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Report prepared for Meridian Energy

# A clearer high standard of trading conduct rule - addendum

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*Kieran Murray, Toby Stevenson*

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|   |  |   |
|---|--|---|
| <b>Wellington</b><br>Level 9, 1 Willeston St<br>PO Box 587<br>Wellington 6140<br>Ph: +64 4 915 7590<br>Fax: +64 4 915 7596                | <b>Auckland</b><br>Level 8, 203 Queen St<br>PO Box 2475<br>Auckland 1140<br>Ph: +64 9 909 5810<br>Fax: +64 9 909 5828                                    |   |
| <b>Sydney</b><br>Level 14, 68 Pitt St<br>Sydney NSW 2000<br>GPO Box 220<br>Sydney NSW 2001<br>Ph: +61 2 9234 0200<br>Fax: +61 2 9234 0201 | <b>Canberra</b><br>Unit 3, 97 Northbourne Ave<br>Turner ACT 2612<br>GPO Box 252<br>Canberra City ACT 2601<br>Ph: +61 2 6267 2700<br>Fax: +61 2 6267 2710 | <b>Melbourne</b><br>Level 8, 90 Collins Street<br>Melbourne VIC 3000<br>GPO Box 3179<br>Melbourne VIC 3001<br>Ph: +61 3 9005 1454<br>Fax: +61 2 9234 0201 |

For information on this report please contact:

Name: Kieran Murray  
 Telephone: +64 4 915 7590  
 Mobile: +64 21 245 1061  
 Email: [kmurray@srgexpert.com](mailto:kmurray@srgexpert.com)



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# 1. Introduction and summary

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## 1.1 Introduction

In February 2018, we prepared a report entitled *A clearer high standard of trading conduct rule*. Since our report was finalised, additional information has become available which is relevant to the analysis of trading conduct on the wholesale electricity spot market.

Firstly, the Electricity Authority (the Authority) released a market performance review entitled *High prices on 2 June 2016* (hereafter, ‘market performance review’).<sup>1</sup> The Authority’s report provides insight into the analytical approach it took when investigating the high prices on 2 June and whether a specific trading strategy would, in the Authority’s view, be consistent with a high standing of trading conduct. In this addendum, we consider whether the analytical method applied by the Authority is sufficiently developed to answer the primary question posed in the market review; that is, whether the trading behaviour analysed was consistent with the Authority’s statutory objective.

Secondly, we have had the benefit of testing the concepts outlined in our original paper in a presentation to, and Q and A session with, the Energy Traders Forum,<sup>2</sup> and subsequently with the Market Development Advisory Group (MDAG) at its meeting in Auckland on 15 March. After reflecting on the insights offered to us during those discussions, we make a further refinement to our proposal for an amended high standard of trading conduct rule and safe harbour provision.

In our earlier paper we proposed to replace the third safe harbour 13.5B (1) (c) with a new safe harbour test that was more reflective of the Wholesale Advisory Group’s (WAG’s) original recommendation than the rule adopted by the Authority. In our view our revised safe harbour rule would also better meet the Authority’s statutory objective than the current rule. We proposed that a gross pivotal supplier would be deemed to be compliant with the HSOTC rule where:

*its price and quantity pairs in offers are not substantially different between the adjacent trading periods, and*

*its offer price is not substantially different from the offers of other last resort generation made during periods those generators are not pivotal.*

We have revisited the wording of “adjacent trading periods” and related issues in light of market performance review and feedback from participants at the Energy Traders’ Forum.<sup>3</sup>

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<sup>1</sup> Electricity Authority, *High prices on 2 June 2016, market performance review*, Roger Miller, Doug Watt, 18 December 2017. Published by the Authority on 20 February 2018.

<sup>2</sup> Freeman Media Energy Trader Forum Wednesday 14th February 2018

<sup>3</sup> *ibid*

## 1.2 Summary

### 1.2.1 Market performance review

On 2 June 2016, electricity spot prices rose to over \$4,000 per megawatt hour (MWh) for one half hour trading period, fell back to what the Authority described as normal levels of around \$180 for the subsequent trading period and rose again to \$3,000 for trading period after that. The Authority shortly afterwards commenced a market performance inquiry into this event. The Authority found that if any of Contact or Genesis or Meridian had not changed their offers in the hours leading up to the high prices, or the Mangahao power station had not tripped, prices would not have been unusual.

While it seems a number of factors contributed to the high price event, the focus of the Authority's market performance review is on Meridian's offer strategy which has the effect of linking prices across a transmission constraint. At the core of the Authority's analytical approach to evaluating this offer strategy is a view that when a transmission constraint binds, the wholesale electricity market separates into two geographical markets. The Authority considers that separate clearing prices should result either side of the constraint, with load downstream of the constraint met by more expensive generation downstream of the constraint, while upstream load is met by cheaper generation upstream of the constraint.

This view, that markets separate either side of a temporary constraint, is consistent with some early empirical and theoretical work following the establishment of wholesale electricity markets. The thermal based systems studied in this early analysis were distinguished from other markets by two related features:

- electricity could not be economically stored in significant scale, and hence could not be bought in one period and then sold (or used) in another. Without an ability to arbitrage between periods, prices at different times of the day, days of the week, and months of the year could behave very differently
- the operational decisions of thermal units within any given time period were static in nature (that is, specific to that time period); because fuels such as coal or gas can be acquired in the corresponding commodity markets, the amount produced in a given period were assumed not to affect the production possibilities in subsequent periods.

These features have never applied in New Zealand's hydro dominated market. The operation of hydroelectricity plants is intrinsically dynamic: each additional unit of electricity produced at a given moment lowers the level of the plant's reservoir, thereby reducing the availability of water for future production - hydroelectricity suppliers "move" energy between periods by controlling the flow of water out of storage.

Also the potential for grid scale batteries (already a reality in some markets), means analytical techniques should increasingly assume that electricity can be stored, and therefore bought in one period and sold in another.

In a competitive market with inventory (hydro electric reservoirs, grid scale batteries, etc), suppliers would not respond to a temporary constraint by continuing to produce the same quantity at a lower price. If the supplier considered that prices were likely to be higher in a subsequent period, it would retain its stored energy/water and generate when prices returned to 'normal' levels. A generator with storage could be expected to arbitrage between

constrained and non-constrained periods such that prices across the periods would be the same, assuming everything else remains unchanged other than the constraint.

The Authority's reasoning suggests that during periods of a constraint, a generator (or owner of battery storage) should accept prices for that stored energy which is below what it could be sold for in the national, competitive, wholesale market absent the constraint. Such an outcome, if imposed by the Authority through its compliance actions, would harm the Authority's statutory objective by:

- undermining the value of storage, the function of which is to arbitrage between periods of plenty and periods of shortage
- potentially distorting prices in all periods; this is because an effective price cap / rule which impedes pricing in one period in a hydro based system alters the opportunity cost of water in periods where the cap is not 'apparently' binding, and hence potentially alters offer strategies and prices in all periods.

As the use of storage to arbitrage prices between periods is unambiguously in the long-term interests of consumers, a measure which prevented such an offer strategy would be unambiguously harmful to consumers.

The Authority also suggests that preventing a hydro generator from using its storage to link prices would increase the demand for financial products and this would be beneficial to the market. The error in the Authority's logic is its presumption that retaining energy in storage upstream of a temporary constraint "moves prices away from workably competitive levels". We show that the ability to move energy from (and in the case of batteries, to) storage is why prices quickly converge toward (rather than away from) workably competitive levels even in the presence of temporary supply constraints.

