0361

Figure 3 Correlation between the pairs of canonical variates



1.27 The scatter plots shown in Figure 3 confirm the results of Table 3—there is no obvious association between the two pairs of canonical variates.

Table 4 Canonical redundancy analysis

The CANCORR Procedure

Canonical Redundancy Analysis

Standardized Variance of the quantity measurements Explained by					
	Their Own Canonical Variables			The Opposite Canonical Variables	
Canonical Variable Number	Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1	0.3868	0.3868	0.0089	0.0035	0.0035
2	0.6132	1.0000	0.0027	0.0016	0.0051

Standardized Variance of the price measurements Explained by					
	Their Own Canonical Variables			The Opposite Canonical Variables	
Canonical Variable Number	Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1	0.1606	0.1606	0.0089	0.0014	0.0014
2	0.4015	0.5621	0.0027	0.0011	0.0025

1.28 Canonical Redundancy Analysis is used to measure the amount of shared variance explained by each canonical variate. Table 4 shows the results of the Canonical Redundancy Analysis. This analysis gives us the proportion of

variance of each canonical variate explained by the set of source data used to construct the canonical variate and by the source data used to construct the other canonical variate.

1.29 Table 4 shows the variances from Canonical Redundancy Analysis for the two sets of canonical variates. We focus on how the canonical variate is explained by the opposite set of data—in other words how much of each price canonical variate is explained by our quantity data and vice versa. Only 0.35 per cent of variance in the first quantity canonical variate is explained by the price data and 0.16 per cent of variance in the second quantity canonical variate can be explained by the price data. Similarly only 0.14 per cent of variance in the first price canonical variate is explained by quantity data and 0.11 per cent of variance in the second price canonical variate can be explained by the quantity data. These results imply that the quantity measurements cannot be explained by price measurements, and vice versa.

1.30 Therefore, we conclude that there is no general association between the set of prices and the set of quantities. However, these results do not preclude isolated incidents of bona fide physical reasons for offer revisions and cancellations being misused to lower offered quantity and increase price.

Introduction to the detailed analysis

1.31 We use boxplots for the detailed analysis. We plot the frequency distribution of how price changes when a generator uses a bona fide physical reason to revise or cancel its offer, focusing on times when trading quantities are reduced. The data is divided as shown in Table 1.

1.32 Boxplots summarise the values of quantitative variables by showing median, spread and shape. They are a good tool to compare the multiple changing patterns.

1.33 We are not focusing on comparing the spread – interquartile range, and shape. But for some examples, the interquartile ranges are very small. This means the distribution of the quantities and prices does not vary much. For a few examples from Trustpower, the interquartile range of the quantities collapse at the median. This is due to some smaller units generating either their maximum, or zero and nothing in between.

1.34 We do not believe there is sufficient data to draw any definite conclusions. However, Authority staff intend to repeat this analysis periodically to see if there are any trends in market conduct that emerge over time.

1.35 We also think that the detailed methodology set out below does provide an effective filter for identifying instances where further investigation is required. This could include requesting supporting evidence such as work/job orders and/or log entries (or any other documents supporting the bona fide physical reason). Consequently we intend to continue to do this analysis and use it to identify instances where we would recommend that the Authority’s compliance team ask follow-up questions of generators that have claimed a bona fide physical reason for an offer revision or cancellation within gate closure.

Summary method and results: Detailed analysis

1.36 Each box plot has two parts as shown in Figure 4. In the left hand part we chart the 5-minute price with the average 5-minute price, the final price with the average final price, NRSS and the PRSS. The averages are calculated for the particular split of data that the chart refers to. The right hand side of the plot shows the quantity changes.

1.37 Each side-by-side boxplot uses the same pattern: the first two boxplots from the left show 5-minute price and quarterly average 5-minute price, the third and fourth boxplots show actual spot price and quarterly average spot price. The fifth and sixth boxplots are the NRSS and the PRSS prices. All of these prices are shown based on the combination weekday, weekend, peak and off-peak for each node in each quarter in table 1. The first and second boxplots on the right show the trading quantities change-from and change-to.

1.38 We undertook this analysis for all cases in the data where quantities were reduced during periods of unusually low prices. We do not intend to publish the results due to the confidential nature of the data.

Figure 4: Explanation of box plots