Regular reporting on generator offer revision behaviour

Market performance review

22 May 2012

Investigation stages

An in-depth investigation will typically be the final step of a sequence of escalating investigation stages. The investigations are targeted at gathering sufficient information to decide whether a Code amendment or market facilitation measure should be considered.

Market Performance Enquiry (Stage I): At the first stage, routine monitoring results in the identification of circumstances that require follow up. This stage may entail the design of low cost ad hoc analysis, using existing data and resources, to better characterise and understand what has been observed. The Authority would not usually announce it is carrying out this work.

This stage may result in no further action being taken if the enquiry is unlikely to have any implications for the competitive, reliable and efficient operation of the electricity industry. In this case, the Authority publishes its enquiry only if the matter is likely to be of interest to industry participants.

Market Performance Review (Stage II): A second stage of investigation occurs if there is insufficient information available to understand the issue and it could be significant for the competitive, reliable or efficient operation of the electricity industry. Relatively informal requests for information are made to relevant service providers and industry participants. There is typically a period of iterative information gathering and analysis. The Authority would usually publish the results of these reviews but would not announce it is undertaking this work unless a high level of stakeholder or media interest was evident.

Market Performance Formal Investigation (Stage III): The Authority may exercise statutory information gathering powers under section 46 of the Act to acquire the information it needs to fully investigate an issue. The Authority would generally announce early in the process that it is undertaking the investigation and indicate when it expects to complete the work. Draft reports will go to the Board of the Authority for publication approval.

The outcome of any of the three stages of investigation can be either a recommendation for a Code amendment, provision of information to a Code amendment process already underway, a brief report provided to industry as a market facilitation measure, or no further action.

From the point of view of participants, repeated information requests are generally concerned with Stage II; trying to understand the issue to such an extent that a decision can be made about materiality.

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1 Introduction and purpose of this report

1.1 This report discusses the ability of generators to make significant revisions to offers just prior to gate closure.

1.2 The report does not consider whether it is right or wrong for generators to influence spot prices to increase spot market revenue, nor the natural tendency for market prices to rise in response to supply/demand pressures. Rather, the report focuses on the problem that significant offer revisions can send confusing signals to other spot market participants, leading them to make inefficient decisions.

1.3 The report discusses some issues around a generator's ability and incentive to influence price in different situations. It also describes a graphical way of presenting a generator's offer revision history, and a metric for quantifying the impact of offer revisions on the market.

1.4 The Electricity Authority (Authority) intends to publish the offer revision graphics and metrics on an ongoing basis.

1.5 The report sites instances on 23 July 2011 and 12 November 2011 where market participants made significant offer revisions prior to gate closure. In each case, the earlier (temporary) offers caused high forecast prices, but these prices did not carry through into final prices as the offers were revised prior to gate closure.

1.6 The Authority has used these two instances to make the offer revision graphics and metrics set out in this report.

2 Ability to influence price

2.1 Wholesale market participants are sometimes in a position to influence the spot price by adjusting their offers or bids. While both generators and purchasers may have this ability, the focus of this report is on generators. In principle, a generator can increase spot prices by raising offer prices and/or restricting offered volumes, and can lower spot prices by reducing offer prices and/or increasing offered volumes.

2.2 The extent to which a generator can affect spot prices depends on the residual demand elasticity, which is a measure of how sensitive the demand faced by the generator is to price movements. (The residual demand equals the total demand minus the offer curves of all other generators.) The main factor affecting residual demand elasticity is the competitive pressure that is able to be exerted by other generators.

2.3 A generator is said to be "pivotal" if at least some of its output is required in order to meet the total market demand (with all other generators' offers fully cleared). This minimum required output is known as the "pivotal quantity". If a generator is pivotal, it implies that the residual demand elasticity is zero. In these instances the generator does not face any competitive pressure, and can essentially increase the spot price without limit.

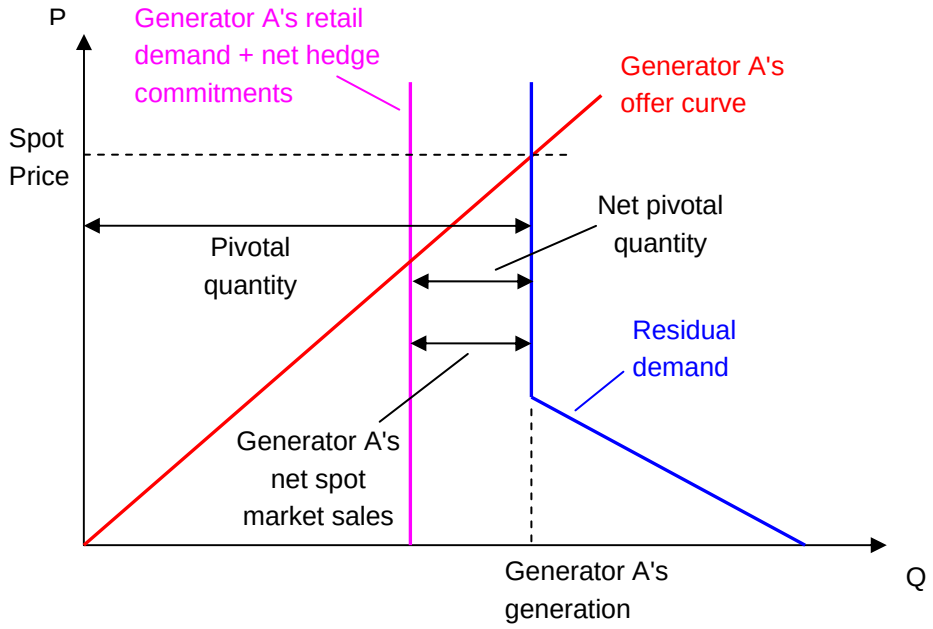
3 Incentive to influence price

3.1 It may not be advantageous for a generator to attempt to raise the spot market price even if it has the ability to do so.

