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NEW ZEALAND INSTITUTE OF ECONOMIC RESEARCH

Assessing the New Zealand wholesale electricity market

Issues affecting the benefits for small electricity consumers

NZIER report to Consumer Advocacy Council

13 December 2022

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Authorship

This paper was prepared at NZIER by Ting Huang

It was quality approved by Christina Leung.

The assistance of Todd Krieble and Sarah Spring is gratefully acknowledged.

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Registered office: Level 13, Willeston House, 22–28 Willeston St | PO Box 3479, Wellington 6140
Auckland office: Ground Floor, 70 Shortland St, Auckland
Tel +64 4 472 1880 | econ@nzier.org.nz | www.nzier.org.nz

Executive summary

The Consumer Advocacy Council (CAC) commissioned NZIER to undertake an economic analysis of the New Zealand wholesale electricity market to identify potential concerns in the market for small electricity consumers (i.e. households and small businesses). We were also asked to recommend areas where further analysis may be required. The objective of this research was to assist the CAC with raising evidence-based issues in their submission to the Electricity Authority's (EA) consultation on the Wholesale Electricity Market Competition Review, which was released on 11 October 2022.

The government's goal of achieving 100 percent renewable electricity by 2030 is at the core of our framework

We built our analytical framework around the context of the government's aspirational goal of achieving 100 percent renewable electricity by 2030 and the current socio-economic state of households and small businesses. We evaluated the performance of the New Zealand wholesale electricity market against four criteria consisting of equity, security of electricity supply, market efficiency and environmental sustainability. Our evaluation was based on findings from our quantitative analysis assessing current trends in the New Zealand wholesale electricity market and desktop research on the literature related to the electricity sector in New Zealand and overseas.

Our findings

The market currently relies on a uniform marginal pricing mechanism, which is still positively associated with the cost of thermal generation (such as gas and coal prices and the cost of emitting carbon), to incentivise generators to increase their renewable generation. However, our analysis showed evidence that this mechanism has driven the spot price spikes and high forward prices, bringing considerable gains to those large generators with much lower fuel costs and renewable generation capacity and who can generate at generation-constrained times. Those gains are eventually passed to consumers as higher costs. In addition, vertical integration of the five large gen-tailers (Genesis, Meridian, Mercury, Contact and Trustpower) has enabled them to self-hedge against the spot price volatility, which smaller or independent retailers have limited ability to do, and curbed out competition from smaller generators and retailers. This has incentivised their ongoing behaviour of making short-term profits to pay dividends to their shareholders rather than reinvesting in new generation capacity.

Our findings reflect the key feature that the New Zealand electricity sector is purely an 'energy-only' market setting, without any price caps or a capacity market working in parallel. The increased number of Transpower's grid emergency notices over the last two winters raises concerns about the security of the electricity supply as they indicate that the market is not currently attracting new renewable generation capacity. This means that the New Zealand electricity sector is not working as intended for the benefit of small electricity consumers. In fact, this has resulted in significant downside consequences on the equity for those consumers as they are facing an increased risk of energy poverty due to their limited capability to make demand responses, especially during peak demand times.

Recommendations

A smooth transition to the government's goal of 100 percent renewables by 2030 should lead to an electricity sector that ensures the security of supply at a fair cost to consumers. This requires a clear roadmap or master plan that puts fairness and equity for small electricity consumers – those more prone to energy poverty, at the centre. Given the tight outlook for the supply of electricity over the next two winters, there is a great sense of urgency calling for necessary reforms in the New Zealand electricity sector. Cross-agency leadership is required to ensure a smooth transition that mitigates the risks of a deterioration in the security of the electricity supply and energy poverty.

Drawing on the findings from our analysis, we recommend that the EA:

- Within its statutory purpose and functions outlined in the Electricity Industry Act 2010, demonstrate and adopt a wider view of the *total* costs and *total* benefits in their regulatory strategy by integrating the different parts of the electricity sector (generation, transmission, distribution and retail) and evaluating the sector against the four dimensions of performance with a stronger focus on consumer equity, taking into account the greater intermittent mix and the technology that will exist in the future.
- Provide leadership in connecting the electricity sector to other government policy objectives to mitigate adverse impacts on climate change, health, poverty alleviation, and economic development.

More specifically, we recommend that the EA should work with Ministry of Business, Innovation and Employment (MBIE), Ministry for the Environment (MfE), Climate Change Commission (CCC) and Ministry of Social Development (MSD) to:

- Outline, model and assess a set of plausible energy generation scenarios that rebalance efficiency, security and sustainability in relation to equity by March 2023[1]
- Identify options and assess the most cost-effective interventions to improve demand response and alleviate energy poverty among small consumers (e.g. price caps, subsidies, benefit payments, home insulation, smart metering, time-of-use pricing initiatives) by June 2023.[2]
- Develop a discussion paper by 30 June 2023 on options for:
    1. Creating a market setting which incentivises investment in new renewable generation to ensure demand capacity and reserves can be reliably met at all times – for example, limiting vertical integration of gen-tailers, introducing a capacity market, initiatives to streamline the use of smart generation technologies; drawing on overseas experiences from Australia, the US, UK and EU who are also moving toward zero-carbon economies.
    2. Developing a Code to ensure that smart meter data can be used for the maximum consumer benefit while not impacting consumers' privacy.