Regulators and participants rightly devote considerable effort to developing financial products and facilitating increased trading to aid price discovery in the underlying physical products. However, we are not aware of any literature or theory that would support impeding arbitrage offers in the physical market to promote arbitrage by way of financial product offers. Policy interventions which lean against each other in this way would raise costs and reduce the long term benefit of the market to consumers

We believe the Authority was justified in investigating the performance of the market when it produces prices of \$4,000 MWh when underlying supply and demand conditions were on the face of it unremarkable. However, we show that the Authority is wrong to conclude that hydro electricity generators should not use storage to prevent price separation across a transmission constraint. This conclusion implies no view as to whether the prices on 2 June 2016 were distorted by market design flaws, other forms of strategic behaviour of participants, or a combination of other factors.

## **1.2.2 Adjacent trading periods and related issues**

For this addendum we reassessed three issues that were raised in response to our proposed clearer high standard of trading conduct rule:

## Pricing for last resort generation in the market

We highlighted the possibility for a “missing money” problem to exist under current market arrangements. This concept refers to the need for wholesale market prices at times of peak demand to satisfactorily compensate plant that only tends to run at peak times. Peaking plant that has low annual running times rely on price spikes for their revenue.<sup>4</sup> If those prices are not high enough there is a risk that such plant withdraws from the market. We revisited this issue and the comparative status of last resort generation from hydro plant based on the performance review and other feedback. Our position on this issue is unchanged from our earlier report.

## Our approach to the safe harbour test for substantial changes to price and quantity pairs by a pivotal generator leading up to an event

Previously we recommended that price and quantity pairs in offers should not be substantially different between adjacent trading periods. We have now taken into account the potential for a generator to be continuously pivotal from the point that their original offer was submitted through to the point of a potential breach. We still want to strike a balance between a generator being able to modify its offer in response to changes in circumstances and participants having the ability to in turn respond to that offer. We have changed the proposed first limb of our safe harbour rule. We now propose that a gross pivotal supplier would be deemed to be compliant with the HSOTC rule where:

*its price and quantity pairs in offers are not substantially changed when there is insufficient time for a market response ~~different between the adjacent trading periods~~ and*

*its offer price is not substantially different from the offers of other last resort generation made during periods those generators are not pivotal,*

## Where a generator is pivotal across multiple days

We understand that the rule the WAG recommended was based on the problem given to it by the Authority. It was intended to deal with situations where market power arose as a result of a generator becoming pivotal. The issue of whether there is an ongoing lack of competitive pressure by virtue of a generator being pivotal day after day is not a matter for a high standard of trading conduct rule. An intervention aimed at controlling prices over many days falls within the scope of the price control provisions of the Commerce Act. We are not aware of any work that suggests extended periods of a supplier being pivotal warrant applying Part 4 of the Commerce Act or that such an approach would be beneficial in the wholesale market.

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<sup>4</sup> Generators may also sell financial products to compensate peaking plant but the pricing of these also relies on the risk that prices spike at times of peak demand also.

## 2. Efficient and inefficient price separation

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### 2.1 Introduction

In its introductory comments to its recently released market performance review, the Authority is careful to distinguish its market performance work from its compliance function.<sup>5</sup> The Authority emphasises that its:<sup>6</sup>

*Market performance reviews are designed to gain a deeper understanding of an event, and assess implications for the competitive, reliable, and efficient operation of the electricity industry.*

This report has the same focus. We consider the analytical approach and tools applied by the Authority. We express no view with regard to the actions of any entity in relation to the high prices on 2 June 2016. Our concern is whether the analytical method applied by the Authority is sufficiently developed to answer the primary question posed in the market review; that is, whether the trading behaviour analysed was consistent with the Authority's statutory objective.<sup>7</sup>

### 2.2 Trading conduct focused on by the Authority

On 2 June 2016, electricity spot prices rose to over \$4,000 per megawatt hour (MWh) for one half hour trading period (5.30-6.00 pm), fell back to what the Authority described as normal levels of around \$180 in the immediately following trading period and rose again to around \$3,000 for the trading period after that.<sup>8</sup> Unsurprising, and appropriately in our view given that the spot market normally trades at less than \$100 per MWh, the Authority shortly afterwards commenced a market performance inquiry into this event.

The Authority's review describes how early in the afternoon (1.14pm) on 2 June the system operator warned there was potentially insufficient generation and reserve offers to meet demand in the North Island and requested more generation be made available. The chronology detailed by the Authority includes the following offer changes in the period of time leading up to and following the system operator warning and the high spot prices:

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<sup>5</sup> Electricity Authority, *High prices on 2 June 2016, market performance review*, Roger Miller, Doug Watt, 18 December 2017.

<sup>6</sup> Ibid, paragraph 2.1.

<sup>7</sup> Ibid, paragraph 1.5.

<sup>8</sup> Ibid, paragraph 1.1.

- Meridian Energy increased its offer price for 205 – 321 MW in the South Island from \$275 - \$975 to \$4,248, at 11.33am
- Contact Energy increased its offer price for 52 MW for Whirinaki price from \$220 to \$5,000/MWh, at 12.07pm
- Genesis Energy increased its offer price for 62 MW for Waikaremoana from \$185 to \$4,000/MWh, at 3.15pm.
- King Country Energy's hydro station at Mangahao tripped at 4.37pm and did not run for the rest of the afternoon.

The Authority observes that had any one of the offer changes listed above not happened, or if Mangahao had not tripped, prices would not have been unusual.<sup>9</sup> While it seems a number of factors contributed to the event, the focus of the Authority's market performance review is on Meridian's offer changes. The Authority observes:<sup>10</sup>

*The salient observation from this event is that generators (and potentially other participants) may consider that Meridian's offer approach – linking prices across a transmission constraint and thereby raising prices in a region with abundant supply – is consistent with the Authority's statutory objective.*

## 2.3 The Authority's conceptual approach

At the core of the Authority's analytical approach to evaluating offer strategies that link prices across a constraint is a view that when a transmission constraint binds, the wholesale electricity market separates into two geographical markets. The Authority sets out this reasoning as follows:<sup>11</sup>

*When transmission flows reach the capacity of a particular grid element, that grid element is said to be constrained. Any further increase in load downstream of the constraint must be met by more expensive generation downstream of the constraint, while increases to upstream load can still be met by cheaper generation upstream of the constraint. This effectively causes separate markets on either side of the constraint, each with their own clearing price.*

In Figure 1 below, we illustrate the Authority's approach. This schematic borrows from economic text book diagrams illustrating trade between two regions. The diagram shows, separately, North Island demand and supply and South Island demand and supply. In this scenario, the HVDC constraint does not bind, and there is a flow of generation from the South Island to the North Island at the market clearing price (MCP). This transfer is represented by the area HVDC. Because of the 'import' of energy from the South Island, the price in the North Island is lower than it would be without the transfers, and hence North Island demand is higher and North Island supply is lower than it otherwise would be. In the South Island, the result is reversed, because of the 'export' of energy to the North