3.2 A participant's incentives depend on its net exposure to the market. If a participant is long on generation (ie their generation exceeds their retail demand and net hedge commitments) then their short term profit is increased by an increase in spot price, whereas if a participant is short on generation (ie their retail demand and net hedge commitments exceed their generation) then their short term profit is increased by a reduction in spot price.

3.3 To profit from adjusting its offers, a generator must possess both the ability and the incentive to influence prices. If a generator's pivotal quantity exceeds its retail demand and net hedge commitments, it is said to be "net pivotal," and this excess is known as the "net pivotal quantity". If a generator is net pivotal, it has both the ability and the incentive to increase spot prices essentially without limit. This situation is depicted in Figure 1.

Figure 1 Generator A net pivotal

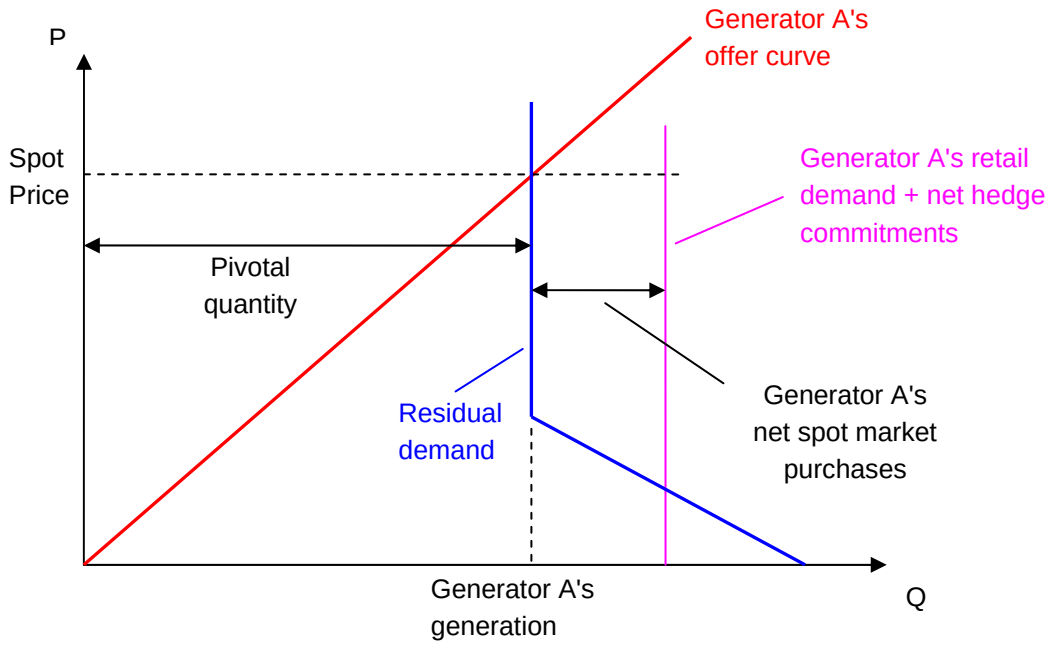


Source: Electricity Authority

Notes: 1. The vertical part of the residual demand curve lies to the right of generator A's retail demand and net hedge commitments. Generator A is therefore net pivotal and can profit by raising the spot price, essentially without limit, since they are a net generator.

3.4 If a pivotal generator's pivotal quantity is less than its retail demand and net hedge commitments, then it is not net pivotal. In this circumstance, the generator still has the ability to increase the spot price without limit, but this will not be profitable as the generator will end up as a net purchaser at those high prices. This situation is depicted in Figure 2.