[1] Working with MBIE, MfE, CCC and MSD

[2] Working with MBIE and MSD

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1 Introduction

The Consumer Advocacy Council (CAC) commissioned NZIER to undertake an economic analysis of the New Zealand wholesale electricity market to identify potential concerns in the current market for small electricity consumers (i.e. households and small businesses) and to recommend areas for further work.

This report coincided with the CAC's submission to the Electricity Authority's (EA) consultation on its Wholesale Market Competition Review. The intent of this report is to support the CAC in raising evidence-based issues for the EA to undertake the necessary research and investigation to help ensure a fair and reasonable electricity market for households and small businesses.

1.1 Background and context

As the regulator of New Zealand's electricity market, the EA released a consultation document for its Wholesale Market Competition Review on 11 October 2022. The purpose of the review is to explore ways to promote competition in the wholesale electricity market for the long-term benefit of consumers as New Zealand transitions towards its aspirational goal of (almost) 100% renewable electricity by 2030.

In the consultation document, the EA shows that electricity spot prices have remained elevated above the average levels prior to the Pohokura gas outage in mid-2018 (Electricity Authority 2022d, 1), even though over 80 percent of New Zealand's electricity is from renewable generation. The CAC notes that the elevated wholesale cost of electricity is now increasing electricity costs to consumers.

The government's carbon emissions trading scheme makes thermal electricity generation (which uses fossil fuels such as gas and coal) more expensive, which in principle should incentivise more switching to renewable generation. However, because the wholesale spot market currently adopts a uniform marginal cost pricing mechanism, renewable generators that could generate electricity at generation-constrained times would benefit from extra earnings if the costs of thermal generation set the spot price – which they would not be able to when adequate non-thermal generation was available given that the price would be low. This may create a disincentive for independent renewable generation to enter the electricity market as it would be difficult for them to enter bilateral arrangements,[3] forcing them to either sell via a physical volume contract (i.e. PPA - power purchase agreement) to existing generators or elect to settle on the wholesale spot market price which is highly volatile.

Thus, the current pricing methodology in the market may result in the exercise of market power by existing generators which impedes new entry and investment in new renewable generation. In fact, the EA has identified a thin pipeline of renewable generation, with most of the investment available after 2025. This may well be one of the barriers to independent renewable electricity generators entering the electricity market.

In addition, moving toward the government's goal of 100 percent renewable electricity generation demands a pipeline of significant infrastructure in the energy domain. This will

[3] Such as hedges which guarantee a set strike price based on a notional volume.

compete directly with large infrastructure works in water, transport and housing that rely heavily on the construction sector, which is already under acute capacity pressures. With households and small businesses already facing increased costs due to high inflation pressures and rising interest rates, it would be detrimental to the long-term wellbeing of small electricity consumers if the wholesale electricity market stays as it is currently and the cost of electricity remains elevated when sufficient renewable generation is not available.

The CAC was established following the Ministry of Business, Innovation and Employment's (MBIE's) 2018-2019 Electricity Price Review (Ministry of Business, Innovation and Employment 2019). The role of the CAC is to advocate for households and small businesses to make their voices heard within the electricity sector and drive positive change for their wellbeing. This consultation on competition in the wholesale electricity market provides the CAC with an opportunity to make the EA aware of potential issues with the current market environment affecting small electricity consumers and what improvements could be made for the long-term benefit of these consumers.

1.2 Objectives and scope

The EA statutory objective is set out in Section 15 of the Electricity Industry Act 2010 and requires the EA to manage the electricity sector (and not just the electricity market) to the long-term benefit of the consumer. Allowing sustained higher wholesale costs that benefit generators far beyond their costs and a fair rate of return is not benefiting consumers. The EA will receive an additional objective in the Electricity Industry Act 2010 on 31 December 2022; this is to protect the interests of domestic and small business consumers in relation to the supply of electricity. This addition to the EA objective makes it very clear that the Authority must consider the impact of the current wholesale market structure and any proposed amendments to the wholesale electricity market structure, dispatch or the wholesale electricity pricing methodology.

This economic analysis aims to assist the CAC with raising evidence-based questions in their submission to the EA. In particular, the CAC wants to ensure that EA will undertake the necessary research and investigation to have a better understanding of whether the New Zealand wholesale electricity market is working as intended for households and small businesses and what improvements should be considered as New Zealand enters a new and evolving decarbonised electricity sector.

Our analysis was themed around whether the current market provides the right incentives for transitioning to 100 percent renewable generation and promoting the long-term benefits of small electricity consumers. The key areas we focused on in our analysis of the New Zealand wholesale electricity market were:

- Whether the market's current pricing model reflects New Zealand's renewable generation profile and is fair for households and consumers
- Whether the market's current competitive environment creates sufficient incentives for increasing supply and investment in new renewable generation
- Alternatives that could help ensure a smooth transition for households and small businesses.

