

MARKET MONITORING REVIEW OF STRUCTURE, CONDUCT AND PERFORMANCE IN THE WHOLESALE ELECTRICITY MARKET

SINCE THE POHOKURA
OUTAGE IN 2018

Prices have been high since the Pohokura outage in 2018

The Electricity Authority (Authority) is reviewing whether electricity spot prices were determined in a competitive environment for the period from January 2019 up to and including the first two quarters of 2021 (this review).

The Authority decided to undertake this review in response to the sustained high spot prices since the Pohokura gas field outage. Prices rose in response to the Pohokura outage and have been, on average, above \$100/MWh since then. The average spot price for 2019 was \$127/MWh. This is the highest yearly average since 2008, when there was a severe hydro shortage during the winter. For comparison, the average spot price from 2009 to the Pohokura outage in 2018 was \$67/MWh.

Prices over the review period have, at least to some extent, reflected underlying supply and demand conditions, which is a sign of a competitive market. Over the review period, demand has been higher; hydro inflows and storage have been low; there have been a number of gas production outages; and all fuel costs — including the value of stored water and the cost associated with carbon dioxide emissions — have been rising. These have all affected electricity spot prices.

However, some of the price increases since the Pohokura outage appear to be unexplained by these underlying conditions. For example, prices tend to increase as the duration of low storage increases. However, in 2019 there was low storage for only about 4 percent of the year but an average yearly price of above \$100/MWh (see Figure 4 in the main review paper). This could be because, given the data available to the Authority, it is difficult to account perfectly for all underlying conditions, or it could be because prices are not being determined in a competitive environment.

This review looks at factors that may indicate whether spot prices over the review period (January 2019 – June 2021) were determined in a competitive environment. Spot prices that are competitively determined are efficient and to the long-term benefit of consumers.

There is some evidence that suggests prices may not be being determined in a competitive environment

We have looked at many different indicators. None in isolation provide concrete evidence to establish whether spot prices are being determined in a competitive environment. However, taken as a complete picture, there appears to be some evidence that spot prices may not have been determined in a competitive environment over the review period. Our observations are as follows.

- The market is dominated by a few large firms, with Meridian needed to meet demand over 90 percent of the time.
- Offer prices have increased since the Pohokura outage, and there is often a large proportion of offers above cost (regardless of the cost estimate used) for some generators. However, these observations could be consistent with gas supply uncertainty.¹
- Some offers do not reflect underlying conditions.

¹ In this paper we refer to gas supply risk and gas supply uncertainty. This is a reference to the fact that there has been supply disruption from some fields and, while we understand initiatives are underway to improve production from those fields, some residual uncertainty remains in the market about potential output from those fields.

- Steeper supply curves in recent years suggest an increased incentive and ability to economically withhold.
- Differences in price between the North and South Island have been subdued over the review period when storage has been high. This suggests some generators may have been economically withholding so the price they pay to cover their retail books in one island is not much higher than the price they receive for their generation in the other.
- The Lerner Index (the mark-up of price over cost) is sometimes high, so these offers above cost appear to be resulting in prices above costs, although this result is sensitive to the cost estimate used.
- Previous instances have occurred where the Authority was concerned about economic withholding. These are discussed in section 5 of the main review paper.
- The contracts made between Meridian and Contact and NZAS in January 2021 (the Tiwai contracts) caused a sharp increase in the forward price. Based on that increase, spot market purchasers could be expected to pay between \$1.6 billion and \$2.6 billion more over the 3 years 2021-2023.
- The price in the Tiwai contracts (which is between \$30/MWh and \$40/MWh)² does not provide assurance that the electricity is going to the highest value use.³
- The estimate of the scale of the potential inefficiency of the Tiwai contracts is significant and raises concerns that the institutional arrangements are creating incentives for this.

Approach to this review

As noted above, the purpose of this review is to assess whether prices over the review period were determined in a competitive environment.