Figure 2 Generator A pivotal but not net pivotal

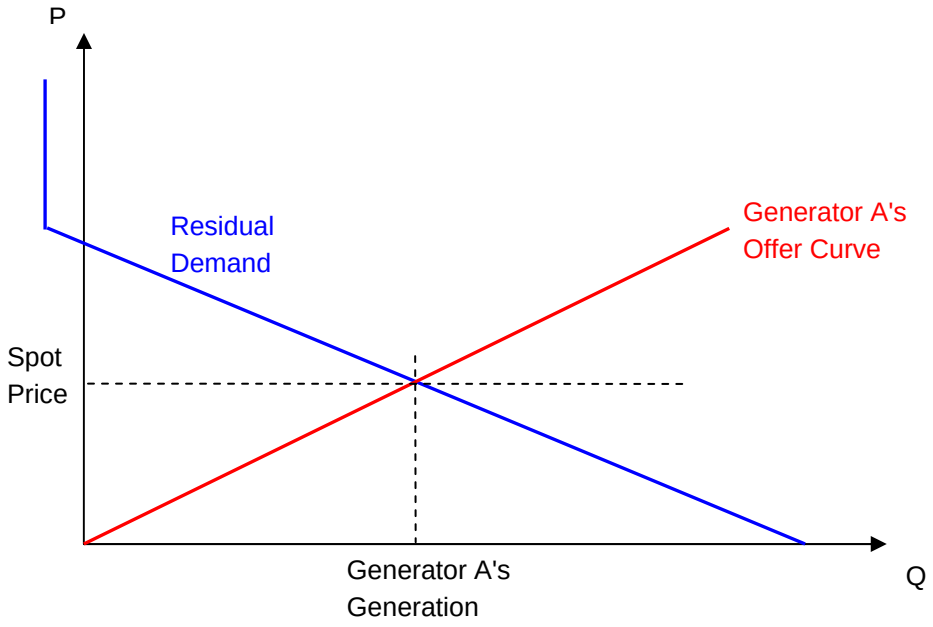


Source: Electricity Authority

Notes:
1. The vertical part of the residual demand curve lies to the left of generator A's retail demand and net hedge commitments. Generator A is therefore not net pivotal. They are still pivotal so they can still raise the spot price essentially without limit, but this will not be profitable since they are a net purchaser. Hence although Generator A might conceivably submit such offers for earlier schedules it would most likely revise them prior to gate closure.

3.5 Figure 3 depicts the situation where a generator is not pivotal. Such a generator may still have the ability to influence price, but this is typically not as strong as for a pivotal generator as it is subject to a greater degree of competitive pressure.

Figure 3 Generator A not pivotal



Source: Electricity Authority

Notes: 1. The vertical part of the residual demand curve lies to the left of the vertical axis. Hence, generator A's offer curve intersects the sloping part and therefore the influence generator A can have on spot price is limited by competitive pressure.

4 Estimating net positions and pivotal quantities

4.1 For the purpose of determining net position, retail demand has been taken from the clearing manager's data (ie wholesale market purchases from the clearing manager). There is an implicit assumption that all this electricity is sold to end consumers at fixed prices (ie at prices independent of spot prices). This may not be true for some larger consumers. However, such consumers may also have purchased hedge contracts which effectively means they do face a fixed price.

4.2 The analysis also ignores hedge contracts that the generator in question may have with other participants or consumers. So the overall assumption is that the relativity between wholesale market sales and purchases is a good proxy for a generator's net exposure to the spot price.

4.3 For the purpose of determining pivotal quantities, demand has been taken from the final pricing schedule and is assumed to be inelastic. While not strictly correct, this is a reasonable approximation for the Authority's purposes of developing an offer revision metric.

5 Offer revision

5.1 The final prices on which the market is settled are determined by, among other things, the generation offers prevailing at the start of each trading period. However, the Code allows

generators, other than embedded and intermittent generators[1], to revise or cancel their offers up until two hours before the start of the relevant trading period. This cut-off requirement is known as gate closure. Cancellation of offers or revision of offer quantities are permitted after gate closure in specific instances, for example when a bona fide physical reason exists or when the system operator has issued a formal emergency notice.

5.2 Due to the incentives to influence prices discussed above, it is likely that a generator's final offers at gate closure will be consistent with its net exposure to the spot market. However, offers that a generator submits for earlier schedules may not be consistent with its net exposure to the spot market.

5.3 There are a number of reasons why a generator might submit initial offers that are inconsistent with its net exposure to the spot market and subsequently revise them before gate closure. One possibility is to try to induce other participants to enter into short duration hedge agreements. Such hedge agreements, negotiated at the last moment, are likely to be overpriced, given that the threat of high spot prices is unlikely by design, to eventuate. However, if a generator consistently tried to influence prospective hedge purchasers in this way, the hedge purchasers would soon learn the generator was bluffing. A generator might have to vary its behaviour so hedge purchasers would be unsure if a hedge was really required or not.

5.4 Generators may also adjust offers in an attempt to discover the shape of the residual demand curve that they face, and hence the structure of their competitors' offers. However, it should be possible to discover this without submitting substantially inconsistent offers.

5.5 The problem with submitting this kind of inconsistent offer is that it can send confusing information to other spot market participants. For example, if a generator submits high-priced offers earlier on in the scheduling process, resulting in high forecast spot prices, this may induce industrial consumers to reduce load in order to avoid excessively high electricity costs. Then, if the generator subsequently submits lower-priced offers, it may turn out that the load reduction was not justified after all. Similarly, high forecast prices may induce a thermal generator to commit its generating plant, but this may not end up being economic if final prices subsequently turn out to be low. This is only a problem in cases where the other market participants have to make their consumption or generation decisions well in advance of real time. For example, the characteristics of an industrial process may not allow a planned load reduction to be reversed at short notice, and certain types of thermal generation plant require a long lead time to get ready to generate and cannot change their output rapidly.

5.6 Furthermore if one generator revises its offers just prior to gate closure, it may be too late for other generators to respond since by the time the forecast prices are published, gate closure would have already passed. This particular issue does not apply to consumers, who are able to monitor 5-minute (real time) prices when deciding their consumption (assuming there are no physical limitations to changing their consumption at short notice, as discussed above).

5.7 Initially offering high prices and then reducing them prior to gate closure will, if anything, reduce the prices actually received, since any responses to the original offers by other participants will tend to improve the supply-demand balance. So a generator considering this type of offer behaviour may have to trade off the potential returns from selling hedges at higher prices versus the potential lower spot price it may induce by encouraging alternative supply or demand reductions. Of course if the generator is short on generation then it would actually benefit from lower spot prices.