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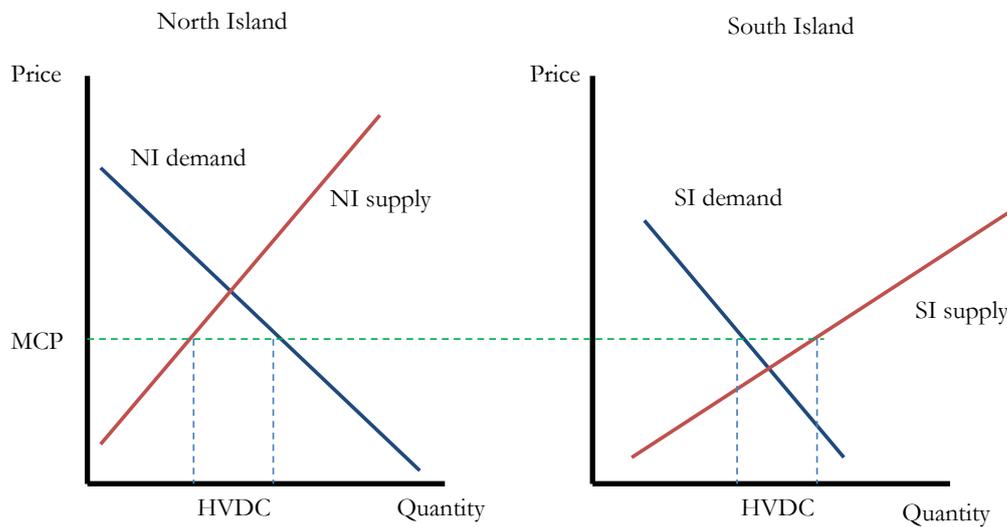
<sup>9</sup> Ibid, paragraph 4.10.

<sup>10</sup> Ibid, paragraph, 5.3.

<sup>11</sup> Ibid, paragraph 3.6.

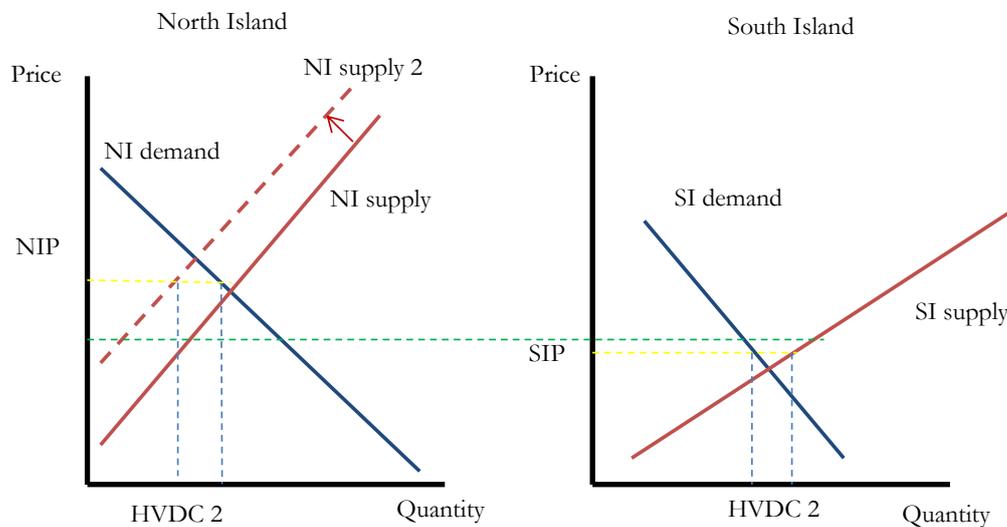
Island the price is higher in the South Island, and supply is higher and demand lower, than without a transmission link.

**Figure 1 Market price and quantity, constraint not binding – Authority’s approach**



In Figure 2, we illustrate the expected outcome, under the Authority’s approach, when the transmission constraint is binding. In this scenario, North Island supply is reduced, including the availability of reserves to cover the HVDC link. This scenario is represented by the North Island supply curve shifting up and to the left and flows across the link are constrained to the quantity HVDC 2. The figure illustrates the Authority’s expectation that in such a scenario the markets would separate on each side of the constraint, each with their own clearing price. Demand downstream of the constraint (the North Island in this illustration) must be met by expensive North Island generation and a smaller quantity of South Island transfers, so the North Island price (NIP) increases relative to the MCP with an unconstrained link (as shown in figure 1). Upstream of the constraint (the South Island), demand can be met by cheaper generation, and with a smaller quantity exported to the North Island, the South Island price (SIP) falls relative to the MCP with an unconstrained link.

**Figure 2 Market prices and quantities, constraint binding – Authority’s approach**



The Authority observes that market outcomes on 2 June, and on other occasions, were not as illustrated in Figure 2. The Authority reasoned that:<sup>12</sup>

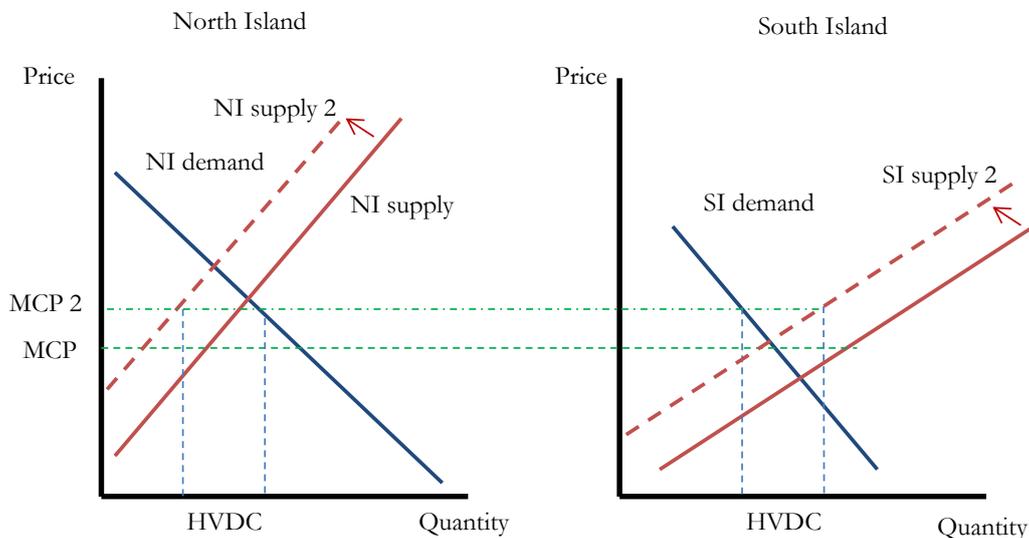
*Meridian raised some of its South Island energy offer prices to reduce the likelihood that the HVDC risk would bind, and so reduce the likelihood of price separation. By using offer changes to link the prices in both islands together, South Island prices increased to levels that reflected the North Island scarcity. This outcome was at odds with the South Island supply/demand situation.*

We illustrate the Authority’s description of events in Figure 3 below.

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<sup>12</sup> Ibid, paragraph 5.2.

**Figure 3 Change to South Island offers to prevent separation**



In Figure 3, the supply curves in the North and South Islands shift up and to the left, to reflect the change in offers from suppliers in both Islands. The constraint on the HVDC link does not bind, and so the same quantity (labelled HVDC) is transferred from South to North as in Figure 1. Because of the offer changes, the market clearing price (MCP 2) in Figure 3 is higher than in Figure 1, though transfers across the link are the same in both examples.