If spot prices are determined in a competitive environment, prices will reflect underlying supply and demand conditions. A detailed analysis of supply and demand conditions for recent years is set out in section 4 of the main review paper. We also investigated through statistical analysis whether prices have reflected underlying supply and demand conditions. We found that some of the increase in the spot price in the review period reflects these underlying conditions, which include fuel supply uncertainty and increased fuel costs. However, there has also been a sustained upwards shift in the spot price since the Pohokura outage that is not necessarily explained by the underlying conditions we have been able to control for in our analysis. The question is: is some of this sustained upwards shift in prices the outcome of a non-competitive environment?

We use the structure, conduct and performance approach to assess competition in the spot market. This approach reflects that the structure of the market influences the conduct of its participants, and that this conduct in turn drives performance. Broadly, the more competitive the structure, the more competitive the conduct of participants, leading to more efficient performance.⁴

² The effective price is even lower because of the rebate for the reduced term at the previous contract price.

³ The user with the highest willingness to pay is used as a proxy for the highest value use.

⁴ Electricity Authority, "What we monitor in the industry and market" <https://www.ea.govt.nz/monitoring/market-performance-and-analysis/what-we-monitor-in-the-industry-and-market/>

Market structure can be analysed using several factors, such as the number of competitors in an industry, barriers to entry, and the level of vertical integration.⁵

Conduct refers to specific actions taken by firms. Measures of market conduct include analysis of offers and the relationships between offers, prices and cost. Analysis of these measures (amongst others) can indicate whether market power is being exercised.

Market power refers to the ability of a firm (or group of firms) to raise and maintain prices above the level that would prevail under competition. In this review, we are concerned with the sustained exercise of market power. This review is not concerned with the occasional exercise of market power, although the Authority may allege a breach under the new trading conduct rules, if it considers such an exercise of market power has occurred.⁶

If firms that have market power exercise it in a sustained way, this can mean spot prices are not being determined in a competitive environment. While it is difficult to determine definitively whether market power has been exercised, we can examine a set of indicators to establish if sustained market power has or is being exercised. We do not expect any of these indicators in isolation to unequivocally show market power has been exercised. Rather, we are looking at all the indicators in the round so we can build a picture of the way the market is operating.

The performance of a competitive market is ultimately one that satisfies the conditions of allocative, production and dynamic efficiency. Given our focus on long-term benefits to consumers, we assess pricing trends, because this is a key determinant in influencing investment within the sector (ie, dynamic efficiency). Because current spot prices reflect past decisions, we also look at whether forward prices reliably reflect expectations of future spot prices and signal an appropriate investment and innovation mix.

Structure: New Zealand's largest generator is needed to meet demand over 90 percent of the time

The structure of the market will influence the level of competition to keep prices down. If the structure of the market allows the potential to exercise market power, or there are structural barriers to entry, competition may be reduced.

Meridian's generating capacity is significantly greater than the other three main generators: close to one-third of New Zealand's total generating capacity. But its importance within the electricity market is larger than its size suggests. Our analysis showed that Meridian's South Island generation has been gross pivotal across the New Zealand market for over 90 percent of the time since 2019.⁷

The New Zealand electricity market is substantially vertically integrated. This is relevant to our analysis if the degree of vertical integration is delaying or creating a barrier to investment, potentially reducing competition in the wholesale market. This can occur if costs for new entrants are increased by low liquidity in the forward market and low demand for power purchase agreements (PPAs) that can support new-entrant generation. Vertically integrated firms have a natural hedge – their retail book - that independent generators do not. This means independent generators need to hedge through other means, or get long-term offtake PPAs. Analysis from Concept Consulting Group (Concept) suggests there may be some signs that independent generators may now more easily be able to do this, with more PPAs being offered. We note also that Trustpower intends to sell its residential retail business to focus on new generation and related opportunities. However, over three-quarters of committed generation

⁵ Vertical integration is where a firm owns both retail and generation businesses.