[1] Embedded and intermittent generators have slightly different rights and obligations in regard to revising and cancelling offers.

5.8 The Authority is aware of two instances within the past 12 months where generators submitted high priced offers and then revised them down substantially prior to gate closure. These occurred on 23 July 2011 and 12 November 2011.

5.9 In the first instance, on 23 July 2011, Genesis Power Ltd made high priced offers for trading periods 13 to 48, which lasted for up to 24 hours before being revised down. For one trading period the high prices were not revised down until an hour before gate closure. The scale of the offer revision and the length of time the high priced offers remained in place suggests that discovering the shape of the residual demand curve was not the reason in this case.

5.10 In the other instance, on 12 November 2011, Contact Energy Ltd made high priced offers again for trading periods 13 to 48, but in this case they only lasted for three or four hours and were revised down well before gate closure. In these circumstances it is difficult to interpret Contact's offer revision behaviour. However, the example is useful as a test of the discrimination of the metric proposed below. Nevertheless at least one other market participant was still very concerned by the forecast prices that resulted from the offer revision behaviour in this instance.

6 Offer revision metric and graphic

6.1 The Authority has developed a metric for quantifying the magnitude of the offer revisions leading up to gate closure. It has also developed a graphical way (a contour plot movie) to show how generation offers change over time. This enables offers inconsistent with net spot market exposure, and large offer revisions, to be readily identified. Because spot market purchase information is confidential it cannot be shown. Instead the contour plot movies will use the quantity of electricity offered at the start of the trading period, at less than $10/MWh, as a proxy for retail demand level.

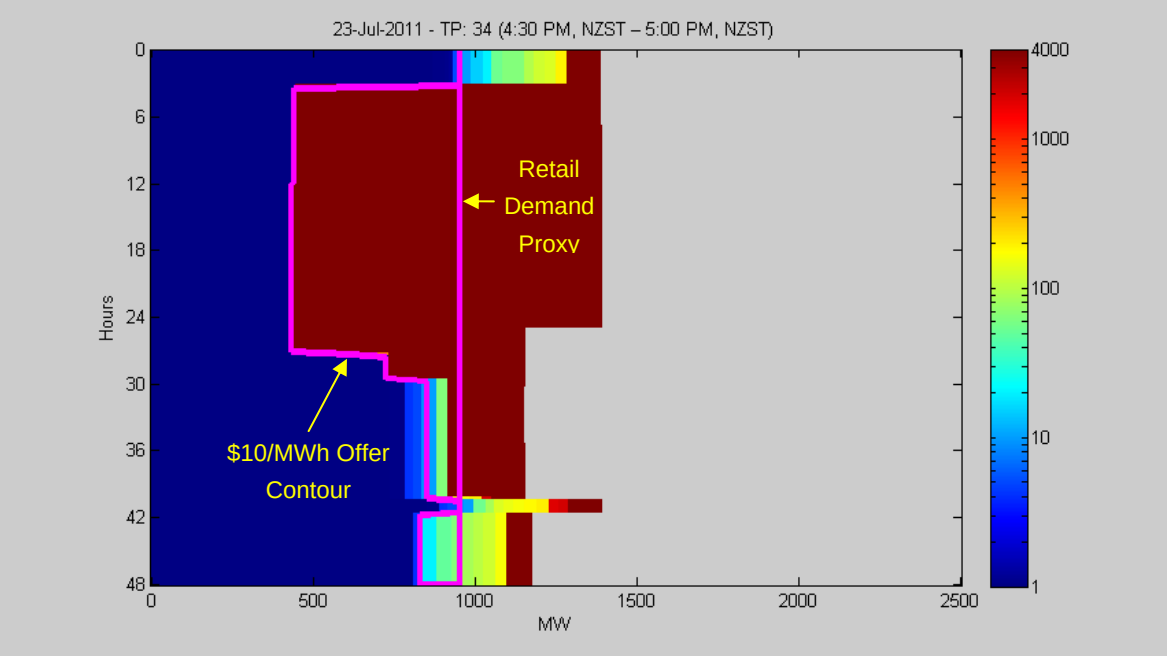
6.2 Because significant offer revisions can lead to inefficient market responses, the Authority intends to publish both the metrics and the movies on a regular basis to provide greater transparency to the market.

