NZIER
NEW ZEALAND INSTITUTE OF ECONOMIC RESEARCH

Wholesale electricity price setting

Comment on Electricity Authority market review

NZIER report to MEUG

22 December 2021

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Key points

EA not sure if generators exercised market power

The Electricity Authority (EA) review[1] of the wholesale electricity market since the Pohokura outage in 2018 is inconclusive.

> *It is not possible to definitively conclude whether all of the increase in prices is due to underlying conditions, including uncertainty about future gas supply from existing fields, or if some of the increase is due to prices not being determined in a competitive environment. ….*
>
> *However, we observed some evidence to suggest that prices may not have been determined in a competitive environment. ….*
>
> *We observed some evidence to suggest that generators have an increased incentive and ability to exercise market power and may have been doing so over the review period.*

The EA supports these findings with a detailed statistical analysis of the electricity price, generation by fuel source cand fuel prices organised using the structure conduct performance framework.

Is 'gas supply uncertainty' a plausible reason for prices to rise by $38 per MWh?

This report focuses on three questions that arise from the report:

- The emphasis on the statistical analysis of price changes establishes correlation and indicates causation but does not explain the mechanism that has made the price duration curves higher and flatter than previously. In particular, the regressions indicate the Pohokura shutdown caused a step-change in wholesale price but does not explain why the step change persisted in 2019 and 2020 despite gas and thermal generation levels returning to normal within three months
- Analysis of two key indicators of potential generator market power:
  - Generator profitability where the EA report commented on movements in generator earnings but did not clearly link this analysis to changes in wholesale prices.
  - Lack of investment in new generation capacity by new generators where the EA noted that recent levels of investment were much lower than expected given wholesale prices.
- Lack of consideration of how the expected investment in generation will affect the market power of hydro generators. Most of the proposed new generation capacity is wind followed by geothermal. The new capacity needs to replace thermal capacity which is used to 'firm' existing hydro and wind capacity as well as to meet demand growth.

[1] 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market, Since the Pohokura Outage In 2018, Information Paper, page ii

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1 Review findings vs analysis

1.1 Approach

The EA has used a structure conduct performance framework to analyse the drivers of wholesale electricity prices to assess whether the high level of prices over the 2018 to 2020 is attributable to underlying demand and supply conditions or whether there is evidence that generators have influenced wholesale market prices by withholding generation capacity.

The EA analysis considers that price movements that are not 'explained' by demand and supply conditions could be attributable to the exercise of market power by generators or other factors that are not included in the statistical models. The review does not define a positive test for the exercise of market power (a price differential from expected levels and the frequency with which it occurs). This approach leads to vagueness in the findings about when wholesale prices could be affected by economic withholding and the price differential that could be attributed to withholding.

A similar problem applies to the EA analysis of generator offers. The EA applies a two-part analysis to the competitiveness of generator offers:

- Comparison of generator offers to their estimated short-run marginal cost to assess changes in mark-up. For thermal generators the price of fuel can be established within a range and a mark-up estimated. However, the water values for hydro generators seem to vary widely partly because they include an expectation of the future value of water and because of different approaches to water storage versus use.
- Analysis of the proportion of generator offers either above the average wholesale price or above $300 per MWh (which seems to be a proxy for offers that are almost always above the market price and therefore are an indicator of offers that generators do not expect will be dispatched).

This analysis does not lead to a conclusive assessment of 'if' let alone 'when' gross-pivotal hydro generators may have withheld water to lift wholesale prices let alone an estimate of the difference between wholesale prices affected by 'withholding' and wholesale prices expected in a competitive market.

The analysis of this issue then collapses to a discussion of undesirable trading situations (UTS). These are rare events that are much more obvious events than the type of withholding that may be implied by the high-priced offers.

2 Statistical analysis of prices and gas supply uncertainty

2.1 What explains the increase in wholesale prices?

The EA analysis makes intensive use of statistical techniques to identify variables that explain price movements or indicate structural changes in pricing behaviour. The success of this approach (assuming good quality data is available) relies on identifying the key

independent variables and then understanding the inter-relationships in the business models used by market participants.

The EA has used three forms of statistical model to assess the movements in wholesale prices over 2018 to 2020:

- Dynamic regression analysis to assess whether wholesale electricity prices reflect underlying demand and supply conditions and to identify the relative importance of different factors in setting wholesale electricity prices.
- Structural break analysis of forward prices to test for step changes in forward prices.
- A regime switching model to determine what 'states' wholesale prices occupied and how likely they are to shift between the two states.

2.2 Dynamic regression analysis[2]

Dynamic regression is a form of time series analysis that looks at changes in, and the moving average of a dependent variable (daily average wholesale electricity prices) and a set of independent variables. The analysis estates the relationship as a linear equation where the dependent is equal to the sum of a set of independent variables each multiplied by a coefficient that indicates its influence on the dependent variable.

The final fitted equation is[3]:

$$yt = 67.15 - 0.06 \times adj.\ storage + 0.68 \times diff(demand) - 6.27 \times wind.\ generation + 3.1 \times gas.\ price + 38.74 \times dummy + \eta_t$$

$$\eta_t = 0.7 \times \eta_1 - 0.02 \times \eta_2 + 0.05 \times \eta_3 + 0.08 \times \eta_4 + 0.04 \times \eta_5 + \varepsilon t$$

Adjusted storage: a unit increase in adjusted daily storage causes on average a $0.06/MWh decrease in the daily adjusted spot price, holding other variables constant.

Difference of demand: a unit increase in difference of daily demand causes on average a $0.68/MWh increase in the daily adjusted spot price, holding other variables constant.

Wind generation: a one MW increase in daily wind generation causes on average a $6.27/MWh decrease in the daily adjusted spot price, holding other variables constant.

Gas price: a dollar per GJ increase in the daily gas price causes on average a $3.1/MWh increase in the daily adjusted spot price, holding other variables constant.