⁶ Electricity Authority, "Trading conduct" <https://www.ea.govt.nz/operations/wholesale/trading-conduct/>

⁷ A firm is gross pivotal if its generation capacity is needed to meet demand – even at extremely high prices.

investment projects and projects that are likely to be committed soon are owned by generator-retailers.

There has been a concern in some sectors that vertically integrated companies could create a barrier to competition in retail by subsidising returns in their retail businesses, placing a margin squeeze on all retailers, while the subsidiary retailer is supported by the generation business. These issues have been addressed in the Electricity Price Review.⁸ This present review does not cover competition in the retail market. But the Authority has recently decided to mandate the disclosure of internal transfer prices by large generator/retailers, and retail gross margin by some retailers, with the aim of increasing transparency.

Conduct: Offer prices at times appear unrelated to supply and demand conditions

We looked at the conduct of industry participants to see if there is any indication of the exercise of market power. Generators interact with the spot market through their offers. Offers are quantity and price pairs.⁹ Therefore, we look at the quantity of offers that are priced in a way that makes dispatch unlikely. If this quantity is unrelated to underlying conditions this could indicate economic withholding. We also look at offer prices at the margin and compare these with costs.

Costs for generators are difficult to estimate

In a competitive market, prices should reflect economic costs. However, estimating economic costs for electricity generators is not straightforward and is sensitive to assumptions. The estimates may also not accurately reflect the true cost associated with gas supply uncertainty caused by the Pohokura disruption. We therefore use a range of cost estimates, but all results using cost estimates must be treated with some caution.

For hydro plant, we used water values obtained from the generators and the DOASA model as a proxy for cost.¹⁰ For thermal plant with storage, we used a short-run marginal cost (SRMC) as a lower bound estimate of cost (because this does not include the opportunity cost of storing gas or coal). We used electricity forward prices as an estimate of the opportunity cost of stored fuel for thermal plant.

Cost is subjective for energy constrained hydro plant¹¹ with storage because water can be stored for generation in the future rather than used for generation now, and judgement about the future is necessarily subjective. DOASA values will always be different from generators' values because DOASA models total system cost rather than individual generators' expectation of future prices. However, DOASA is valuable as a consistent benchmark that the Authority uses to observe trends.

⁸ Electricity Authority "Electricity Price Review" <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-consultations-and-reviews/electricity-price/>

⁹ Generators can offer up to five price bands (called tranches).

¹⁰ Both of which are sensitive to assumptions. DOASA is a model of system wide scheduling. Note that Meridian provided us with minimum sell values (alongside modelled generation guidance), which Meridian advised are not a measure of cost. When we refer to water values provided by generators we are referring to these minimum sell values for Meridian.

¹¹ This means that for any given year, hydro inflows are fixed and energy cannot be added into the system beyond these inflows. This is in contrast to the coal units at Huntly that can import energy.

The Lerner Index indicates some pricing of offers above cost at the margin, but is sensitive to the cost estimate used

The Lerner Index measures the mark up over a firm's marginal cost. It compares marginal offers to marginal costs. In a competitive market, when a generator is setting the price, the price will reflect its costs, so the Lerner Index will be near zero. If a marginal generator is raising its offer prices above cost, the Lerner Index will be greater than zero.

Contact had a high Lerner Index for its thermal plants at Stratford in times of low storage during the review period. However, this could be due to the way peaking plants are managed – they may offer some capacity at higher prices (rather than not offering at all) when they are unable to run for sustained periods of time.¹²

Both Mercury (for its Waikato hydro plants) and Meridian (for its Waitaki hydro plants) had high Lerner indices in the review period using DOASA water values (even in times of high storage), but their Lerner indices were lower if we use the water values they provided.

There is some evidence of economic withholding, but different indicators provide conflicting evidence

The Lerner Index does not incorporate the entire impact of the exercise of market power, because a generator can withhold quantity and influence the price even when it is not marginal. We therefore also looked at the proportion of higher priced offers in relation to the spot price, a high offer price threshold, and to estimated costs. If significant quantities of a generator's capacity are offered at a high price, above the spot price and cost, this can be an indicator of economic withholding (offering some quantity at higher prices with the intention that it not be dispatched, to reduce supply and increase the spot price), which is an exercise of market power.