1.3 Structure of this report

This report is structured as follows:

- Section 2 sets out the analytical framework of our analysis.
- Section 3 assesses trends in the New Zealand electricity market.
- Section 4 discusses the potential concerns in the market and recommends areas requiring further work.

2 Analytical framework

This section sets out the analytical framework that forms our analysis's basis. We begin by describing the key elements of the New Zealand electricity sector, followed by the concepts and challenges of the 100 percent renewable electricity goal. We also highlight some of the recent trends in households and small businesses to give the social and economic context for our analysis. Section 2.4 outlines the framework we used to evaluate the New Zealand electricity market and the approach we adopted in our analysis.

2.1 Key elements of the New Zealand electricity sector

Currently, the New Zealand electricity sector has the following features:

- The wholesale market, which generates and supplies electricity through trading in the wholesale spot market and hedge trading through secondary financial bilaterals.
- A Crown Entity, the Electricity Authority, established under the Electricity Industry Act 2010 to oversee and regulate aspects of the New Zealand electricity sector, which includes the electricity market.
- Transpower, which owns the national transmission grid and acts as a system operator, is responsible for ensuring electricity demand and supply match throughout the day, as well as grid security and reliability.
- Line companies, which distribute electricity from the grid exit points to the end consumers.
- The retail market, which purchases electricity from the wholesale market and insurance through hedge bilateral and sells electricity to consumers.

The New Zealand wholesale electricity market adopts a locational marginal pricing auction model to determine the price for quantities of electricity to be supplied at each point of connection to the grid. Each generator makes an offer to generate some amount of electricity for a half-hour trading period for a nominated price. Retailers and some other major industrial users (e.g. the Tiwai Aluminium Smelter), on the other hand, make bids to offtake at grid exit points. The system operator, Transpower, then undertakes a match between modelled supply and demand such that the combination of offers with quantities satisfies demand at the lowest cost get selected. As bids and offers start 36 hours before and may be revised before, the trading period (the actual real-time consumption), the final prices at each node are computed the following day. The highest generator's offer that is dispatched for a given half-hour interval sets the wholesale spot price for that trading period.

Wholesale spot prices are highly volatile as they can vary significantly across time and locations. Generators' offer price is influenced by fuel cost and the mix of generation changes with consumption demand (e.g. higher prices in winter when demand is high) and supply constraints (higher prices during a dry period of the year or below-average hydro inflows and limited electricity storage). Thus, there are also bilaterals used to minimise price volatility. These include an over-the-counter hedging market directly between retailers/consumers and the New Zealand generators, an electricity futures market

operated by the Australian Stock Exchange (ASX) and a specialised financial transmission rights (FTR) market to help generators and retailers hedge the risk of price volatility.

New Zealand's approach to calculating the wholesale spot price is essentially uniform pricing. In theory, all generators should be paid at the grid point of connection they ultimately inject into, the same price per unit of electricity supplied at a given time but adjusted for transmission losses. If there is sufficient competition, this pricing mechanism should achieve a market price paid by consumers to reflect the marginal cost of electricity production, even when prices are highly volatile (Came and Dupuy 2005, 2). However, when competition is weaker in the market, generators may be more incentivised to drive prices above their marginal costs.

2.2 The 100 percent renewable electricity goal

The government is committed to transitioning to a low-carbon economy and has a goal of 100 percent renewable electricity by 2030. In addition, the Emissions Reduction Plan sets a decarbonisation target of 50 percent renewable energy consumption by 2035 and identified increasing electrification as an area of focus (Ministry for the Environment 2022, chap. 11).

A recent report by the Boston Consulting Group (2022) assessed the various pathways for New Zealand to achieve 100 percent renewable electricity against the energy trilemma – equity, security and sustainability (World Energy Council 2021). A smooth transition requires the right balance across all three dimensions of the trilemma so that rapid decarbonisation can be achieved without increasing energy price volatility and affecting the reliability of supply for consumers. For New Zealand, the right balance requires the swift build of new renewable generation and the right energy and capacity mix – including a small amount of fossil fuel generation and network and transmission capacity availability. This is to ensure sufficient generation to meet peak demand and respond to different weather conditions (e.g. dry year). A significant increase in investment will be required across generation, transmission and distribution to meet New Zealand's renewable generation goal, which also creates a challenge to consumers' cost of electricity.