The Authority considers the salient question, for its market performance review, from the events of 2 June is whether linking prices across a transmission constraint and thereby raising prices in a region with abundant supply - as illustrated in Figure 3 above (and indeed in Figure 1) - is consistent with the Authority’s statutory objective.<sup>13</sup> The Authority concludes that the practice of linking prices has various adverse effects on the Authority’s statutory objective. These adverse effects would result from prices being higher upstream of the constraint - the South Island in this example- than the Authority would expect if upstream of the constraint were considered a separate market with abundant supply.

The Authority’s concern is not limited to the very high prices on 2 June 2016, but encompasses all circumstances where the HVDC (or any other transmission constraint) binds, and prices do not fall upstream of the constraint. The Authority reasons that these higher prices (relative to its expectation of what should occur) have the potential to:

- lead to higher retail and hedge prices upstream of the constraint in the long term
- incentivise over-investment in peaking generation upstream of the constraint.

The Authority considers these outcomes would be inefficient if there is fundamentally no supply scarcity upstream of the constraint.

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<sup>13</sup> Ibid, paragraphs 5.2, 8.1.

## 2.4 The Authority's market analysis is incomplete

### 2.4.1 Markets are multi-dimensional

The conventional first step for an economist in understanding the competitive implications, and hence efficiency outcomes, of market conduct is to define the relevant market. The term 'market' defines the field of exchange (or potential exchange) in which the goods and/or services being considered are substitutable for other goods and services. It is these substitution possibilities which set the limits upon a firm's ability "to give less and charge more".<sup>14</sup>

Markets are multi-dimensional and are generally defined in terms of:

- product dimension – the good(s) or service(s) exchanged between buyers and sellers
- functional dimension – where the good or service sits in the production or distribution chain
- geographic dimension – the area within which the goods or services are obtained or supplied
- temporal dimension - where relevant, markets might have a temporal dimension or time-frame within which the market operates.

When analysing the conduct of linking wholesale prices across a transmission constraint, the product (electricity) and functional (wholesale) dimensions of the market would seem uncontentious. The Authority's analysis rests on its (mostly implied) views in relation to the geographic and temporal dimensions of the wholesale electricity market.

### 2.4.2 Geographic dimension

A geographic market is defined as an area of effective competition, or the area within which consumers of a product or service can source an alternative supplier.<sup>15</sup> This dimension of the market is central to the Authority's conclusion that prices should have fallen in the South Island because of "its abundant supply";<sup>16</sup> the South Island could be viewed as having abundant supply relative to demand only if analysed separately from the North Island.

The Commerce Commission has generally viewed the wholesale electricity market as a national market, for although nodal off-take prices vary across the country, the transmission network means no region individually constitutes a separate market. The Commission historically viewed transmission constraints as not occurring on a sufficiently regular and

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<sup>14</sup> Re Queensland Co-operative Milling Association Ltd; Re Definance Holding Ltd (1976) ALR 481, citing Attorney General for the USA Report of the US Attorney General's National Committee to Study the Antitrust Laws (31 March 1955), 320.

<sup>15</sup> In electricity markets, the dimension might more accurately be referred to as the electrical area rather than geographic area (as it is the transmission circuits which join areas not geography), but nothing turns on this language and in the case of the HVDC the geographic and electrical separation are the same.

<sup>16</sup> Electricity Authority, *High prices on 2 June 2016, market performance review*, ibid, paragraph 8.2.

predictable basis to indicate separate markets,<sup>17</sup> though with some exceptions.<sup>18</sup> The concept of a national wholesale market has also found support in the Australian courts<sup>19</sup> and by the New Zealand High Court.<sup>20</sup>

However, the Commission has observed that “*transmission constraints can result in geographic areas separating*”.<sup>21</sup> At face value, this observation by the Commission is consistent with the Authority’s reasoning. However, the Commission did not go as far as to claim that whenever a constraint arises the national market splits into separate markets – the Authority’s explanation of its analytical approach is very brief, but the inference from its comments is that it considers that market separation occurs whenever a transmission constraint binds (see paragraph 3.6 of its Market Performance Review, cited above).

Temporary supply constraints arise in many markets without competition economists concluding that the market fragments. The Commission proposed a test for market separation in its 2009 Investigations Report into the electricity sector. The Commission suggested that if nodal prices at two locations are highly correlated then both locations would be part of the same market. “*In contrast, if the prices at two locations were to exhibit a lower correlation, they would likely fall in separate markets.*”<sup>22</sup> The nodal pricing correlation analysis prepared by Professor Wolak for the Commerce Commission at that time concluded national nodal prices were sufficiently closely correlated that a single integrated wholesale market exists for the vast majority of the half-hours in a year. This analysis found the correlation between North and South Islands was very close to one even during drier years, with the implication that constraints on the HVDC link did not cause the national wholesale market to separate into North Island and South Island markets for the purposes of competition analysis. The substantial upgrades to the transmission grid since the Commission’s study would likely result in a closer correlation.

The economic theory supporting the Commission’s approach is referred to in the literature as the *Law of One Price*.<sup>23</sup> The concept of the Law of One Price relates to the impact of market arbitrage and trade on the prices of identical commodities exchanged in two or more different geographical locations. An efficient market should result in only one price of identical commodities regardless of where they are traded, once adjustments are made for transport and transaction costs. In the jargon of traders, an efficient trading market would

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<sup>17</sup> Commerce Commission, *The Investigation into the Acquisition by Meridian of the South Island Retail Electricity Customer Base of On Energy*, 10 April 2003.

<sup>18</sup> The Commission defined a geographic market for the upper part of the South Island in 2005, as the area had traditionally suffered a greater number of periods in which transmission into the area is constrained, see Commerce Commission, *Contract between Meridian Energy Limited and TrustPower Limited Investigation Termination Report*, 25 May 2005.

<sup>19</sup> *Australian Gas Light Company v Australian Competition and Consumer Commission*, above n 47, (No. 3) [2003] FCA 1525, para 387.

<sup>20</sup> *Commerce Commission v Bay of Plenty Electricity Ltd* (13 December 2007) HC, Wellington, CIV-2001-485-917.

<sup>21</sup> Commerce Commission, *Investigation Report, Commerce Act 1986 S 27, S 30, and S 36 Electricity Investigation 22 May 2009*, Wellington, page 36.

<sup>22</sup> Commerce Commission, *Investigation Report*, op cit, para 175.

<sup>23</sup> A nice overview of the concept is available at Economic History Association website <https://eh.net/encyclopedia/the-law-of-one-price/>, accessed 2 April 2018.

reduce if not eliminate the basis risk between identical products at different locations. If the price of a product varies between locations, then an arbitrageur could purchase the commodity in the cheaper location and sell it where prices are higher to earn a profit. Prices of a commodity in separate geographical locations (though in the same market) may not necessarily be identical, but any price differential should reflect transport and transaction costs. This Law of One Price effect was illustrated in Figure 1 above.

The Commission did comment that it found that at certain times transmission constraints on various parts of the transmission network could result in significantly different nodal prices on either side of the constraint. The Commission suggested that it could be appropriate to define geographically distinct markets for a period of time, most likely to be the period of the constraint. It gave as an example a scenario which the HVDC link was out of operation, or there was a significant reduction in the capacity of the HVDC.<sup>24</sup> The implication from the Commission's comment is that the constraint must be sufficiently frequent, or sufficiently severe, to cause the national market to split into two or more distinct markets for assessing competitive conduct, a qualification which is not apparent in the Authority's reasoning.