High offer prices for some quantity of a generators' capacity can also be an appropriate response to surrounding demand and supply conditions, operating constraints and resource consent obligations, so it can be hard to tell if higher priced offers are being used for these reasons or to economically withhold. But if these offers appear unrelated to underlying conditions this could indicate that the generator is using these offers to influence the price.

The percent of offers at higher prices (measured by offers over \$300/MWh) has been increasing for all generators since 2017.¹³ The increases in the percent of high priced offers from Contact (for its Clutha stations) and Mercury (for its Waikato stations) appear to broadly reflect storage, although Contact's high offers for its Clutha stations did not come down as much when storage increased as they had done in the past. Meridian's percentage of high offers for its stations on the Waitaki has been increasing overall since 2015. High priced offers from peaking plants, such as Stratford, are to be expected in times of low hydro storage (consistent with our observations of their Lerner Index).

Analysis of water values shows that, for both Mercury and Meridian, estimated cost reflects storage, but this is not necessarily reflected in their offers. Meridian and Mercury both seem to have a high percent of high-priced offers in periods of high storage compared with Genesis and Contact, whose offers appear to better reflect storage.

¹² Peaking plants are those kept in reserve for times of high demand

¹³ We use \$300/MWh because it is a reasonably high price (price is only above this around 1.6 percent of the time historically) but is low enough to show the change in offer behaviour by some of the large generators more recently (ie, decreasing the offer price in the top tranche).

For thermal, as far as we can tell, the percent of offers above estimated cost reflect underlying conditions. The peaking plants have a higher percent of offers above cost as discussed above.

We also compared hydro offers to gas SRMCs, because hydro generators, to manage hydro storage, can be expected to follow thermal generator offers in the market. We observed that between 20 percent and 40 percent of Contact (Clutha), Meridian (Waitaki) and Mercury (Waikato) offers have been higher than gas SRMC since 2017. Genesis (Tekapo), as a price taker, follows hydro storage more closely.¹⁴

To see if economic withholding may have been affecting prices, we ran simulations in the vectorised scheduling pricing and dispatch model (vSPD) where demand was decreased by 2 percent in the South Island (because a decrease in demand is the same as an increase in supply at lower prices in the short term). The simulation showed the average price decrease was greater in the review period than in 2016–2018 (excluding the Pohokura outage in 2018) in both \$/MWh and as a percent change. This might suggest economic withholding has been increasing, or it could be reflecting other conditions. At the least, it may show that there has been an increased incentive to economically withhold in recent years.

Subdued price separation between the North Island and South Island could also indicate economic withholding. Firms with significant generation in one island and significant retail in the other might not want too much price differential between the two islands. They could economically withhold to subdue such price separation. Analysis of the ratio of the Haywards to Benmore price from 2014–2018 showed higher price separation when South Island storage was higher, and vice versa. This is what we would expect to see. However, over the review period, price separation in times of higher South Island storage has been subdued.

In high-priced trading periods, we observed that changes to offers in pre-dispatch were consistent with underlying supply and demand conditions, but some generators still had a high proportion of offers above final price. In trading periods where we may have expected some systematic behaviour to influence prices, we again observed changes to offers in pre-dispatch were consistent with underlying supply and demand conditions. Final offers in these trading periods also did not show any increased evidence of economic withholding compared with other trading periods.

Overall, while there can be good reasons for higher offer prices for short periods of time (eg, to store water pending a planned outage), interpretation of the data indicates that economic withholding may have been taking place over the review period.

There has also been conduct by some generators in the past where the Authority was concerned that economic withholding was taking place. These are discussed in section 5 of the main review paper.