2.3 Current socio-economic state of households and small businesses

Electricity is an essential service. It is estimated that 69 percent of all household energy in New Zealand is powered by electricity (K. O'Sullivan and Viggers 2021). However, the term energy hardship, or energy poverty, has increasingly received more attention. It refers to the situation when households cannot access or afford the energy to provide for their energy needs within the home – e.g. keeping the house warm, cooking, washing etc. (Ministry of Business, Innovation and Employment 2021; K. C. O'Sullivan 2019; K. O'Sullivan and Viggers 2021). This could leave people living in cold and damp houses, or some may choose to reduce their spending on other essentials to pay for their energy needs or vice versa, which are detrimental to households' health and wellbeing. The issue of energy poverty for households may be even more concerning in the current environment of high inflation and rising interest rates. Prices of other essentials, such as food, have increased by over 10 percent in the past year, and more households are expected to face higher mortgage repayments later next year as more fixed-term mortgage rates get repriced.

Stats NZ's Household Living-Cost Price Index (HLPI) shows that the electricity cost for households has increased by about 20 percent since 2012, which is similar across income

groups. The Household Economic Survey (HES) suggests energy bills make up a higher proportion of household expenditure among the lower income deciles. In fact, in the 2015/16 HES, more than one-quarter of New Zealand households were struggling to pay utility bills on time, had cold, damp, or mouldy housing, or paid more than twice the median energy costs as a percentage of their income (Stats NZ 2020).

It is known from the 2018 Census that 90 percent of households in New Zealand have access to electricity. However, this was only 84 percent for households living in rental properties, among which a greater proportion is on lower household incomes than those who live in their own dwellings. Also, compared to households living in their own houses, for those living in rentals, there is a smaller proportion using heat pumps or electric heaters for heating (73 percent), and they are more likely to have problems with dampness (29 percent) and mould (23 percent). Unsurprisingly, the 2018 General Social Survey (GSS) also finds that those lived in houses they didn't own experienced colder indoor temperatures (Stats NZ 2020).

Electricity is also essential for the operation of businesses. Stats NZ's Business Demography Statistics for 2022 indicates 97 percent of businesses in New Zealand have less than 20 employees. Almost all new business births and deaths of enterprises over the last 10 years are small businesses (less than 20 employees). Smaller businesses have a lower rate of survival. Of those businesses established in 2017, only those with 20 or more employees have a survival rate above 70 percent.

NZIER's *Quarterly Survey of Business Opinion*, in which the majority of those surveyed are small businesses (with 20 employees or less), shows downbeat business sentiment and deteriorating profitability over the past year. This reflects weaker business confidence in the current environment of high inflation, rising interest rates and heightened uncertainty about the economic outlook. Businesses have been facing very acute capacity pressures and cost increases. If electricity costs stay elevated, it would add further cost pressures for small businesses that are already struggling.

2.4 Our framework and approach

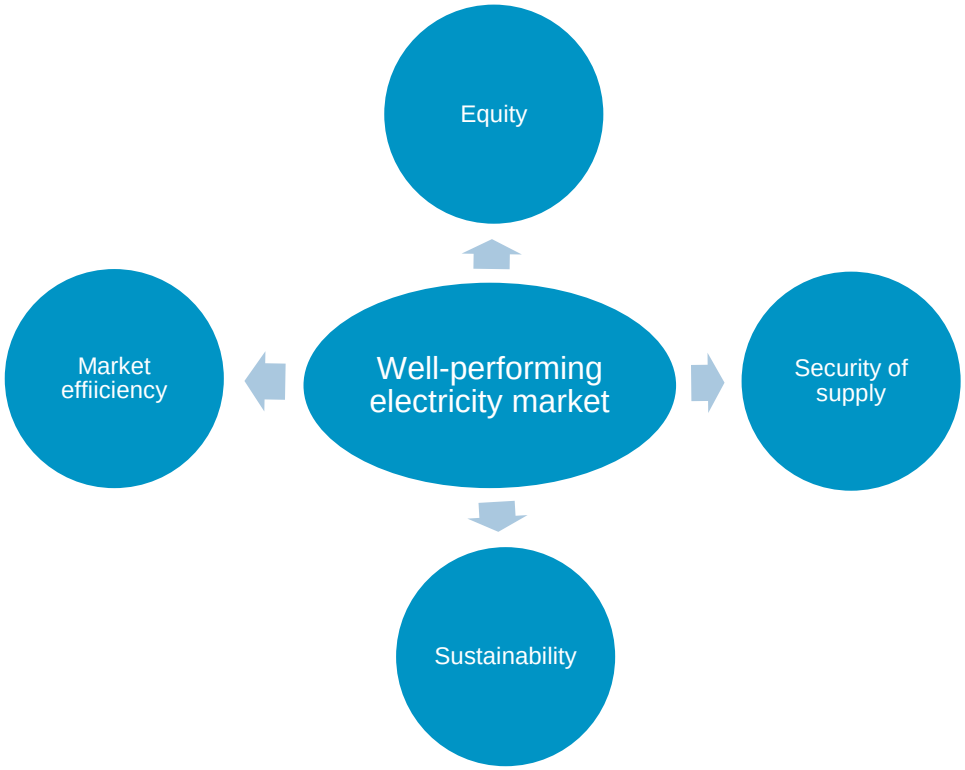
Our analysis was to evaluate the New Zealand electricity market's current performance to test whether it is working as intended. A range of frameworks are available for the economic evaluation of market performance, for example, the Structure-Conduct-Performance paradigm, which assesses the interaction between market structure, market conduct and market performance (Ferguson 1988; Tan 2016; Dranove 2011; Sutton 2001). However, we reviewed the literature on electricity market analysis to select a framework suitable for our context.