A further potentially complicating factor is that it might be argued that the Commission's analysis did not anticipate the behaviour of concern to the Authority – a practice of linking prices across a constraint would cause prices to be more correlated than otherwise. We consider that these issues are resolved when the temporal dimension of the market is considered. As Justice French observed:<sup>25</sup>

*The geographic market is not to be determined by a view frozen in time or by observations based on shortrun time scales.*

### 2.4.3 Temporal dimension

Economists generally view markets as operating continuously over time. The Commerce Commission usually does not define a time dimension for a relevant market, although it may do so if it considers suppliers can price discriminate across time periods because buyers' competitive alternatives vary over time. An example provided by the Commission is where products are perishable, and suppliers cannot easily switch production from one time period to another.<sup>26</sup>

The Authority appears to have adopted the view that the wholesale electricity has a temporal dimension and competitive conduct should be analysed on a trading period by trading period basis, at least for the set of trading periods for which a constraint on a transmission link binds (or would bind but for the offer strategy under consideration).

If this is the view of the Authority (we need to infer the Authority's reasoning as it simply states its view that the markets separate when a constraint occurs), it would be consistent with competition analysis prepared in the early days of reformed wholesale electricity markets. For example, about 15 years ago the Federal Trade Commission in the United

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<sup>24</sup> Commerce Commission, *Investigation Report*, page 47.

<sup>25</sup> *Australian Gas Light Company v Australian Competition and Consumer Commission*, above n 47, (No. 3) [2003] FCA 1525, para 387.

<sup>26</sup> See for example, the Commerce Commission, *Mergers and Acquisitions Guidelines*, July 2013, page 28.

States found that each segment of time in a wholesale electricity market constitutes a separate product market, though suggested an analysis of time periods with similar conditions (such as peak and off-peak) to make the process more manageable.<sup>27</sup>

The Commerce Commission has previously observed that market conditions in electricity markets can vary considerably over time, and suggested that this could justify the use of a temporal dimension to market definition. However, in its investigations to date it has taken the approach that it has not been necessary to consider a time dimension, and to do so would unnecessarily increase the complexity of the competition analysis.<sup>28</sup>

The difficulty with these historical comments is that the early empirical and theoretical work, which supported conclusions in relation to the temporal dimension of wholesale electricity markets, focused on the operation of predominantly thermal based systems.<sup>29</sup> The systems studied in this early analysis were distinguished from other markets by two related features:<sup>30</sup>

- electricity could not be economically stored in significant scale, and hence could not be bought in one period and then sold (or used) in another. Without an ability to arbitrage between periods, prices at different times of the day, days of the week, and months of the year could behave very differently
- the operational decisions of thermal units within any given time period were static in nature (that is, specific to that time period); because fuels such as coal or gas can be acquired in the corresponding commodity markets, the amount produced in a given period were assumed not to affect the production possibilities in subsequent periods.

These features have never applied in New Zealand's hydro dominated market. In a system like New Zealand's, the presence of hydro storage means the operation of hydroelectricity plants is intrinsically dynamic: each additional unit of electricity produced at a given moment lowers the level of the plant's reservoir, thereby reducing the availability of water for future production. In other words, hydroelectricity suppliers "move" energy between periods by controlling the flow of water out of storage. The New Zealand electricity wholesale market, and other markets with substantial hydroelectricity generation such as Brazil, Canada, Colombia, Venezuela, Switzerland and Norway, function in way that distinguishes them from thermal based systems.

Looking to the future with the potential for grid scale batteries (already a reality in some markets), analytical techniques should increasingly assume that electricity can be stored, and

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<sup>27</sup> "Remedying Undue Discrimination through Open Access Transmission Service and Standard Electricity Market Design, Docket No. RM01-12-000", *Comment of the Staff of the Bureau of Economics and the Office of the General Counsel of the Federal Trade Commission*; see also Organisation for Economic Co-operation and Development, 2003, *Competition Policy in the Electricity Sector 2002*, DAF/COMP(2003)14, Paris, p. 408 & p. 420.

<sup>28</sup> Commerce Commission, *Investigation Report*, page 49.

<sup>29</sup> See for example, Borenstein, S., Bushnell, J., 1999. *An Empirical Analysis of the Potential for Market Power in California's Electricity Market*. *Journal of Industrial Economics* 47 (3), 285-323; Green, R., Newbery, D., 1992. *Competition in the British Electricity Spot Market*. *Journal of Political Economy* 100 (5), 929-953; Joskow, P., Kahn, E., 2002. *A Quantitative Analysis of Pricing Behaviour in California's Wholesale Electricity Market During Summer 2000*. *Energy Journal* 23 (4), 1-35.

<sup>30</sup> For a fuller discussion see Luiz Rangel,(2008), *Competition Policy and Regulation in Hydro-Dominated Electricity Markets*, *Energy Policy*,36, issue 4, p. 1292-1302.

therefore bought in one period and sold in another, reducing or removing a feature that historically distinguished electricity markets from other forms of commodity market. In economic terms, the ability to shift production from one period to another (as with hydro storage) and the ability to store produced electricity, are analytically similar – both allow the potential for arbitrage from one period to another and mean that prices and other outcomes in one period cannot be frozen in time and considered separately from market conditions in other periods.<sup>31</sup>

In the following section we explain why the Authority was wrong to conclude that in a market with hydro storage (and potentially grid scale batteries) prices should necessarily separate across a transmission constraint.

## 2.5 Electricity markets with storage

### 2.5.1 Storage can be expected to align prices across constraints

In a competitive market, a hydroelectric generator with storage would not respond to a temporary transmission constraint by continuing to produce the same quantity at a lower price (as the Authority reasons and we illustrate in Figure 2 above). If the generator considered that prices were likely to be higher in a subsequent period, the generator would retain its stored water and use that water to generate when prices returned to ‘normal’ levels. A generator with storage could be expected to arbitrage between constrained and non-constrained periods such that prices across the periods would be the same, assuming everything else remains unchanged other than the constraint.<sup>32</sup>

By utilizing storage, hydro electricity generators smooth prices compared to what would occur if each trading period were a separate market. This price-smoothing effect of storage negatively affects producer rents of electricity generating firms, which benefit from peak prices. For consumers, the opposite is true: their surplus increases because consumers benefit more from lower peak prices than they are harmed by higher off-peak prices. As the increase in consumer rent outweighs the decrease in producer rent, overall welfare increases – this is why The Law of One Price effect is synonymous with efficient, welfare enhancing markets.<sup>33</sup>

These comments imply no view as to whether the prices on 2 June 2016 were distorted by market design flaws, strategic behaviour of participants, or a combination of factors – as

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<sup>31</sup> The economic analysis of moving electricity between periods using batteries may involve strategic decisions on output but also on inputs, which may add further complexity to the analysis.

<sup>32</sup> In the case of 2 June 2016, everything else did not remain the same. The Authority found that if any of Contact or Genesis or Meridian had not changed their offers, or Mangahao had not tripped, prices would not have been unusual.