6.3 The Authority will also continue to monitor the extent of such offer revision behaviour.

7 Offer contour plot examples

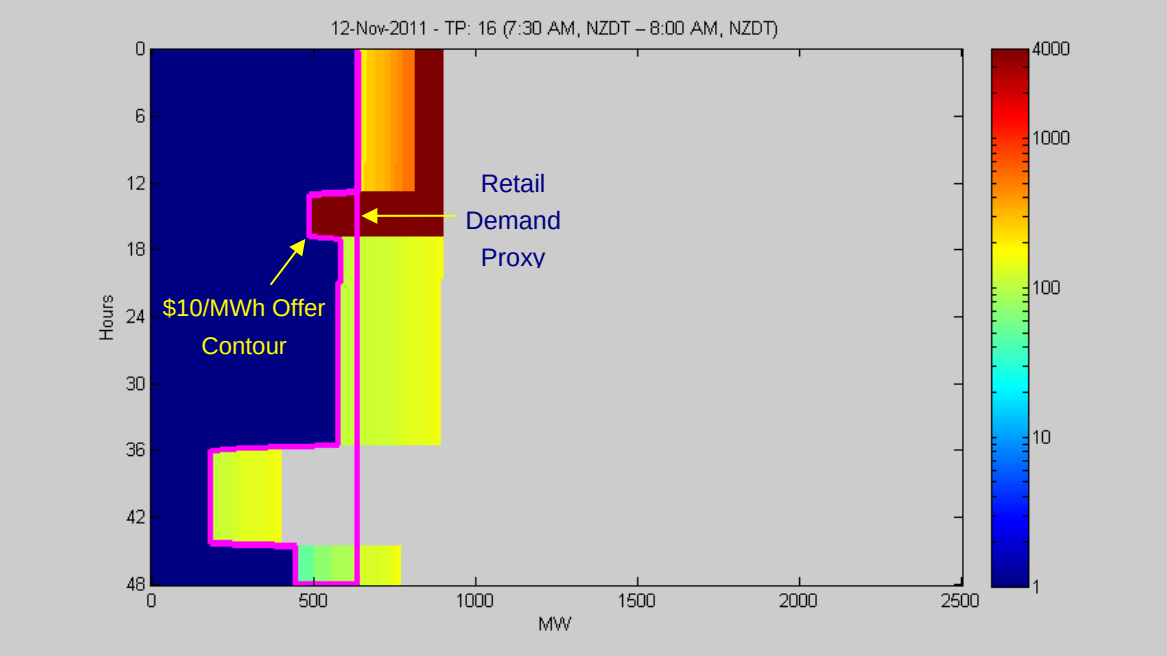
7.1 The Authority intends to publish a movie of each generator's offers over a period of time, probably every month, for regions where the generator is reasonably likely to be able, from time to time, to influence prices. Figure 4 and Figure 5 show snapshots of a single trading period from the two days last year when the unusual offer revision behaviour was observed. This sort of behaviour was observed for the majority of trading periods on each of the days concerned.

Figure 4 Genesis Power Ltd North Island offers for 4:30 pm on 23 July 2011



Source: Electricity Authority

Figure 5 Contact Energy Ltd North Island offers for 7:30 am on 12 November 2011



Source: Electricity Authority

7.2 In these graphs, the vertical axis indicates the number of hours before the start of the relevant trading period. Each horizontal slice represents the generator's offer curve at a particular point in time, with quantity in MW on the horizontal axis and offer price in $/MWh indicated by colour, increasing from left to right. Individual trading period contour plots are combined into a movie covering, for example, a calendar month.

7.3 The left-most pink curve is the $10/MWh offer contour line. The right-most vertical pink line is the proxy for the generator's retail demand in the trading period, and coincides with the $10/MWh offer contour line at the start of the trading period (top of the graph). The dark blue area to the left indicates low offer prices less than $1/MWh, while the brown area towards the right indicates high offer prices of $4000/MWh or more. The boundary between the brown and grey areas indicates the extent of the generator's offer curve.

7.4 In the two snapshots shown, the high-priced brown area protrudes to the left of the vertical retail demand proxy line for part of the period. However, these offers do not persist till gate closure and hence do not translate into final prices. Whether or not any of these offers would have been cleared in earlier schedules depends on the residual demand curve facing the generator.

7.5 If the residual demand curve intersects the generator's offer curve to the left of the retail demand line, the generator is not net pivotal and will end up being short of generation and will have to purchase from the spot market at the clearing price to meet the balance of its retail demand (refer Figure 2).

7.6 The fact that the high-priced offers did not persist beyond gate closure suggests the generator was not net pivotal. If it had been net pivotal, it would have had an incentive to push up the final price in order to increase the profit on its excess generation. However, leaving high-priced offers in when not net pivotal risks having to purchase at a high price to cover its generation shortfall, thereby increasing costs.