Dummy variable: For the period from 28 September 2018 onwards, the daily adjusted spot price is on average $38.74/MWh higher than the daily adjusted spot price before 28 September 2018, holding other variables constant.

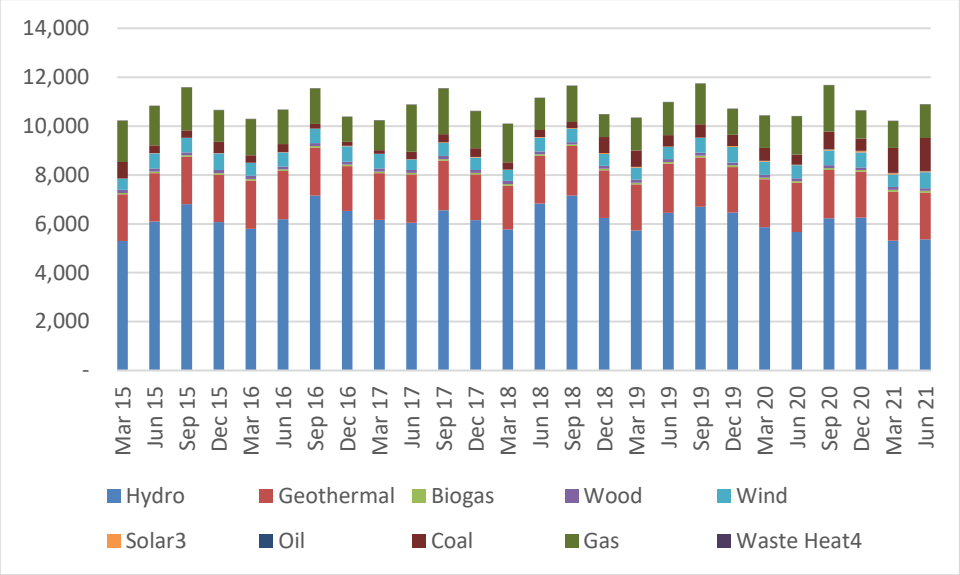
The dynamic regression estimation and comment from market participants that the Pohokura shutdown focused attention on gas supply uncertainty seem to be the main reasons advanced by the EA for uncertainty about gas supply being a major driver of the

[2] 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market, Since the Pohokura Outage In 2018, Information Paper Appendix A pages 97 to 104.

[3] 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market' page 103

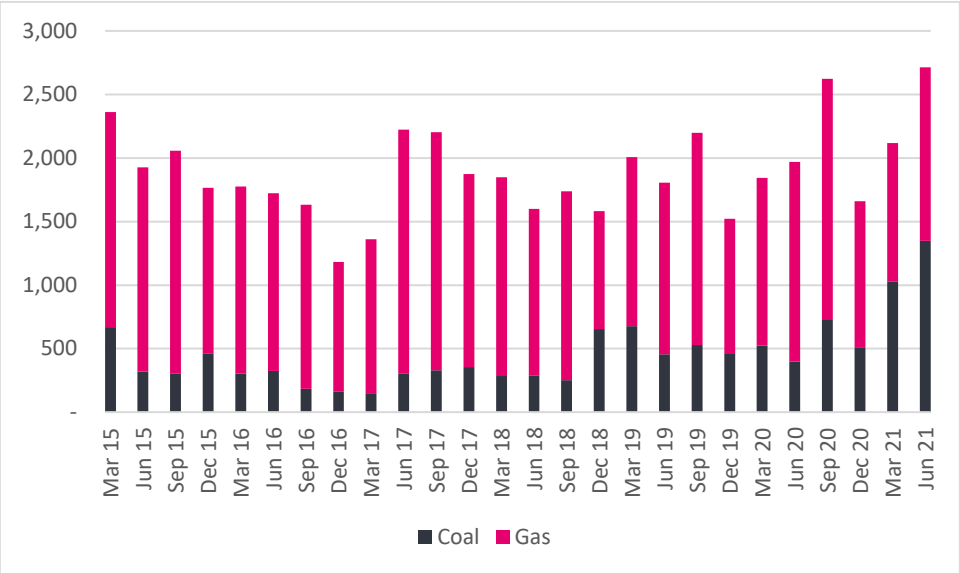
increase in wholesale electricity prices. However, the estimated impact of gas supply uncertainty of $38 per MWh on average seems to be very high when compared to both the use of gas for electricity generation over the period and the ability of thermal generators to meet electricity demand by switching to coal as shown Figure 1 and Figure 2 below. These charts are based on quarterly electricity generation and consumption[4] data published by the Ministry of Business Innovation and Employment (MBIE).

Figure 1 Electricity generation by fuel (GWh per quarter)



Source: NZIER

Figure 2 Electricity generation from coal and gas (GWh per quarter)



Source: NZIER

[4] 'Electricity graph and data. Table 1', MBIE. Available at https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/electricity-statistics/

If gas supply uncertainty has materially affected prices in the electricity market in addition to the price effect already included in the regression, then we would expect to see an increase in the volatility of the volumes of electricity generated using gas if not a reduction in the use of gas.

A review of the operational reports for Genesis Energy and Contact Energy[5] indicates the following:

- Genesis Energy has:
  - Increased thermal generation overall by increasing its use of coal while maintaining average gas-fired generation over 2019 to 2021 at about 87 percent of the average over 2016 and 2017
  - Faced a price increase in the average cost of thermal fuel that is reported at 15.8 percent over from 2016 to 2021 which is considerably lower than the increase in the average price received for electricity reported at 198.5 percent from 2016 to 2021. The thermal fuel cost reported by Genesis does not seem to include the cost of CO_2 emissions[6]. We estimate that average thermal fuel costs including emissions costs would have increased by at least 43 percent from 2016 to 2021.
- Contact Energy has roughly maintained baseload gas fired generation levels (except for a drop in 2018) but halved generation at its peaker plant after 2018.