New Zealand Aluminium Smelters is potentially paying below the opportunity cost for energy, and its presence increases energy costs for the rest of the country

Generators and their customers can enter into contracts at agreed prices to 'hedge' the risk of volatile prices in the spot market. These contracts for difference (CFDs) are derivatives of the spot market, not contracts for physical supply. They can be agreed bilaterally over-the-counter (OTC) or exchange traded on the Australian Stock Exchange (ASX). OTC contracts provide a

¹⁴ We used the maximum gas short-run marginal cost (SRMC) for Huntly. See Appendix B in the main review paper for a description of how the SRMCs for thermal generators were calculated.

higher degree of flexibility beyond just price (e.g. different nodes, time periods), while ASX contracts have less counterparty risk. However, OTC contracts mean there is:

- less pricing transparency
- the potential for price discrimination.

On 14 January 2021, a new contract was announced relating to the electricity supply for the NZAS smelter at Tiwai Point. While the smelter buys its electricity from the grid at the market price, the new contract it entered into with Meridian is a CFD, which means Meridian pays NZAS the difference between the market price paid and the lower price agreed between NZAS and Meridian, effectively lowering the price the smelter pays for its power. Contact has supported Meridian in this with a supporting CFD between Contact and Meridian, where Contact meets the cost of this for 100 MW of the power supplied to the smelter. In the main review paper we refer to these two CFDs as “the Tiwai contracts”.

The smelter consumes about 13 percent of New Zealand’s electricity demand, so these contracts affect the wholesale electricity market. If the smelter had exited, that electricity would have been available to the rest of New Zealand and the increased supply would have reduced prices. The effect on spot prices for the rest of the country would have been the same no matter what the smelter paid for its power, as long as it was there using that electricity. However, NZAS is paying a significantly lower price than the rest of New Zealand and this low price raises the possibility that electricity is being allocated inefficiently. This leads to a potential efficiency cost in the New Zealand economy that has been estimated at between \$57 million and \$117 million per year.

Meridian’s internal documentation suggests that, in negotiating with NZAS, Meridian was looking to keep the spot price from falling. Meridian’s scale means it profits more from the higher prices of electricity sold into the grid than it loses on the electricity sold to NZAS at the lower price. In this context, scale is not referring to the fact that Meridian is a vertically integrated generator–retailer, it is referring to its large generation capacity and concentration of generation in the South Island. That is to say, these issues arise from the scale of generation (particularly in the South Island), not because of vertical integration.

As noted, Contact is also a participant in the Tiwai contracts through a back-to-back arrangement to sell a 100 MW CFD to Meridian at a similar price.

The potential effect of the Tiwai contracts on the New Zealand forward market is shown in Figure 34 in the main review paper. The figure shows a timeline of Tiwai announcements and the impact of the arrangements on prices in the forward market, which indicates the potential impact on spot prices over the next 2–3 years.

There were two announcements that triggered rises in the spot price: August 2020 (‘might stay’) and 24 January 2021 (‘will stay’). The expected spot market impact is shown below.

Table 1: Expected spot market impact 2021/22/23

Scenario		Spot market difference (billion)
Day before and day after announcement(s)	Both announcements	\$2.589
	August only	\$1.467
	January only	\$1.121
	July price fall	-\$2.155

Scenario		Spot market difference (billion)
Day before and day of announcement(s)	Both announcements	\$1.567
	August only	\$0.610
	January only	\$0.956
	July price fall	-\$2.248

The result of the Tiwai contracts has meant spot market costs to purchasers are higher by between an estimated \$1.6 billion and \$2.6 billion, an increase that will translate into spot prices over the next 3 years.

This impact on prices would ultimately be borne by consumers, with an impact first on commercial and industrial consumers, because their contracts are more closely linked to spot prices than residential consumers' contracts.

Additionally, the cycle of decision-making about the smelter's continued operation could impact investment incentives because of the large effect an NZAS decision to stay or go can have on prices (see above). Uncertainty about future prices can affect the business case for any new investment, and these delays can mean the investment market is not operating as efficiently as it should. Investment in efficient and low carbon technology needs to displace legacy technology and support wider decarbonisation of the economy, so delays are not in the long-term interests of consumers.