Figure 1 below depicts the framework we selected to evaluate the performance of the New Zealand electricity market. It consists of four evaluation criteria – equity, market efficiency, security of supply and sustainability. This builds on the framework adopted by InnoEnergy (2017) in their analysis of the impact of electricity regulation in Europe which consists of dimensions of security of supply, environmental sustainability and competitiveness; as well as the World Energy Council's energy trilemma (2021) of equity, security and sustainability adopted in BCG's (2022) assessment of New Zealand's pathways to the 100 percent renewable goal. We combined the two frameworks in light of the government's policy targets for a low-carbon economy (Ministry for the Environment 2022) and moving toward

100 percent renewable electricity by 2030. Under our analytical framework, a well-performing electricity market means that:

- Its market design fosters competition and incentivises the allocation of resources towards more renewable generation.
- There is sufficient supply to meet the increased demand for renewable electricity at any time, including periods of peak demand and dry years.
- The price of electricity is fair and reasonable such that it reflects the cost of supplying and is affordable by everyone, especially for those households and small businesses who are already facing energy hardship and/or having difficulties in keeping up with the increased costs in the current economic environment of high inflation and rising interest rates.
- Encourages New Zealand to move toward decarbonisation.

Figure 1 Criteria for evaluating the New Zealand wholesale market



Source: NZIER

Our New Zealand electricity market evaluation drew on quantitative data analysis and desktop research. We used secondary data from various sources such as EA's Electricity Market Information (EMI) website, MBIE's electricity statistics and annual reports from the five large generator companies (Genesis, Meridian, Mercury, Contact and Trustpower) to assess current market trends. We also undertook desktop research on the literature related to the electricity sector in New Zealand and overseas to gather useful empirical evidence and insights.

3 Trends in the New Zealand electricity market

Since 2014, more than 80 percent of the electricity generated in New Zealand has come from renewable sources, with hydro being the largest source of renewable generation.

The New Zealand wholesale electricity market is dominated by five generator companies – Genesis, Meridian and Mercury, which are 51 percent owned by the government; and Contact and Trustpower, which are private sector companies. Those five major generators are also the five major retailers in the retail electricity market and are often referred to as gen-tailers.

Currently, there are about 47 generation stations connected to the national grid owned by Transpower. The gen-tailers own most of the renewable generation capacity (mostly hydro) in New Zealand, and Genesis owns the largest thermal power station in Huntly.

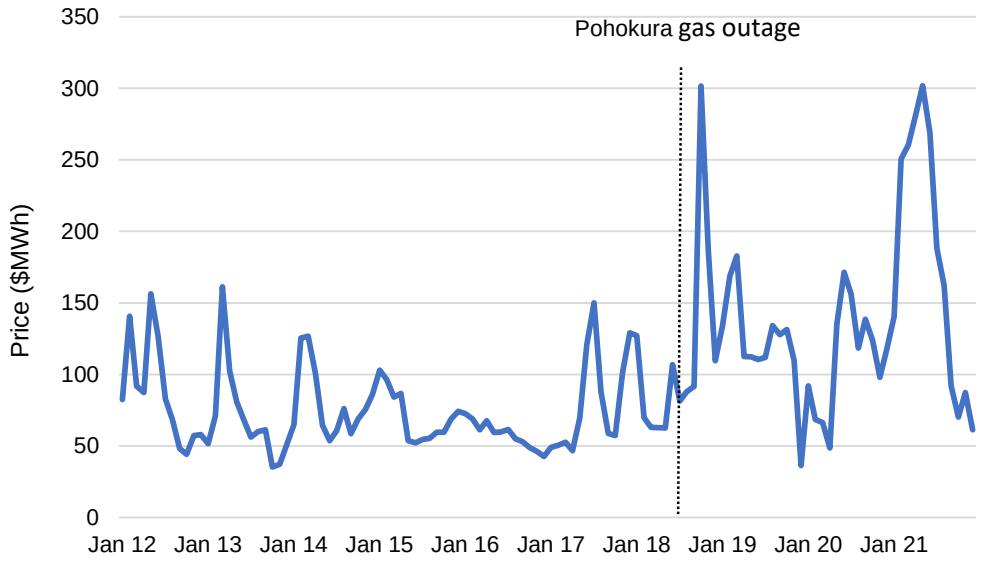
The rest of this section assesses trends in the wholesale electricity market, including:

- wholesale electricity price
- demand and costs of electricity
- trends across the five gen-tailers with regards to electricity generation, earnings, dividend payments and their competitive positions in the electricity market.

3.1 Wholesale electricity price

The price volatility in the wholesale spot market reflects the varying demand for electricity during different times of the year – higher during winter when demand tends to be higher and vice versa during summer. However, we can observe that since the Pohokura outage in mid-2018, spot price volatility has increased significantly.