[5] We have not been able to find equivalent published information for Todd Energy which operates gas-fired peaker plant at McKee (100 MW) Junction Road (100 MW) and gas-fired base load plant at Whareoa (68 MW).

[6] The simple daily average price of New Zealand Units (NZU) was $10.19 for the year ended 30 June 2016 and $38.61 for the year ended 30 June 2021. The current price is closer to $70 per NZU which would add about $3.77 per GJ to the cost of gas and about $6.43 per GJ to the cost of coal.

Table 1 Thermal generation and reported fuel cost

Genesis Energy and Contact Energy for year ended 30 June

Description[1]	2016	2017	2018	2019	2020	2021
Genesis Energy[2]						
Generation by fuel						
Gas (GWh)	3,240	3,082	3,392	2,583	3,122	2,546
Coal (GWh)	803	186	657	1,404	1,339	2,955
Total Thermal (GWh)	**4,043**	**3,268**	**4,049**	**3,987**	**4,461**	**5,502**
Fuel costs and prices						
Gas Burn Cost ($/GJ)[3]	*9.87*	*8.74*	8.02	$8.69	$9.00	$9.53
Coal Burn Cost ($/GJ)[3]	*6.19*	*6.19*	5.44	$6.33	$6.80	$6.21
Thermal fuel cost – no CO_2 ($/MWh)	**61.76**	**63.94**	**66.53**	**73.78**	**78.85**	**71.54**
Thermal fuel cost – with CO_2 ($/MWh)[4]	**69.08**	**76.43**	**73.79**	**85.06**	**88.44**	**98.91**
Average price received ($/MWh)	**64.07**	**60.63**	**91.59**	**139.01**	**113.88**	**191.30**
Contact Energy						
Gas-fired generation						
Taranaki Baseload (GWh)	334	1,020	1,071	1,013	871	1,126
Stratford Peaker (GWh)	506	495	528	207	291	234
Total (GWh)	**840**	**1,515**	**1,599**	**1,220**	**1,162**	**1,360**

Note:

1 Unless otherwise stated the data in this table is quoted from Genesis Energy and Contact Energy

2 Genesis Energy thermal generation is predominantly baseload.

3 Gas burn cost for 2016 and 2017 is estimated by assuming a coal cost of $6.19 per GJ. (This is the simple average of the coal cost over 2018 to 2021. However, the use of coal is so low in 2016 and 2017 that the estimated gas price is not very sensitive to the assumed coal price.)

4 Estimated assuming no free allocation of NZU over the period and simple averages of NZU prices for each year.

Source: NZIER

This high-level analysis of the change of the use in gas in electricity generation over 2016 to 2021 suggests that it would be useful to analyse generator offers during periods with high wholesale price to assess how the price and quantity of gas-fired peaker offers has changed before and after 2018 and what capacity has been offered instead.

The EA analysis seems to have taken a broader approach as described below.

2.2.1 EA analysis of offers

The EA analysis uses two measures of changes in offer behaviour:

- Percent of offers greater than short-run marginal cost
- Percent of offers greater than the average forward price

If uncertainty about gas supply was affecting thermal generator offer decisions over and above the impact of the gas price, then it would also be expected to encourage gas

generators to increase their offer prices and that the proportion of offers above the SRMC would have increased significantly during 2019 to 2021 for all gas generators. However, Table 2 below shows mixed changes in this indicator for gas-fired generators rather than an across-the-board increase after 2018.

Table 2 Percent of offers greater than SRMCs, by storage level, for thermal plants
[insert caption subheading]

Period	Storage level	McKee (Peaker)	Huntly OCGT (Baseload)	Stratford (Peaker)	Rankines (coal)	E3P	TCC (Baseload)
2014 to September 2018	Low hydro storage (less than 80% of mean)	22	23	45	26	22	14
	High hydro storage (greater than or equal to 100% of mean)	84	23	49	20	15	19
2019 to June 2021	Low hydro storage (less than 80% of mean)	46	63	74	20	13	19
	High hydro storage (greater than or equal to 100% of mean)	52	29	61	27	11	15

Source: EA[7]

Other potential analysis to test the 'gas supply uncertainty' hypothesis could have included:

- Comparison of offer behaviour during shortages with periods when supply was stable
- Analysis of offers when prices were above thermal generation SRMC to assess:
  - Whether thermal generation was running at or below the expected level and whether this was attributable to gas supply constraints or other issues.
  - How hydro generator offer curves were affected by the availability of thermal generation capacity.

2.2.2 Structural break analysis and regime switching models

The EA also included two other models to test for structural changes in price setting behaviour that are not dependent on hypotheses about generator fuel availability.

The structural break analysis[8] was applied to forward prices from 1 October 2018 to June 2021 used four approaches (level, trend, polynomial fit and auto-regressive model) which

7 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market' page 61

8 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market' pages 118 to 128.

identified between one[9] and six structural breakpoints. The EA summarised the output from the models as indicating six '*overlapping or similar'* breakpoints: mid-January 2019, May 2019, late January 2020, March 2020, August 2020 and mid-October 2020. This a more granular analysis of the change in market conditions after September 2018 than the dummy variable used in the dynamic regression analysis. It provides a starting point for further analysis of the role of gas supply uncertainty in wholesale price-setting – are the dates linked to changes in the level of gas supply uncertainty and what other factors were affecting the markets at these times.

The regime switching model was applied to average spot prices over the period 1 January 2018 to 31 December 2020 and is used to:

- Identify two states for average prices: 'low' ($64.28 per MWh) and 'high' ($140.94 per MWh).
- Estimate the proportion of prices in each state and the probability that prices will move from one state to the other.

Applying this analysis to the same period as the dynamic regression analysis (1 January 2014 to 30 June 2021) would provide a cross check on how the average prices of each state and share of prices in each stated changed after 2018 and identify the times of the day or seasons of the year in which the change was most pronounced.