Further, it was immediately after the announcement that the smelter would remain operational until 2024, that the two generator-retailers that are party to the Tiwai contracts announced investments. Being privy to the negotiations means they could be prepared to move with their proposed investments ahead of other investors, regardless of the outcome of the negotiations. Announcing investments may effectively impact the business case for other investment because the market has only so much room for new generation. This could affect dynamic efficiency, which is discussed further in section 5 of the main review paper.

Performance: some factors have held back investment, but this seems to be improving now

Performance is about the efficiency of the industry. For this part of the structure, conduct and performance framework, the Authority has looked at pricing trends, profitability, and investment because they are indicators of market performance and the efficiency of the industry.

Pricing trends are consistent with a sustained upwards shift in prices, and an increased incentive to economically withhold

Pricing trends are an important factor influencing investment and innovation and can reveal a lack of competition or otherwise. There should be downward pressure on prices in a competitive market. Further, in a competitive market, the marginal price should be consistent with underlying conditions.

Our regression analysis showed that **movements** in prices are consistent with underlying conditions but a sustained upwards shift has occurred in the **level** of prices since the Pohokura outage. This observation is supported by two statistical tests for structural breaks – one using a dummy variable (ie, a variable equal to zero before the Pohokura outage and equal to one after)

in a linear regression analysis while controlling for supply and demand conditions, and another using the Bai and Perron test.¹⁵ While our analysis controlled for most supply and demand conditions, given the data available to the Authority, it is difficult to account perfectly for all underlying conditions, including expectations of future gas supply uncertainty. Therefore, it is not possible to definitively conclude whether this shift is solely due to uncertainty about future gas supply from Pohokura and other fields or some of it is due to prices not being determined in a competitive environment.

We modelled a 2 percent increase in demand to assess the impact on prices. Our modelling showed an increase has occurred in the average price change from a 2 percent increase in demand. This is consistent with the tighter supply situation (and the overall upwards shift in prices), but also indicates that the incentive to economically withhold has increased.

Profitability analysis shows no big changes for the review period compared with previous years for most generator–retailers

If market power has been exercised, we would expect this to show in company earnings. The Authority asked Concept to review electricity related earnings of the largest four generator–retailers for the 2016 to 2020 financial years.

For the financial years June 2016 to June 2018, aggregate EBITDAF¹⁶ was fairly stable for the combined companies. At the individual company level, most generator–retailers had relatively modest earnings across the pre- and post-2018 periods. Meridian was the exception, with earnings increasing by 24 percent in 2019.

Factors that may have impeded investment in the past may be improving

The Authority also asked Concept to interview market participants to build a picture of the current investment environment. Concept found that forward prices have been above the cost of new electricity supply by about 50 percent, and this has been the case for longer than we would expect to see in a workably competitive market. This gap is signalling the need for investment in new generation, at least over the period of the forward curve.

As discussed above, investment in efficient and low carbon technology needs to displace legacy technology. A reasonable number of consented projects remain unbuilt, but only a small number of projects are likely to proceed to the commissioning stage. There are a variety of reasons for this thin pipeline¹⁷ of build-ready projects, including a reported need to update consents for new technology; the need for transmission connections; and some reported delays while firms await certainty around government policy. Another significant factor leading to delays is the time taken to obtain consents; solar being the exception.

Other factors that may have impeded investment in the past may be improving: vertical integration (generator–retailers only investing in new generation to match the rate of growth of their retail book) and access to revenue streams. There is some evidence of increasing use of PPAs to support new investment that could ameliorate both of these, including the recent Genesis PPAs and the recent PPAs between Contact and Oji Fibre Solutions and Pan Pac Forest Products. However, Concept found that generator–retailers may have been making investment decisions with regard to maximising returns on their existing assets.

¹⁵ See Appendix A and Appendix C of the main review paper for details.

¹⁶ Earnings before interest, tax, depreciation, amortization and fair value adjustments.

¹⁷ By “pipeline” we are referring to projects that have been signalled but not yet committed to being built.



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