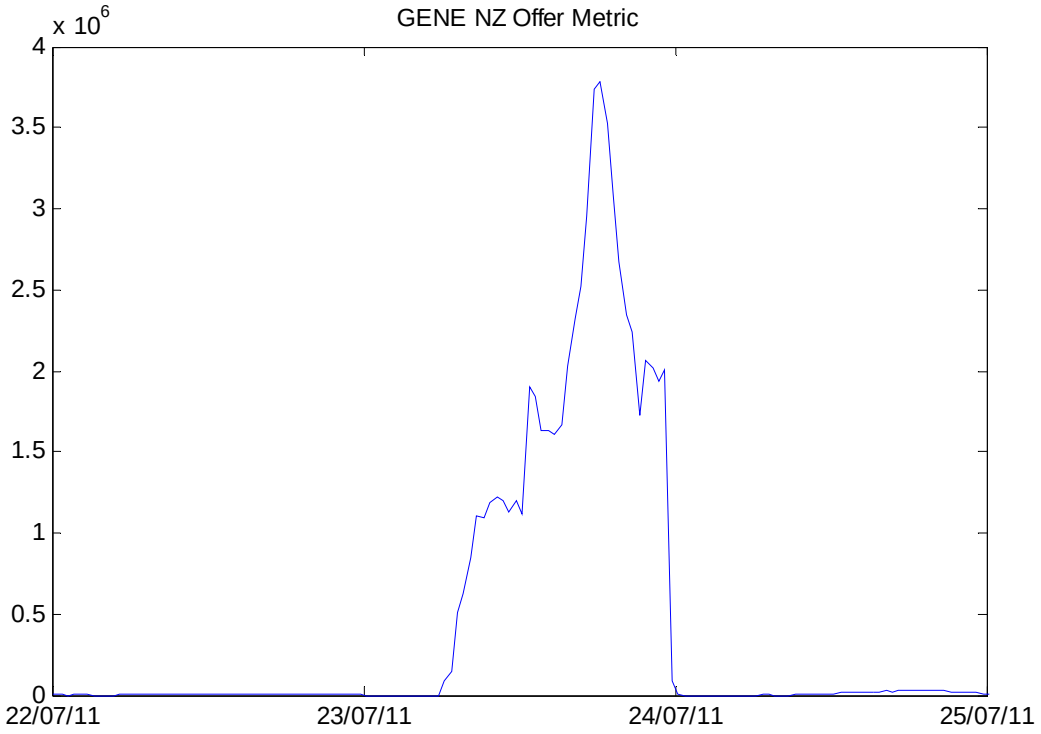
8 Offer revision metric examples

8.1 The area between the two pink lines in Figure 4 and Figure 5 is a measure of the volume (horizontal dimension) and duration (vertical dimension) of the generator's offers that did not persist till gate closure. The third dimension (offer price) is a measure of the likely effect of the offer revisions on forecast prices. Multiplying these three dimensions together (ie integrating the offer price curve over the area between the two pink lines) forms a metric of the degree to which other participants could be confused by such offer behaviour. This is based on the assumption that the strength of the 'revision signal' is proportional to the duration, volume, and price. A more accurate metric can be obtained by using the actual retail demand rather than the $10/MWh proxy. The Authority proposes to publish this more accurate metric, which it calls the 'offer revision' metric.

8.2 Figure 6 and Figure 7 plot the offer revision metric for the same two days when the large offer revisions were observed. The metric, as currently calculated, is in units of $-days/hour (or $24) but it is the relative size of the metric rather than the numerical value which is important.

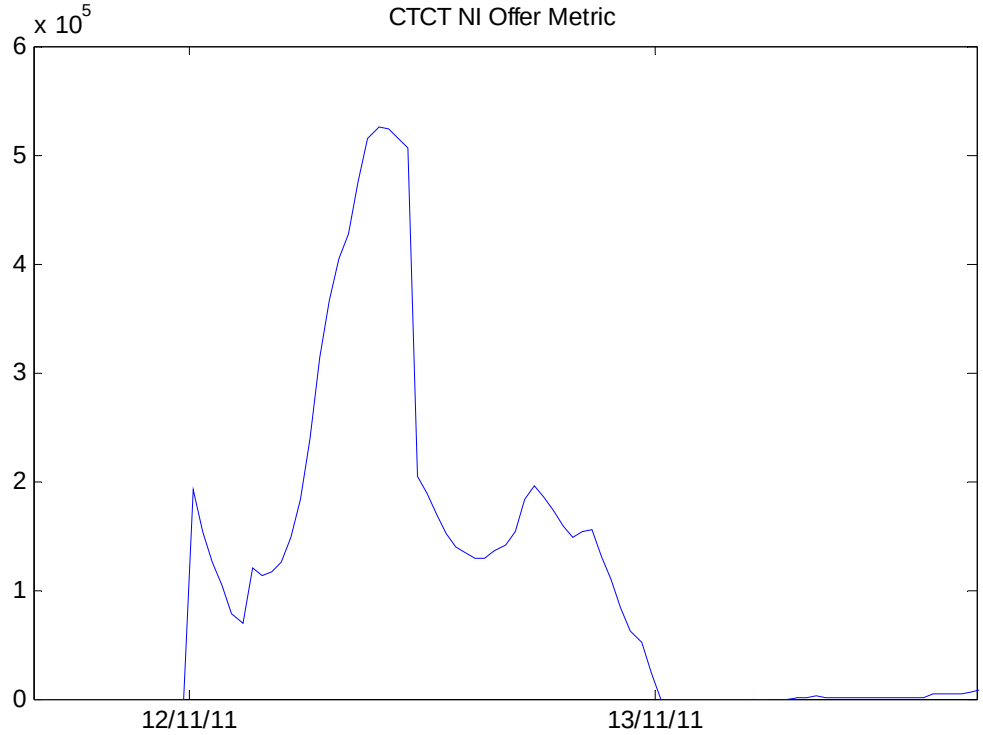
8.3 The offer revision metric is never zero, as a generator is not able to forecast its retail commitment perfectly. Based on analysis of over two years of offer revisions (Figure 8), a NZ-wide or island-wide metric exceeding 1,000,000 would appear to be a suitable trigger for closer inspection. A lower trigger level would probably be suitable for smaller regions. Note that the Contact Energy metric for 12 November is an order of magnitude lower than the Genesis Power metric for 23 July due to the significantly shorter time during which the high priced offers were in place, and the smaller quantity of offers involved. This indicates that only the Genesis offers on 23 July would have triggered further investigation.