3 Generator profitability and barriers to entry

3.1 Generator profitability

The EA commissioned Concept Consulting to analyse the earnings before interest, tax, depreciation, amortization and fair value adjustments (EBITDAF) of the Meridian Energy, Mercury Energy, Genesis Energy and Contact Energy[10] over the period 2016 to 2021. Concept Consulting[11] found that most gentailers (except Meridian) had modest difference in earnings for the pre and post 2018 periods. In contrast Meridian increased its earnings by '*$156m (24%) in FY2019 and a further $17m (2%) in FY2020'*. Concept Consulting conclude that:

- Some of the increase in Meridian EBITDAF could be attributed to Meridian selling its generation into higher value channels and increasing prices in some channels.
- There are some open questions about how Meridian was able to increase earnings while other non-thermal generators did not and whether the drivers of Meridian's increased earnings from derivatives are temporary or *'enduring'*.

3.1.1 How is EBITDAF linked to wholesale prices

The Concept Consulting report illustrates the difficulty of using gentailer accounts to trace how much and over what period wholesale electricity prices affect the prices charged to

[9] The analysis that produces the single breakpoint is the auto-regressive model and the breakpoint occurs at 27 August 2020.

[10] Concept Consulting also obtained data from Trustpower but excluded Trustpower from the analysis because its generation base was changing due to the demerger of its wind and solar assets in 2017.

[11] 'ANALYSIS OF GENERATOR RETAILER FINANCIAL DATA, Prepared for the Electricity Authority, 23August 2021' Concept Consulting page 1 and pages 4 to 5.

gentailer customers. Some of this difficulty is due to the differences in segment definitions and transfer price regimes used by the gentailers as noted by Concept Consulting in its report. The use of contracts for difference (CFDs) by gentailers and their consumers also complicate the analysis.

The Concept Consulting analysis does not consider how gentailer EBITDAF is linked to this question as it is outside the scope of the analysis requested by the EA. These comments are not a criticism of the Concept Consulting analysis.

However, the link between wholesale electricity prices and gentailer EBITDAF is an important part of structure conduct performance analysis. The EA and its dynamic regression model and structural break modelling both suggest there have been one or more step changes in wholesale prices since 2018. The dynamic regression suggests a step change in average wholesale prices of $38.74 per MWh (an increase more than 30 percent on average prices before September 2018. The EBITDAF analysis suggest the increase in wholesale prices has not flowed through into generator returns despite no material change in volume of electricity sold. This raises two further questions for the EA review:

- How long are the lags between a sustained increase in wholesale prices and the prices paid by customers? Table 3 below shows broad groups of customers. The sensitivity of prices charged by gentailers for each customer group to movements in wholesale prices is an important indicator of the intensity of competition in the market, but this Is missing from the wholesale price review.
- What is the expected impact on gentailer EBITDAF of the increase in wholesale prices modelled in the EA analysis? The drivers of the increase in average wholesale prices increase the generation cost and limit the generation capacity of gas fired generators but do not affect the generation costs and capacity of hydro, wind and geothermal generators and therefore should increase the EBITDAF for these generators. Table 4 below shows generation by fuel type.

Table 3 Electricity use by customer group

Electricity consumption for year ended 30 June in GWh

Customer group	2016	2017	2018	2019	2020	2021
Residential	12,440	12,506	12,466	12,552	12,914	12,924
Commercial	9,471	9,452	9,432	9,467	9,233	9,460
Agriculture, Forestry, and Fishing	2,821	2,399	2,484	2,392	2,616	2,753
Industrial	14,704	14,444	14,621	14,801	14,372	14,029
Other[1]	1,372	1,123	888	820	718	669
Total	**40,808**	**39,925**	**39,890**	**40,033**	**39,852**	**39,835**

Note:

1 Transport and other unallocated.

Source: NZIER

Table 4 Electricity generation by fuel

Electricity generation for year ended 30 June in GWh

Generation by fuel	2016	2017	2018	2019	2020	2021
Hydro	24,868	25,898	25,302	25,585	24,694	23,176
Geothermal	7,817	7,666	7,658	7,876	7,868	7,771
Wind	2,367	2,235	2,069	2,021	2,296	2,391
Other Renewable[1]	812	826	829	837	881	916
Coal	1,393	797	1,260	2,038	1,908	3,613
Gas	5,929	5,602	6,267	5,096	5,625	5,504
Other Thermal[2]	52	53	54	59	48	74
Total	**43,238**	**43,077**	**43,439**	**43,511**	**43,321**	**43,445**

Notes:

1 Biogas, wind and solar.

2 Oil and waste heat.

Source: NZIER

3.2 Barriers to entry

The EA analysis notes investment in new generation has been lower than expected despite forward prices being about 50 percent above the cost of electricity supply but does not consider what barriers to entry exist or how these may change in the near future. Uncertainty about the short-term outlook for the mismatch between demand and supply due to if and when the aluminium smelter will be closed is listed as a possible contributing factor while the time and cost of obtaining resource consents is another short-term issue.

Most of the new proposed and potential generation identified by MBIE analysis of the generation stack is wind followed by limited geothermal potential. Wind generation has high initial capital costs and carries two risks for new investors:

- Wind generators cannot control when their plant will operate and are likely to be operating and therefore tend to receive lower weighted average prices for their generation than hydro or thermal generators.
- The capital cost of wind generating equipment is expected to fall steadily over the next 10 years as technology improves which creates an incentive to defer investment for short periods.

Theoretically, a generator with a portfolio of hydro and wind assets can boost their revenue by using wind generation to conserve their water resources for generation in higher price periods intraday and to a lesser extent seasonally. A new entrant into the generation market with no access to hydro assets does not have this opportunity. The EA analysis did not investigate either this factor or the expectation that the capital cost of wind generation would fall over time as potential disincentives to investment.

4 Price impact of 100 percent renewables

The focus of the EA analysis on the effect of a combination of uncertainty about the availability of gas fired generation combined with below average hydro storage hints at the potential effect on wholesale electricity prices of moving to 100 percent renewables. Conversely, simulation of prices in a market with 100 percent renewables provides a cross-check on the drivers of the price levels that have occurred in the market since 2018.