Figure 2 Average monthly spot price, 2012 to 2021

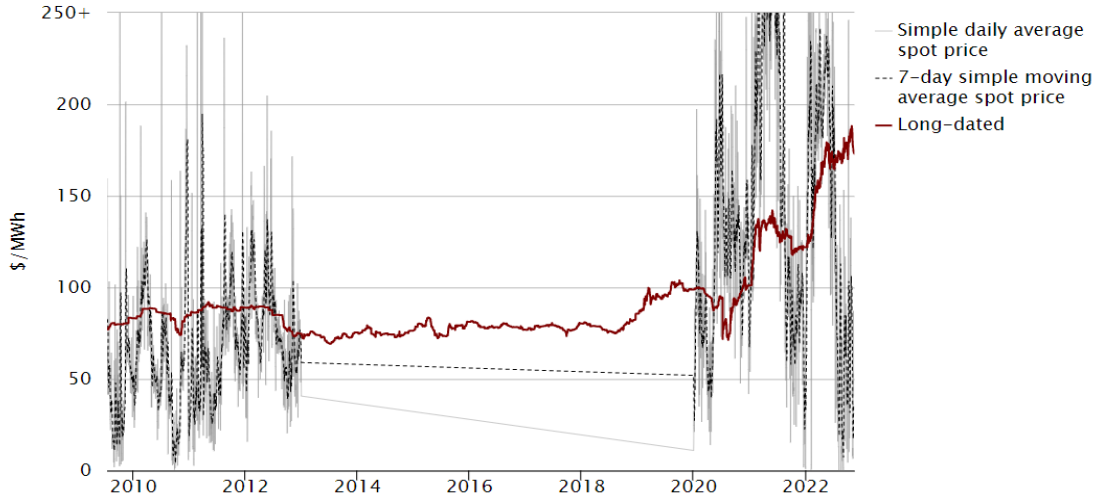


Source: Electricity Authority (2022)

We also looked at forward price curves to see how prices in the futures market have behaved (see Figure 3). For example, for the Ōtāhuhu baseload, the spot prices are even more volatile than the average spot price in the wholesale market. Although this volatility is significantly reduced under the long-dated futures contracts, the associated forward prices have been rising rapidly since mid-2018. The EA (2022c) recently explained that increasing forward prices are influenced by a combination of factors, such as the occurrence of La Nina conditions in winter (which could reduce hydro inflows), high thermal fuel and carbon prices, low hydro inflows and gas outages.

It is important to note here that the increase in the cost of fossil fuel (gas and coal) for thermal generation could result in extra earnings for renewable generators only when they can generate electricity at peak demand times. It creates no benefit to renewable generators which cannot generate those times or are not connected to the national grid, for example, solar generation from solar farms or domestic installations by those consumers who elect to generate their electricity.

Figure 3 Forward price curves – Ōtāhuhu baseload futures

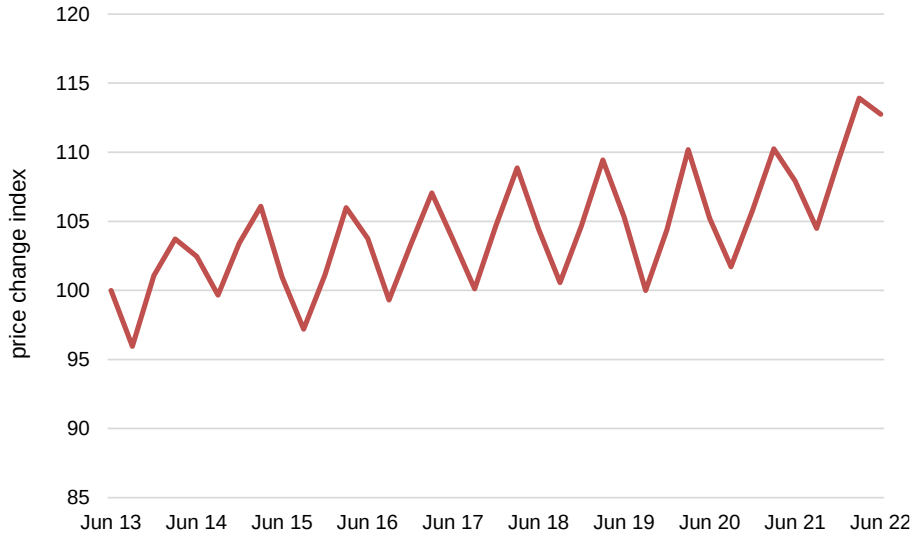


Source: Electricity Authority (2022)

Trends in electricity spot and forward prices shown above suggest changes in the costs of fossil fuels and carbon (which are key components in thermal generation) could be linked to wholesale electricity prices. To test this, we reviewed trends in gas and carbon prices.