Figure 6 Genesis Power Ltd NZ-wide offer revision metric for 23 July 2011



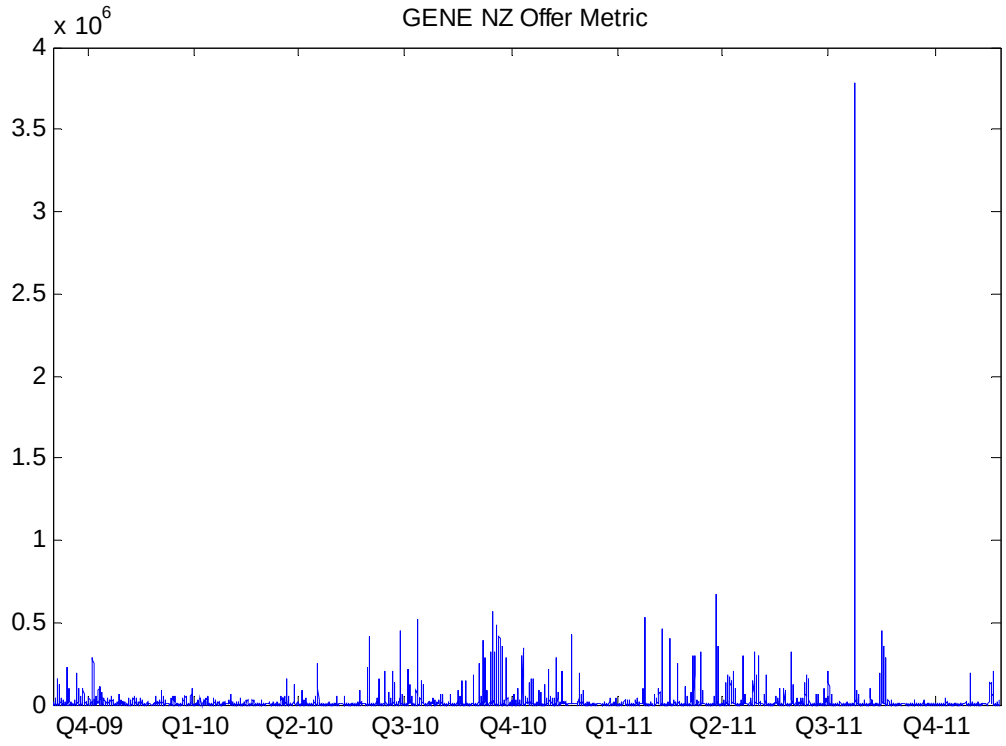
Source: Electricity Authority

Figure 7 Contact Energy Ltd North Island offer revision metric for 12 November 2011



Source: Electricity Authority

Figure 8 Genesis Power Ltd NZ-wide offer revision metric for Sept 2009 to Nov 2011



Source: Electricity Authority

9 Constrained regions

9.1 When there are no binding transmission constraints on the grid, the whole country essentially operates as a single electricity market, and a participant's ability to influence price and a participant's net position can be determined on a national basis. However, when a transmission link such as the inter-island HVDC link is constrained, the electricity system effectively separates into two regional markets. When two or more constraints bind simultaneously, each additional constraint essentially forms an additional regional market.

9.2 A participant may be able to engage in strategic offering on the down stream side of a binding constraint by restricting generation offers and/or increasing offer prices. It appears this was the situation in one of the cases discussed in this report. For the majority of trading periods on the days in question, the HVDC was shut down (ie constrained to zero), and Genesis and Contact respectively were pivotal in the North Island, although as already noted it appears Contact was not intentionally offering strategically. This is a special case where two completely separate electrical islands are formed and no import or export of power (in this case over the HVDC) is possible. Such a scenario can be analysed in the same way as for the single national market, except that each electrical island must be considered in isolation.

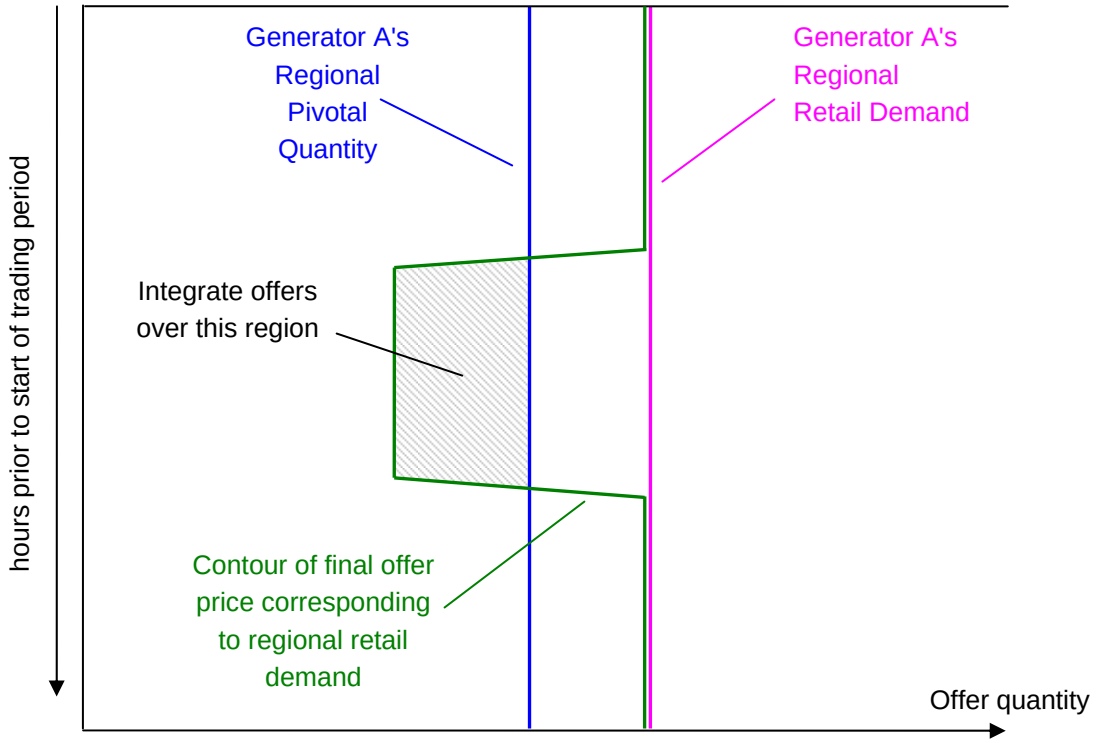
9.3 The situation is a little different when the constrained region is electrically connected to the rest of the network, since low-priced imports from the upstream side of the constraint will clear ahead of high-priced local offers. For this reason regional strategic offering is really only an issue when the local generator is pivotal in that region. This means the import transmission capacity is insufficient to meet the local demand without support from local generation.