The EA Market Development Advisory Group (MDAG) has commissioned simulations[12] of wholesale prices with no thermal generation from Concept Consulting and John Culy.

The simulations compare the simulations for the average of 86 weather years in a simulated 2020 year with 100 percent renewable generation (with and without flexible load). The key findings are:

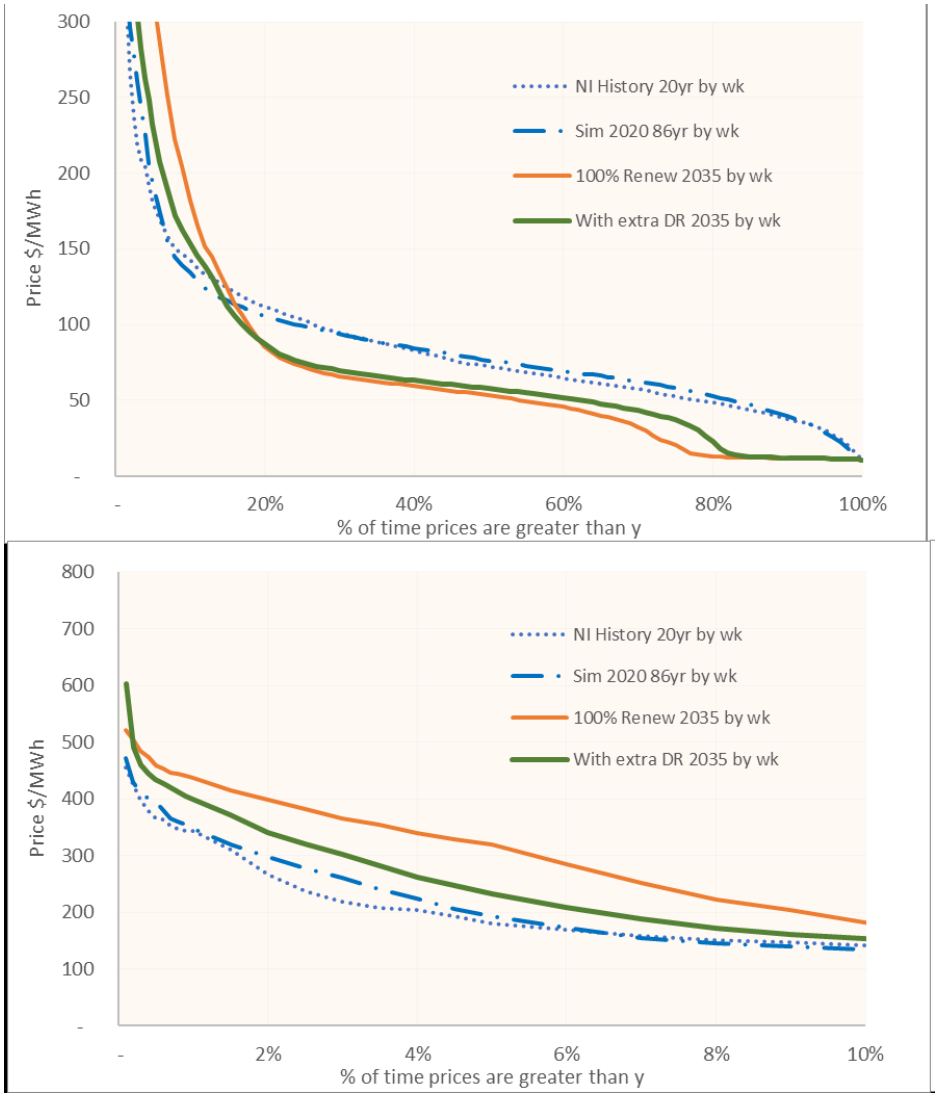
- Average wholesale prices are similar under both simulations, but volatility is higher for 100 percent renewables. (The ratio of the standard deviation to the mean in 2035 is about 40 percent higher than the 2020 simulation.)
- Price duration curves in 2035 and the 2020 simulation have a roughly similar shape and level (see Figure 3). Most of the time the prices are around the cost of new energy supply of $60 per MWh to $80 per MWh.
- The seasonal variation in prices is higher in 2035. The winter peak is higher and earlier but prices before winter are lower.
- Generator weighted average price factors for hydro increase by 36 percent and for wind decrease by about 25 percent. (The share of wind generation quadruples from 6 percent to 32 percent.)

[12] 'Price Discovery with 100% Renewable Electricity Supply, Work in progress draft version 2.1, Prepared for Market Development Advisory Group, October 2021'.

In Figure 3 below (which is copied as a picture from the presentation to MDAG) the graph of the price duration curve is split into two pieces:

- 'Bottom' which shows the 'lower' prices that that are forecast for all the trading periods other than the 10 percent of trading periods with the highest prices.
- 'Top' which shows the 'highest' prices which occur in 10 percent of the trading periods.

Figure 3 'Bottom' and 'top' of weekly price duration curve in 2035



Source: 'Price Discovery with 100% Renewable Electricity Supply', page 6

A comparison of the projections prepared for MDAG with the movements in wholesale price since 2018 (activated by a very modest limitation of thermal capacity and therefore a weak example of the price discovery under 100 percent renewables) would be helpful cross-check of the EA review of wholesale prices as well as an indication of how the structure conduct and performance of the wholesale market may change over time.