<sup>33</sup> For empirical estimates of these consumer benefits in electricity markets, see Schill, Wolf-Peter; Kemfert, Claudia, (2011), *Modeling Strategic Electricity Storage: The Case of Pumped Hydro Storage in Germany*, Energy Journal, ISSN 0195-6574, Vol. 32, Iss. 3, pp. 59-87; Sioshansi, R. (2010). “Welfare Impacts of Electricity Storage and the Implications of Ownership Structure.” Energy Journal 31(2): 173-198.

noted in our introduction, we believe the Authority was justified in investigating the performance of the market when it produces prices of \$4,000 MWh when underlying supply and demand conditions were on the face of it unremarkable. However, the analysis above does show that the Authority is wrong to conclude that hydro electricity generators should not use storage to prevent price separation across a transmission constraint.

The Authority's reasoning suggests that during periods of a constraint, a generator (or owner of battery storage) should accept prices for that stored energy which is below what it could be sold for in the national (competitive) wholesale market absent the constraint. Such an outcome, if imposed by the Authority through its compliance actions, would harm the Authority's statutory objective by:

- undermining the value of storage, the function of which is to arbitrage between periods of plenty and periods of shortage
- potentially distorting prices in all periods; this is because an effective price cap / rule which impedes pricing in one period in a hydro based system alters the opportunity cost of water in periods where the cap is not 'apparently' binding, and hence potentially alters offer strategies and prices in all periods.<sup>34</sup>

As the use of storage to arbitrage prices between periods is unambiguously in the long-term interests of consumers,<sup>35</sup> a measure which prevented such an offer strategy would unambiguously be harmful to consumers.

## 2.5.2 Risk markets and managing basis risk

The Authority suggests that a hydro generator using storage to link prices across a constraint would reduce the demand for risk products and eliminating the approach would increase the demand for these products:<sup>36</sup>

*...the Authority considers that eliminating the offer approach would increase demand for various risk products and promote development of an efficient hedge market.*

The Authority considers that should it intervene in the wholesale market to prevent the use of offer strategies to arbitrage across a constraint and the additional demand would cause more financial products to become available:<sup>37</sup>

*This would, in turn, provide more options for parties such as Meridian to hedge their market risks without resorting to moving prices away from workably competitive levels – in short, a virtuous cycle.*

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<sup>34</sup> Alfredo Garcia, James Reitzes, Ennio Stacchetti, (2001), 'Strategic Pricing when electricity is storable', Journal of Regulatory Economics 20:3 223-247.

<sup>35</sup> Some studies have shown how hydro generators with storage can offer strategically to lower consumer welfare (increase producer surplus) relative to a perfectly competitive market benchmark; all have found that the use of storage enhances consumer welfare relative to its absence. For an overview of this literature, see Schill (2011) and Rangel,(2008), *ibid*.

<sup>36</sup> Electricity Authority, market performance review, *ibid*, paragraph 8.14.

<sup>37</sup> *Ibid*, paragraph 8.14.

The error in the Authority’s logic is its presumption that retaining energy in storage upstream of a temporary constraint “moves prices away from workably competitive levels”. As most illustrations of The Law of One Price describe, the ability to move stock to and from inventory is why prices quickly converge toward (rather than away from) workably competitive levels even in the presence of temporary supply constraints. In a market with arbitrage and trade, inventory adjustments mean prices respond in the constrained period to expectations of future shipments not just to the short-term demand supply balance either side of the constraint.<sup>38</sup>

There is a large literature discussing how financial products can increase liquidity thereby aid the forces which act to restore the Law of One Price in the presence of shocks. Regulators and participants accordingly devote considerable effort to developing financial products and facilitating increased trading. However, we are not aware of any literature or theory that would support impeding arbitrage offers in the physical market to promote arbitrage by way of financial product offers. Policy interventions which lean against each other in this way would raise costs and reduce the long term benefit of the market to consumers.

## 2.6 Our proposed HSOTC protects all participants from opportunistic behaviour

In our main report, *A clearer high standard of trading conduct rule*, dated 14 February 2018, we discuss safe harbours and guidelines for interpreting the HSOTC rule to protect consumers (and other participants) from the opportunistic behaviour of a supplier in a pivotal position because of a transmission constraint. This opportunistic behaviour would manifest through artificially high prices downstream of the transmission constraint, during periods in which the normal operation of the market does not constrain the supplier’s offers.

The Authority’s analytical approach in its market performance review would inadvertently expose suppliers who have invested in storage (either hydro storage or battery storage) to opportunistic behaviour. This opportunistic behaviour would manifest through an expectation of artificially low prices upstream of a transmission constraint – prices would be expected to be artificially low in the sense of ignoring the role and impact of storage in providing arbitrage between otherwise low and high price periods.

The application of HSOTC rule should protect participants from both artificially high *and* artificially low prices.

In the following section we review our proposed safe harbour provision in the HSOTC rule in light of comments received on our main report.

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<sup>38</sup> See the discussion of adjustments to inventory and prices in <https://eh.net/encyclopedia/the-law-of-one-price/>, accessed 2 April 2018.

## 3. Adjacent trading periods and related issues

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### 3.1 The problem identified originally

In July 2012, the Authority asked WAG to consider issues associated with pivotal supplier situations. The Authority describes a supplier as being pivotal when it must offer at least some of its capacity if demand in a given area is to be met. The Authority described pivotal supplier situations as periods where the competitive forces in the wholesale market are temporarily reduced, generally due to a short-term transmission constraint.<sup>39</sup>

The Authority was concerned that, in situations where demand cannot be met without the services of a specific generator (the pivotal supplier), the generator could set the price in the constrained region of the market and may have an incentive to set it to a high level.<sup>40</sup> Such prices might be viewed as artificial, in the sense of a price that does not reflect the forces of genuine supply and demand in an open, informed and efficient market. Prices set artificially high could:

- reduce confidence in the price discovery process as prices in the pivotal period would be imposed by a single entity, not discovered through market exchanges
- wrongly incentivise new investment in generation or transmission or in demand reduction (as the price results from the exercise of market power rather than underlying excess of demand relative to supply)
- impede entry and competition in the retail markets by increasing price risk.

Analysis undertaken by the Authority suggested that pivotal supplier situations were relatively rare, but did arise from time-to-time in the New Zealand wholesale market. The Authority was concerned about situations where generators in that position had both the incentive and the means to exploit short-term market power. The Authority was concerned that such behaviour could inefficiently discourage retail competition and business investment in the general economy.<sup>41</sup>

In asking the WAG to consider the issue, the Authority sought to<sup>42</sup>

*improve confidence in the efficiency of prices when competitive pressures in the wholesale market are weak, thereby contributing to the Authority's statutory objective by improving wholesale and retail market competition.*

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<sup>39</sup> Electricity Authority, (18 February 2014) *Improving the efficiency of prices in pivotal supplier situations*, Consultation Paper, page C.

<sup>40</sup> *ibid*

<sup>41</sup> Electricity Authority, (18 February 2014) *Improving the efficiency of prices in pivotal supplier situations*, Consultation Paper, page C.

<sup>42</sup> Correspondence – letter to WAG Chair, (22 June 2012), WAG work plan: <http://www.ea.govt.nz/our-work/advisory-working-groups/wag/5Jul12/>

## 3.2 The current situation

What has become apparent since the rule was introduced and has been tested is that there are situations where a generator may be pivotal continuously for several days or more leading up to the point where their behaviour may be viewed through the HSOTC rule. For example, the market performance review entitled reported:<sup>43</sup>

*Meridian said the safe harbours are not well framed to deal with Meridian's circumstances, where it is pivotal in the South Island for a large proportion of the time but needs to take market actions in the context of its overall New Zealand market position.*

Further, a question following the presentation of our paper at the Energy Traders Forum focused on our proposed test of comparing the pivotal supplier's price offer pairs with its offers in "adjacent trading periods". It is in this context that we revisit the wording of our proposed new safe harbour provision.