Figure 4 shows an upward trend in wholesale natural gas prices with seasonality over the last 10 years. It appears that the price of natural gas is much less volatile compared to wholesale electricity spot prices and electricity forward price curves shown earlier, indicating the linkage between gas and electricity prices is limited to some extent.

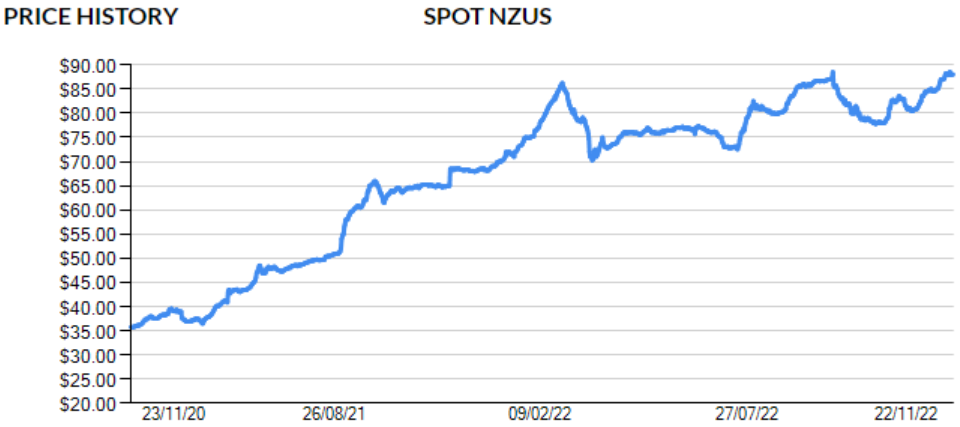
Figure 4 Wholesale natural gas price, June 2013 to June 2022



Source: Ministry of Business, Innovation and Employment (2022)

Figure 5 shows that over the last two years, the carbon spot price has been moving upward, with movements quite similar to those longer-term electricity futures prices shown in Figure 3 earlier. However, as over 80 percent of New Zealand's electricity is supplied by renewable generation, we would expect a weaker relationship between the two.

Figure 5 Carbon spot prices, 23 November 2020 to 21 November 2022



Source: Jarden (2022)

3.2 Electricity demand and costs

As described in section 2.4, the security of the electricity supply is one of the four key criteria of a well-performing electricity market. That is, the market needs to ensure a sufficient supply of electricity at any time, even during times of peak demand or when there is low capacity for renewable generation due to weather conditions (e.g. dry years).

Figure 6 shows a general trend that electricity demand from the national grid is markedly higher during winter than in summer. This is expected as it is the time of the year when more peak demand arises due to increased consumption requirements from households

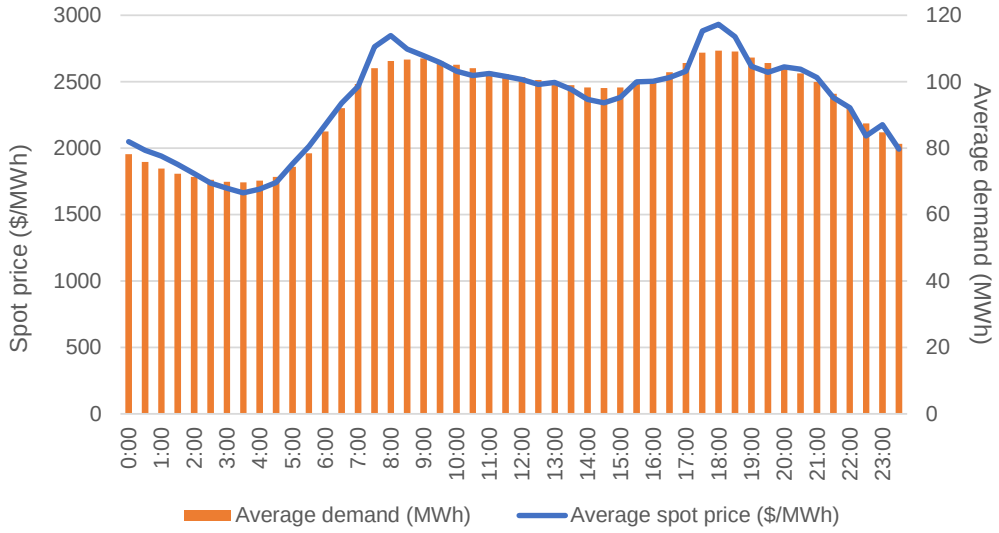
and businesses for heating. However, there have been concerns about the sufficiency of electricity generation in recent winters, as New Zealand saw an increased number of grid emergency notices from Transpower, urging the generators to increase their supply to avoid further risk of electricity disruptions during peak hours (NZ Herald 2022a). More recently, Transpower has expressed concerns about the supply outlook for the next two winters as its forecasts suggest constrained generation (Transpower 2022a; 2022b). This raises the question of whether the market has been attracting new generation and whether it has sufficient capacity to meet the increased peak demand as New Zealand decarbonises and transitions to 100 percent renewable electricity.