Appendix A EA feedback questions

A.1 Summary Paper - SCP review conclusions

The EA considers there is some evidence that prices are not being determined in a competitive environment – after considering a complete picture based on multiple indicators. None of the indictors reviewed by the EA provides concrete evidence in isolation that establishes if prices are being determined in competitive environment. This assessment is based on evidence of *'economic withholding (ie, offering some quantity at higher prices for the express purpose of reducing supply and increasing the spot price).'*[13]

Observations that suggest prices are not always being determined in a competitive environment include[14]:

- Some generators often have a large proportion of their offers above the cost of generation and some offers do not reflect underlying conditions.
- Differences in wholesale prices between the North and South Island have been '*subdued when storage has been high'* which suggests economic withholding by some generators to limit differences between the price paid to cover retail supply in one island and price received for generation in the other island.
- The contracts between Meridian, Contact and NZAS in January 2021:
  - Are expected to increase the cost to spot market purchasers by $1.6 to $2.6 billion over 2021 to 2023
  - Do not provide assurance that the electricity is going to the highest value use (based on an estimated price between $30 per MWh and $40 per MWh).

Structure

Meridian's South Island generation has been gross pivotal for the New Zealand market for 90 percent of the time since 2019 which gives Meridian greater market power than is suggested by its share of generation.

Vertical integration of generation and retail activities is discussed but is not described as the main driver of non-competitive pricing behaviour. The Information Paper notes that Meridian's vertical integration has increased but has fallen for other generators.

Conduct

The EA suggests that there is some evidence of economic withholding by some generators:

- The Lerner Index – mark-up over marginal cost is 'high' for Mercury (Waikato scheme) and Meridian (Waitaki scheme) using DOASA water values but estimates of cost can vary over a wide range.
- Both Mercury and Meridian seem to have a high proportion of high-priced offers in periods of high storage.

13 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market, Since the Pohokura Outage In 2018, Information Paper paragraph 5.42 page 49.

14 'Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market, Since the Pohokura Outage In 2018, Summary Paper' page 3.

- Meridian's internal documentation suggested that in its negotiations with NZAS it was attempting to prevent the spot wholesale price from falling *as 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*.[15]

However, other than the estimates of impact of the Meridian Tiwai contract, the EA does not reach a conclusion on the materiality of the economic withholding or how much it affected wholesale prices after September 2018

Performance

The EA considered pricing trends, profitability and investment as indicators of the efficiency of the industry.

- Pricing. There should be downward pressure on pricing in a competitive industry and the marginal price should reflect underlying conditions. The EA could not conclude definitively whether the upward shift in prices is solely due to uncertainty about future gas supply or if *some of it is due to prices not being determined in a competitive environment.*
- Profitability[16]. The EA compared EBITDAF for the largest four generators over the period 2016 to 2018 and 2019 to2020 and concluded they were similar (except for a jump in Meridian earnings in 2019) – suggesting market power was not exercised. Concept Consulting completed this analysis for the EA and suggested two open questions about Meridian earnings[17]:
  - *Why did Meridian's earnings lift appreciably while other companies (e.g. Mercury which also has 100% renewable generation base) record relatively flat or lower earnings post-2018?*
  - *A material portion of Meridian's earnings uplift appears to stem from higher net income recorded on derivatives it purchases from third parties. It is unclear whether this reflects temporary influences (e.g. attractive deals which will eventually expire) or some enduring factor?*
- Performance[18] The EA asked Concept to interview market participants about generation investment. Concept found that:
  - Forward prices have been about 50 percent above the cost of new electricity supply for longer than the EA would expect to see in a workably competitive market.
  - Only a small number of projects are likely to proceed to the commissioning stage due to the need to update consents for new technology; the need for transmission connections; and some reported delays while firms await certainty around government policy.
  - Other factors that may have impeded investment in the past may be improving.

15 'Summary Paper' page 8.

16 The EA papers do not refer to the EVA analysis of Meridian completed by MEUG.

17 Concept Consulting, 'Analysis of Generator Retailer Financial Data', 23August 2021, page 5.

18 Concept Consulting, 'Review of generation investment environment', August 2021.

We have provided feedback on the EA ‘Table 2: Summary of structure, conduct and performance observations’ The EA has also defined a two sets of high-level feedback questions.

Table 5 EA market structure observations

Dimension	Indicator	EA Observation	Comment
Seller concentration	Generation HHI	HHI for generation is of limited use because it is driven by storage, and storage over the review period has been low a lot of the time. This has meant that the HHI has fallen at times during the review period, but this may just be due to drier conditions. It remains around 2000, as it has done since 2014.	Agree this is of limited use as a measure of change in market power. However, concentration of generation in New Zealand is already high in comparison to other markets such as Australia and the United Kingdom.
	Gross Pivotal	Meridian has historically been gross pivotal around 77 percent of the time, but in the review period this has increased to around 90 percent to 95 percent.	The gross pivotal generator has substantial market power[1] The EA analysis of this market power only notes that is has increased but should also consider how the exercise of this market power has changed particularly with respect to discussing why price duration curves are higher and flatter than previously.
Barriers to entry	Vertical integration	While Mercury and Contact's level of vertical integration has decreased (based on our measure), Meridian's has increased. The level of vertical integration remains high in the New Zealand market. Some indication of increased use of PPAs and potential PPAs means vertical integration is less of a barrier than it might have been.	The EA analysis notes that forward prices have been above the cost of supply by 50 percent and that the total of committed generation investment is not enough to replace existing thermal generation. The EA analysis should consider whether the market power of existing generators is a barrier to entry, how the low level of planned investment and the nature of the planned generation could affect the market power of incumbent generators. Essentially thermal capacity which provided firming for wind and hydro is being replaced mainly with wind generation. This will need to be firmed by hydro further strengthening the market power of hydro generators.

Notes:

1 The regulator in the ERCOT market (Texas) applies administered price in trading periods when there are three or fewer gross-pivotal generators.