The HSOTC rule is concerned with short term opportunistic behaviour. We say the rule has to be able to accommodate the distinction between opportunistic exploitation of short-term market power at times when the generator is pivotal and behaviour that facilitates the offer of full potential capacity while reflecting the circumstances underlying the offers.

We made a switch from a comparison with "previous period or when not pivotal" in the current rule to "adjacent periods" combined with our reference to non-pivotal generator offers. The issue here is that a pivotal generator should be reasonably able to formulate offers taking into account the circumstances that prevail at the time or reasonably make offer changes that reflect changes in circumstances. Armed with the perspectives we have now we have revisited three aspects of our proposed rule.

### 3.2.1 Pricing for other last resort generation in the market

Earlier we raised the potential for 'missing money' in the current wholesale market design. This is the concept where some means of generating electricity needs to be available to meet short-term peaks in demand (or shortages in the usual means of supply) and the price paid for that short period of operating must be sufficient to compensate the owner for keeping the means of generation available, otherwise it will not be kept available and the reliability with which demand can be met would be threatened.<sup>44</sup> In a market where generation is not compensated for providing a last resort service there is said to be a missing money problem.

We noted that the rule proposed originally by WAG explicitly accounted for the prudent and established market practice for dispatching hydro generation. Prudent hydro operators plan ahead their use of water through the daily cycles hoping to optimise reservoir levels and expected prices whether they are pivotal or not. Typically, having planned the optimal and most likely dispatch of its plant, the operator has the ability to bring generation forward at short notice for reliability purpose; that is, if the balance between supply and demand

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<sup>43</sup> Electricity Authority, *High prices on 2 June 2016, market performance review*, Roger Miller, Doug Watt, 18 December 2017.

<sup>44</sup> See for example, Michael Hogan, (2017) *Follow the missing money: ensuring reliability at least cost to consumers in the transition to a low-carbon power system*, *The Electricity Journal* 30 92017) 55 – 61.

tightens. The practice for hydro operators in New Zealand is to offer their full capability but to price water they are reluctant to use in the current period well above clearing prices. That high priced tranche of generation capability equates to last resort generation at that point in time. This practice, of identifying the full capability of the system in the offer stack, is desirable and consistent with the objective of having an informed market and hence an efficient, secure and reliable system.

We set out to recognise the reality that in some areas of the New Zealand market, a specific hydro generator may be pivotal and that the value of the highest tranches of their offer is analogous to the value of other last resort generation. We proposed that the test should require that the generator's price and quantity pairs for that generation are not substantially different from the offers of other last resort generators made during periods those generators are not pivotal. We proposed that this form a second limb of our revised third safe harbour provision.

Specifying the safe harbour offer price by reference to the offers in the market when those generators are not pivotal, means the offer price would reflect the market's view of the opportunity cost of last resort generation which is available to suppliers ex ante when preparing offers and to the Authority in any ex post review.

This approach is similar in concept to that adopted in electricity markets governed by the United States Federal Energy Regulatory Commission (FERC). The ISO-NE, PJM, MISO, NYISO and CAISO all implement a form of pivotal test. Offers by a supplier or suppliers (CAISO and PJM, for example, operate a 3 pivotal supplier test) in a pivotal situation are assessed against a "reference price" for that supplier and the original offer amended to the reference price if it exceeds the reference price by a set margin. The ISO-NE, MISO, and NYISO have a preferred option of calculating the reference price from the offers of the supplier over a period of time when market conditions are competitive. PJM and CAISO have a cost based calculated, adjusted for "opportunity costs" such as fuel or permit restrictions.<sup>45</sup>

In the New Zealand context, as the reference price would define a safe harbour, and opportunity cost is difficult and contentious in a hydro based system (and a strength of the market is the difference in views as to the opportunity cost at any point in time) a simple system of setting the reference price from offers of other last resort generators made during periods those other last resort generators are not pivotal would seem to strike the balance of protecting consumers and allowing the market to operate efficiently.

We argued that this provision would advance the Authority's statutory objective because:

- it provides for suppliers of last resort to be compensated for making generation available, as long as the prices offered do not exceed those offered in periods in which the supplier is constrained by the competitive conditions in the market – a supplier cannot alter its offer simply because it is pivotal without being able to justify that its offer remains consistent with a HSOTC

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<sup>45</sup> For an explanation of the calculation of the reference prices in the US markets see Federal Regulatory Energy Commission, Price Formation in Wholesale Electricity Markets: Staff Analysis of Energy Offer Mitigation in RTO and ISO Markets, October 2014, Appendix A1 – A 16.

- neither the Authority nor suppliers need to second guess as to what prices might be efficient, when supply is constrained relative to demand
- all participants in the market (purchasers and suppliers) can have confidence that the prices that might prevail in pivotal periods would be no higher than prices in periods when suppliers are not pivotal (except where higher prices can be justified on investigation as being consistent with the HSOTC rule)
- suppliers have a clear rule, ex ante, as to what offers are acceptable during periods they become pivotal.

Accordingly we retain this proposed aspect of our safe harbour test.

### 3.2.2 Early gate closure for pivotal

We had suggested that price and quantity pairs in offers should not be substantially different between adjacent trading periods. We have revised our approach to take into account the tension created by the potential for a generator to be continuously pivotal from the time they submitted their original offer through to the period under examination. We still want to strike a balance between a generator being able to modify its offer in response to changes in circumstances and participants having the ability to respond to the price signal.

The New Zealand Electricity market design is based on full nodal pricing. That is, individual half hourly prices at each (of some 250 nodes) account for losses and constraints arising from congestion and that there are no price caps below the value of unserved energy. Full nodal pricing is intended to provide appropriate signals for participants' operational decisions. As the market has operated with full nodal pricing since its inception in 1996 we expect that participants are well used to detecting prices that reflect constraints and have organised themselves to respond to them or manage the risks such as a binding constraint that may emerge.

Generators make their substantive offers the day before each trading day with their furthest out offers being for trading periods 36 hours ahead. During each daily cycle purchasers and generators assess the forecast volumes and prices and adjust their own offers and potential demand responses accordingly. As each trading period draws near the moment arrives when the traders no longer wish to change their offers. To reflect the well documented concerns around pivotal generators' offers it is reasonable to insist that pivotal generators should have already stabilised their offers prior to the point that non-pivotal generators settle their offers but for any late bona fide changes required. We refer to this as allowing sufficient time for the market to respond rather than quantifying a number of trading periods for an extended gate closure because what is reasonable will be situation specific.

Accordingly we propose that where price outcomes may be the result of offers from pivotal generators the safe harbour assessment should be whether there is sufficient time between the pivotal generator settling their final price and volume pairs in their last substantive offer change and market gate closure for all participants to reasonably respond to those offers in the spot market.