9.4 A generator's regional pivotal quantity (if any) can be determined by setting all of the generator's offers in the relevant region to a very high price (say 30,000 $/MWh) and solving the Scheduling Pricing and Dispatch software (SPD). The degree to which SPD clears the high-priced offers in the constrained region, is the best measure of their 'regional pivotal quantity'.

9.5 To constitute a valid regional pivotal quantity, the import constraint must be binding[2], in which case the import capacity into the region will form part of the region's residual demand curve (ie regional residual demand = regional demand - import capacity - other regional offers).

9.6 Similar offer contour plot movies and offer revision metrics can be developed for such interconnected regions. However, since local high-priced offers are only likely to clear as a last resort, it is more appropriate to only include in the integral calculation of the offer revision metric, offers that protrude to the left of the regional pivotal quantity line (refer Figure 9).

Figure 9 Offer revision metric for interconnected region



Source: Electricity Authority

Notes: 1. Generator A is pivotal but not net pivotal in the constrained region. Only offer prices within the shaded region to the left of the regional pivotal quantity are integrated to form the offer revision metric.

[2] There are several scenarios when this might not happen, for example: it can happen when instantaneous reserves are scarce and the high-priced energy offers have to be cleared in order to access the generator's partly-loaded spinning reserves. It can also happen if energy offers are scarce at the island level. In both cases the transmission constraint into the region would not be binding and there would be no price separation at the regional level, so these cases can be readily filtered out.

10 Spring washer effects

10.1 Constraints are typically expressed as a limit on the weighted sum of flows on two or more transmission branches. When the branches making up the constraint form a cut set (ie completely cut the grid in two) the situation is clear. Examples of such constraints are the HVDC link and the Upper North Island stability constraint. When such constraints bind, there is essentially a single market price in each region (transmission losses also cause minor price differences within each region).

10.2 However, when a constraint occurs within a loop in the AC network, although there is a single marginal generator on each side of the constraint, a spring washer develops causing prices to vary continuously from node to node as the network is traversed from one side of the constraint to the other. This makes the incentive to influence price much more difficult to analyse, for the Authority and presumably for participants. This is because the participant's wholesale market sales and purchases throughout the "constrained region" are all settled at different prices, so it is no longer just a matter of comparing the total sales and purchases. For this reason, the Authority's analysis up to this point has focused on constraints that form cut sets and in particular the HVDC link.

10.3 Although a spring washer occurred on 26 March 2011 (which the Authority has determined constituted a UTS event), Genesis was in a pivotal position in the Upper North Island region and was able to set prices at a very high levels. However, in this particular instance, the high-priced offers persisted beyond gate closure indicating Genesis was also net pivotal, and therefore would not have caused a high offer revision metric.

10.4 The Authority intends to continue investigations in order to better understand offering incentives in spring washer situations, and hopefully develop applicable metrics.

11 Alternative courses of action considered

11.1 The Australian National Electricity Market (NEM) has a "good faith offering" rule. It requires that electricity offers and bids are made in good faith - that is, there must be a genuine intention to honour the offer or bid, but offers and bids can be revised if there is a change in material conditions.

11.2 However, there have been no successful cases brought against NEM participants under the "good faith" provisions. A case was brought in July 2009 which was subsequently dismissed by the Federal Court. The judgement has not been appealed.

11.3 It would be possible to propose amendments to the Code to include provisions to address the issue. However, amending the Code to include a "good faith offering" rule may not be the best option at this stage. Based on the Australian experience, bringing proceedings under such a provision would likely be costly and have a low probability of success.

11.4 The Authority's preferred approach initially is to improve market confidence by making offer revision data more available and transparent.

11.5 Hopefully this greater availability and transparency would discourage generators from making offers in a way which may send confusing signals to other participants.

12 Future work

12.1 The Authority intends to further its analysis of offering incentives in smaller regions and develop suitable offer revision metrics, including cases where spring washer situations arise.

12.2 The Authority intends to investigate alternative metrics to the ones described in this report. Such metrics might include one or more of the following features:

- a factor related to how soon before gate closure the high-priced offers are revised down (ie the longer other participants have to respond to the revised offer, the less significant it is);
- a factor proportional to the divergence between spot price and the forecast price resulting from the earlier high-priced offers.

Glossary of abbreviations and terms

Authority	Electricity Authority
Code	Electricity Industry Participation Code 2010
Contact	Contact Energy Limited
Genesis	Genesis Power Limited (trading as Genesis Energy)
MW	Megawatt
MWh	Megawatt hour