Source: NZIER

Table 6 EA market conduct observations – price cost relationship

Dimension	Indicator	EA Observation	Comment
Price–cost relationship	Offers over time	Offer prices have been higher in recent years. It is not clear whether this is due to gas supply uncertainty, increases in costs or generators exercising market power. It appears that some of Meridian's offer behaviours have changed following the UTS at the end of 2019. But it still has a large percentage of offers in its top tranche, even when storage is higher (and its offers over $300/MWh have been steadily increasing since 2014).	The EA dynamic regression analysis of the drivers of electricity prices attributes most of the change in prices to a step change in September 2018 (the start of the Pohokura outage). The analysis does not explicitly consider a change in the way market power was exercised by hydro generators as an alternative to a combination of gas supply uncertainty and fluctuations in lake storage levels
	Percent of offers above cost	Meridian and Mercury always have a higher percentage of offers above cost compared with Genesis and Contact, regardless of the storage situation. However, some of this may be explainable by gas supply uncertainty or hydro operating constraints.	The EA review should at least suggest some hypotheses for what percentage of the higher offers are not explained by gas supply uncertainty or hydro operating constraints and indicate the effect of these offers on the 'stickiness' of wholesale prices.
	Relationship of storage to cost	Significant negative correlations for all generators in the review period, although slightly weaker correlations for Mercury (using its water values) and Genesis (using DOASA water values). This indicates water values accurately reflect one aspect of cost for hydro generators.	The EA should comment on what other cost aspects are driving hydro generator prices and what level of divergence between cost and market prices it would regard as evidence of market power when the generator setting the market price is gross pivotal.
	Lerner Index	Stratford has had a reasonably high average Lerner Index during the review period, higher than in previous years. But this could be expected given that gas scarcity may not perfectly be factored into their cost. Meridian and Mercury had higher Lerner indices during the review period using DOASA water values.	The correlation between water values and offers by hydro generators overall and in particular at times when the generator has market power should be a key indicator of the likelihood that a generator is exercising market power. The EA analysis seems to acknowledge that there are differences between the water values quoted by generators and estimated from DOASA.

Source: NZIER

Table 7 EA market conduct observations – output

Dimension	Indicator	EA Observation	Comment
Output	2 percent decrease in demand in the SI	The simulations showed that the average price decrease (from a decrease in demand) was larger in the review period than in previous years. This could be due to the steeper supply curve (due to supply conditions).	This is not surprising, but it would be useful to understand how the demand reduction affected the steepness of the price duration curve.
	Inter-island price separation	Inter-island price separation was subdued in the review period compared with previous years, when storage was high.	No comment.
	Trading periods with price separation in pre-dispatch but not in final	For trading periods with price separation in pre-dispatch but not in final prices, offer changes in pre-dispatch were consistent with underlying conditions. There is no evidence that any generator changed offer prices to avoid or cause price separation consistently in predispatch, although some generators always have a high percentage of higher priced ('non-clearing') tranches.	No comment.
	Trading periods with high prices	These higher prices compared with surrounding trading periods could be explained by changes in market conditions at the time. There were no obvious signs that the changes made to offers in pre-dispatch during these periods were inconsistent with market conditions. However, most hydro generators still had a large percentage of offers priced at greater than the final price in these trading periods, which could suggest economic withholding.	The EA analysis should clarify what percentage of offers priced above the final price as highly likely to indicate economic withholding and what the impact of this withholding would be on prices in theses trading periods. It would also be helpful for the EA to apply the Hidden Markov model analysis in Appendix E to pre 2018 price data and compare this to the 2018-2020 results.
	Tiwai contracts event analysis	A large change in the forward price was observed following the announcement of the contracts. Meridian's internal documentation suggests that, in negotiating with NZAS, Meridian was looking to keep the spot price from falling. If the smelter would have exited in preference to paying a market price, then the below cost contract offered by Meridian implies an efficiency cost.	This is informative. However, the price changes that can be linked to the Tiwai contract are modest and recent compared to the changes over 2016 to 2021.

Source: NZIER

Table 8 EA market performance observations – pricing trends

[insert caption subheading]

Dimension	Indicator	EA Observation	Comment
Pricing trends	2 percent increase in demand	There has been an increase in the average price change from a 2 percent increase in demand. This is consistent with the tighter supply situation, but also indicates that the incentive to economically withhold has increased.	This is not surprising, but it would be useful to understand how the demand reduction affected the steepness of the price duration curve.
	Spot market supply curve	Over the past few years, the supply curve has become steeper, at least in the $1/MWh to $200/MWh price range. The change is less dramatic in winter when supply has generally been tighter anyway. A steeper supply curve may increase the incentives to exercise market power.	The EA analysis should describe what behaviour it would see as the evidence of economic withholding and the exercise of market power.
	Marginal analysis	Percentages of time each generator is marginal are similar to previous years, and any changes during the review period are consistent with underlying conditions. However, Mercury has been marginal more often since 2018 in high-priced trading periods. This is consistent with gas supply issues (thermal is less often marginal) and dry conditions, but it could also indicate a stronger incentive and ability to exercise market power.	The time for which a generator is gross-pivotal, and the pricing offers by gross-pivotal generators are a better indication of market power and its exercise than marginal analysis.
	Actual versus predicted prices	Prices have been increasing since the Pohokura outage in 2018. Regression analysis supports a sustained upwards shift in prices since Pohokura, as do structural break tests. However, we cannot be completely sure whether this upwards shift is caused completely by underlying conditions.	The EA should at least advance some hypotheses about how much of the lift in prices is caused by changes in underlying conditions and what evidence it would regard as sufficient to accept those hypotheses.
	Forward prices	The forward price was pricing in certain scarcity for some of 2021 but, overall, is unbiased.	This does not seem to be consistent with the comment in paragraph 2.9 . *Previous Authority analysis concluded that there has been a bias in the forward price over the past 3 years, with the forward price underestimating the spot price. Before 2018, the forward price predicted the spot price with no evident bias. This observation of higher than expected spot prices over the past few years may be consistent with underlying supply conditions being persistently worse than anticipated, whether this is gas supply or hydro inflows.*

Source: NZIER

Table 9 EA market performance observations – profitability and dynamic efficiency

Dimension	Indicator	EA Observation	Comment
Profitability	Cost to income ratio	Concept's analysis does not opine on what profits should be, only whether they have changed and their proximate causes. For most firms, earnings did not change markedly between FY 2018 and FY 2020. Meridian was the exception with an increase in earnings.	The EA analysis of 'gentailer' profit does not answer the EA question of whether generators are making supernormal profits but focuses on the lack of change in entailer earnings over a short period of time. The EA analysis should at least acknowledge the economic profit analysis by MEUG suggests that further analysis of this question is required.
Dynamic efficiency	Investment	The pipeline of build-ready investment projects has become very thin. There has also been uncertainty of various types in the investment environment, which has likely affected investment decisions. Furthermore, the relatively thin pipeline for new supply may be weakening the incentive on existing players to commit new investment in a timely manner.	The EA review should also consider the potential disincentives to potential investors in wind of the risk of falling average returns and the lack of access to other generating assets to diversify the revenue risk of a wind-only generation portfolio.