We now change the first limb of our safe harbour rule as follows. A gross pivotal supplier would be deemed to be compliant with the HSOTC rule where:

*its price and quantity pairs in offers are not substantially changed when there is insufficient time for a market response ~~different between the adjacent trading periods,~~*

### 3.2.3 Continuously pivotal for multiple days

We are now more aware of the concern that a supplier may be pivotal and, as a result, in a position to inflate its offers continuously across multiple days. If this is the case the issue concerns the competitive pressure in the market more broadly, rather than the standard of trading conduct in any particular period. The HSOTC rule in the code is not the place to deal with this concern.

If the Authority has a concern where a supplier is pivotal for an extended period (and its work has not found a concern) then this is a matter for market design. It is not the Authority's role to consider an intervention that would aim to control prices over multiple days. Such a regulatory action would fall within the scope of the Commerce Act Part 4:<sup>46</sup>

*This Part provides for the regulation of the price and quality of goods or services in markets where there is little or no competition and little or no likelihood of a substantial increase in competition.*

We are not aware of any work that suggests continuous days of pivotal supplier warrant applying the Commerce Act or that such an approach would be beneficial in the wholesale market.

## 3.3 An updated proposed HSOTC rule

We have revised our proposed safe harbour rule whereby a gross pivotal supplier would be deemed to be compliant with the HSOTC rule where:

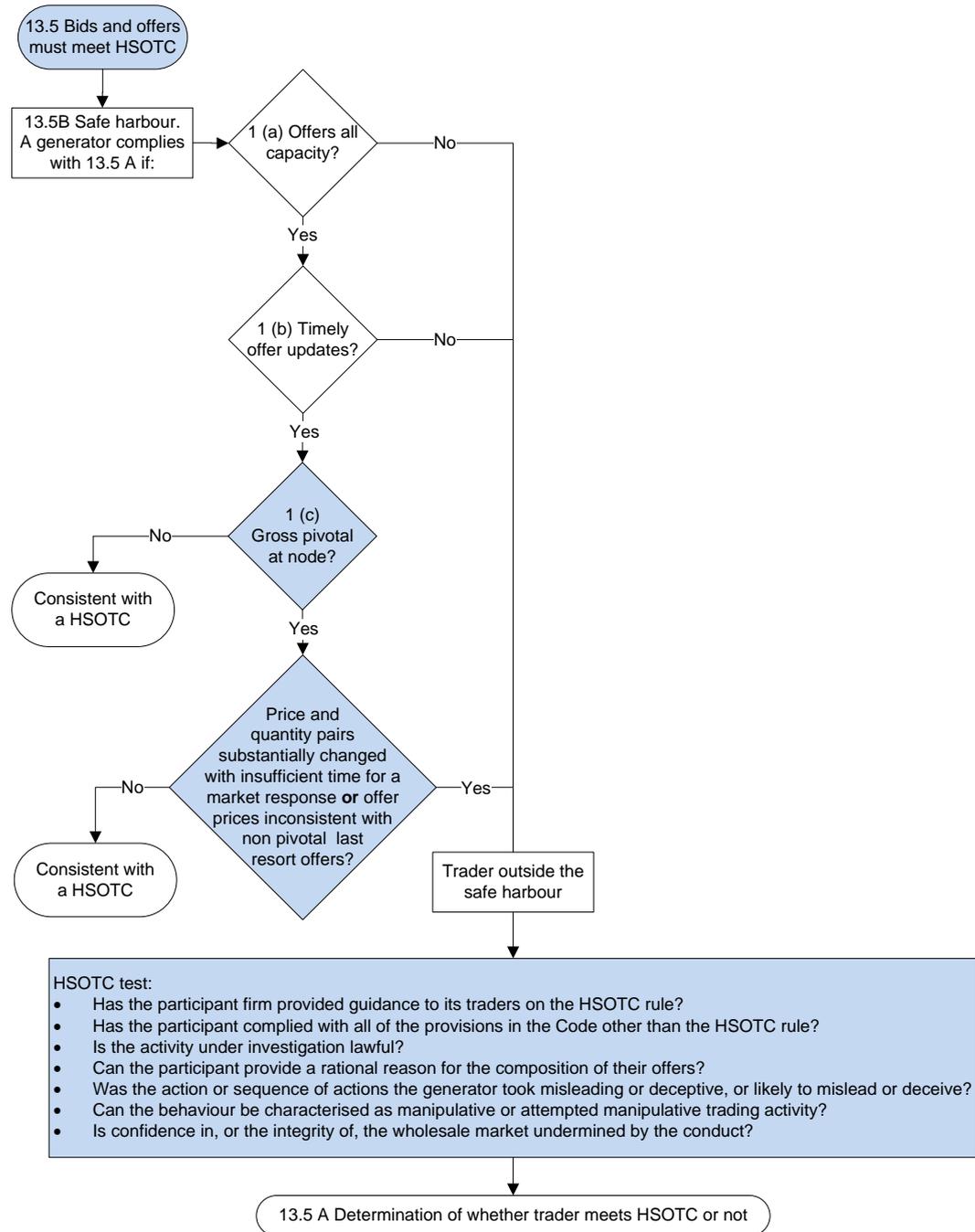
*its price and quantity pairs in offers are not substantially changed when there is insufficient time for a market response, and*

*its offer price is not substantially different from the offers of other last resort generation made during periods those generators are not pivotal*

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<sup>46</sup> Commerce Act 1986 part 4 s 52

Figure 4 Schematic for a revised HSOTC proposal



## Appendix 1: A clearer rule

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The rule drafted below is based on the combined safe harbour and HSOTC components we propose in our paper. This is not intended to be the finished article and would at the least need to be subjected to a careful legal review if our proposed changes were adopted.

### **13.5A Conduct in relation to generators' offers and ancillary service agents' reserve offers**

- (1) Each generator and ancillary service agent must ensure that its conduct in relation to offers and reserve offers is consistent with a high standard of trading conduct.
- (2) Subclause (1) applies when—
  - (a) a generator submits or revises an offer; or
  - (b) an ancillary service agent submits or revises a reserve offer.
- (3) A generator's or ancillary service agent's conduct in relation to offers and reserve offers is consistent with a high standard of trading conduct if:
  - (a) the generator or ancillary service agent has provided guidance to its traders on the need to ensure offers and reserve offers are consistent with a high standard of conduct;
  - (b) the generator or ancillary service agent's conduct is compliant with all provisions in the Code other than clause 13.5A;
  - (c) the generator or ancillary service agent's conduct is otherwise lawful;
  - (d) the generator or ancillary service agent can provide a rational reason for its offers;
  - (e) the generator or ancillary service agent's conduct is not misleading or deceptive, or likely to mislead or deceive;
  - (f) the generator or ancillary service agent's conduct is not manipulative or attempted manipulative trading activity; and
  - (g) the generator or ancillary service agent's conduct does not threaten confidence in, or the integrity of, the wholesale market.

### **13.5B Safe harbours for clause 13.5A**

- (1) A generator complies with clause 13.5A if—
  - (a) the generator makes offers in respect of all of its generating capacity that is able to operate in a trading period; and
  - (b) when the generator decides to submit or revise an offer, it does so as soon as it can; and
  - (c) in the case of a generator that is pivotal,—
    - (i) the generator's price and quantity pairs in offers are not substantially changed when there is insufficient time for a market response prior to gate closure; and
    - (ii) its offer prices are not substantially different from the offers of other generators made during periods those other generators are not pivotal.
- (2) A generator does not breach clause 13.5A only because the generator does not comply with subclause (1).

*[13.5B(3) and (4) which duplicate the above for ancillary service agents are omitted here].*