Source: NZIER

Table 10 EA specific feedback

EA question	Comment
What are you views on the structure, conduct, performance approach used to assess competition in the wholesale market?	The structure, conduct performance framework is a useful starting point for analysis of the price setting in the market but it needs to be adapted so that it focused on price setting behaviour in peak periods and what makes price duration curves higher and flatter after 2018 that they were before 2018.
Is there any other methodology or framework that the Authority should be using instead of structure, conduct, performance? (If so, please describe.)	
Are the indicators used in this information paper appropriate to inform the Authority's assessment of wholesale market competition?	The EA review is incomplete with respect to both analysis of how increases in wholesale prices affect both customers and gentailer earnings, the reasons for the lower than expected investment on generation and the outlook for investment in generation.
Do you agree with the Authority's interpretation of the indicators presented in the information paper? (If not, please explain.)	The analysis of the indicators has not delivered firm conclusions on the drivers of wholesale price increases let alone when and if generators have exercised market power.
What other indicators should the Authority use to inform its assessment of wholesale competition?	Rather than look for other indicators the review needs to find more sensitive tests of whether prices determined in competitive market or not. For example, there seems to be such a wide range pf plausible views for water values that it is not possible for the EA review to make a definitive assessment of when the Lerner indicates an excessive mark-up.
Are there any additional competition issues that the Authority should consider?	See earlier comment about the disincentives for new investment.
Are there any interventions that the Authority should consider, to improve competition in the wholesale market?	No comment.
Are there any future workstreams that the Authority should develop to transition red and orange indicators outlined in Table 2 of the Information Paper to green?	No comment.
How should any proposed interventions be monitored and evaluated?	No comment.

Source: NZIER

Appendix B Market power in overseas electric markets

B.1 Overseas approaches to mitigating market power

A brief assessment of the approaches to measuring and limiting market power in the following countries: the United Kingdom (UK), the European Union (EU), the United States (ie, PJM, California, New York and Texas), Singapore, Canada (Ontario and Alberta), New Zealand and Ireland[19].

> *The United Kingdom, New Zealand and the EU tend to rely on anti-trust legislation, conduct rules and expost enforcement to mitigate market power. These jurisdictions tend to be less prescriptive about behaviours or circumstances that need to be prohibited or curtailed through ex-ante measure … A common theme across all jurisdictions is the use of market monitoring and reporting on the operation of the wholesale electricity market. Typically, this involves reporting on the competitive performance of the market with the purpose of identifying, on an ex-post basis, the abuse of market power. Page (ii)*
>
> *Mechanisms for market power mitigation can be classified as either ex-ante or ex-post measures. Ex-ante measures are those that involve setting rules that restrict behaviour of firms with the aim of avoiding the exercise of market power prior to it occurring. These ex-ante measures can be structural in nature, ie, restrictions on the market share of participants, or that target or prohibit specific conduct, eg, administrative pricing in circumstances when transmission constraints bind and firms may otherwise have undue influence over prices.*
>
> *Ex-post measures are designed to assess whether market power has been exercised in the past. Typically, ex-post measures are accompanied by a specification of principles that market participants should uphold, or forms of conduct that is prohibited. Subsequent regulatory action seeks to prove that participant behaviour was in breach of these principles or rules. These frameworks rely on the incentives resulting from enforcement and associated penalties to ensure that market participants do not exercise market power in circumstances where they might otherwise have the ability and incentive to do so. Page3*

B.2 Overview of the ERCOT electricity market

> *The ERCOT market is one of the most competitive electricity markets in the United States.22 The design of the ERCOT market is net-pool and energy-only with both day-ahead and real-time markets. In contrast to other competitive markets in the United States, the ERCOT market does not have a capacity market mechanism. (Page 13)*
>
> *Texas state legislation provides a prescriptive set of rules regarding the allowable behaviour of electricity utilities. Relative to other comparable energy-only markets*

[19] 'International review of market power mitigation measures in electricity markets, A report for the Australian Competition and Consumer Commission, May 2018' Houston Kemp. Available at https://houstonkemp.com/documents/international-review-of-market-power-mitigation-measures-in-electricity-markets/

around the world, ERCOT has arguably the most comprehensive set of ex-ante rules to protect against abuse of market power.

In addition to these structural regulations, significant behavioural regulations are also in place. These include: bid mitigation (which is a process of bid price capping), prohibitions on activities by market participants, the option for market participants to enter into a voluntary market power mitigation plan to reduce regulatory risk of future actions against them, and a condition that firms with less than 5 per cent generation market share are ruled, a priori, not to have are ruled, a priori, not to have ERCOT wide market power.

Ex-ante tests of abuse of market power

Pivotal supplier tests identify times when a small set of suppliers are able to meet demand, particularly during periods of network constraint. During these circumstances, the system operator implements administered pricing for these generators. The three pivotal supplier test is applied in all markets, ie, real-time energy market, day-ahead energy market, regulation market and the capacity market. This enables targeted mitigation of market power in the relevant market (page 16 see box 3.1 for pivotal supplier test) applies in capacity market