Figure 6 Aggregated monthly demand from the national grid

Source: Electricity Authority (2022)

Literature on the New Zealand electricity market has highlighted that electricity demand is inelastic to changes in price (Poletti and Wright 2020; Browne, Poletti, and Young 2012; Came and Dupuy 2005). This is verified in our comparison between wholesale spot prices and electricity demand, which shows both are moving very closely at any trading period throughout the day (see Figure 7).

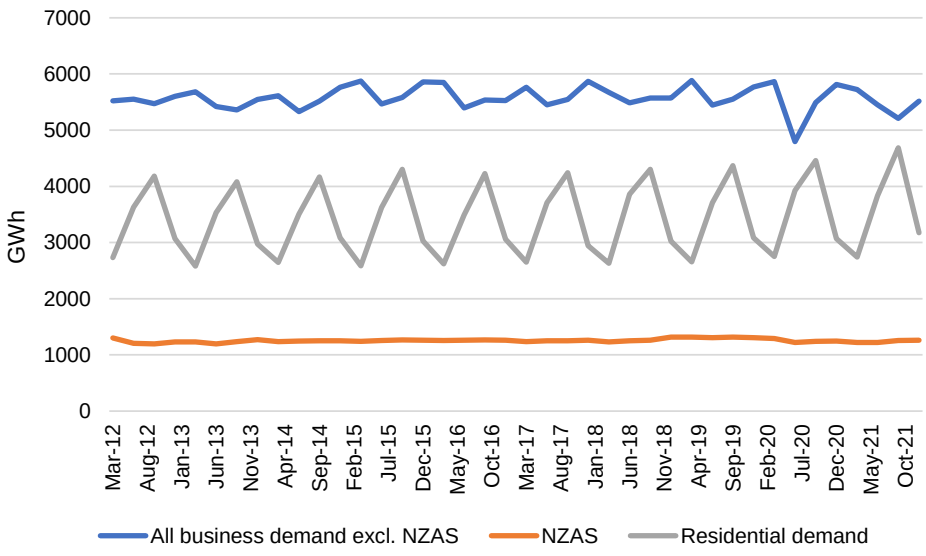
Figure 7 Average spot price and average electricity demand by trading period, 2012 to 2021



Source: Electricity Authority (2022)

Looking at demand more closely (see Figure 8), a breakdown of wholesale electricity consumers showed businesses are the largest group of electricity demand, making up between 50 and 60 percent of the total electricity consumption. The New Zealand Aluminium Smelters (NZAS) at Tiwai Point, the largest single consumer of electricity, which is directly connected to the grid and currently has a bilateral electricity contract with Meridian, represents another 11–13 percent of the total demand. While households are the second largest group, there is greater variability in their demand compared to larger commercial and industrial consumers (i.e. NZAS).

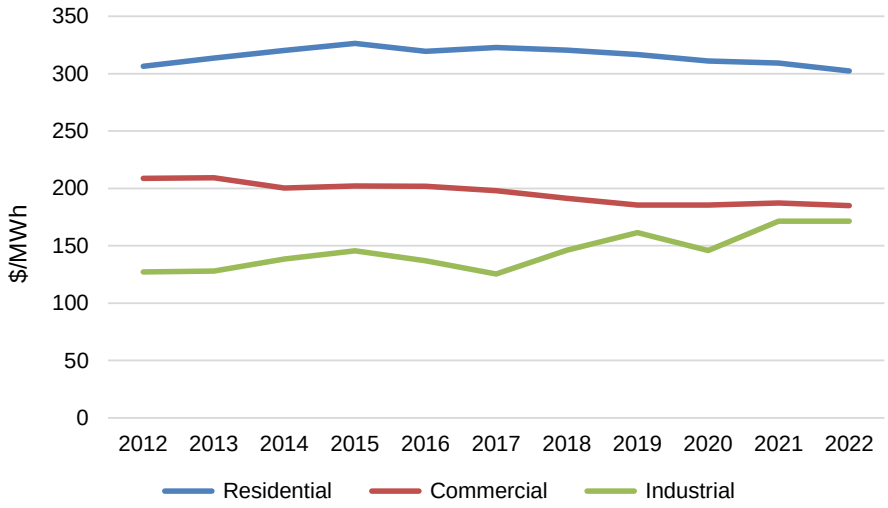
Figure 8 Quarterly residential and business demand, 2012 to 2021



Source: Electricity Authority (2022)

The above points to the fact that peaking generation capacity is required for periods of domestic-led demand peaks – for cooking, lighting, and electric heating in winter. Due to the significantly lower residential load factor compared to commercial and industrial consumers, the costs of generating and conveying electricity to residential consumers are also markedly higher compared to commercial and industrial consumers. Currently, electricity retailers average those costs and charge householders a flat rate per unit of electricity consumed (K. O'Sullivan and Viggers 2021). This means that residential consumers face significantly higher electricity costs than commercial and industrial consumers, as shown in Figure 9.

Figure 9 Real electricity costs by ICP category – years ended March 2012 to March 2022



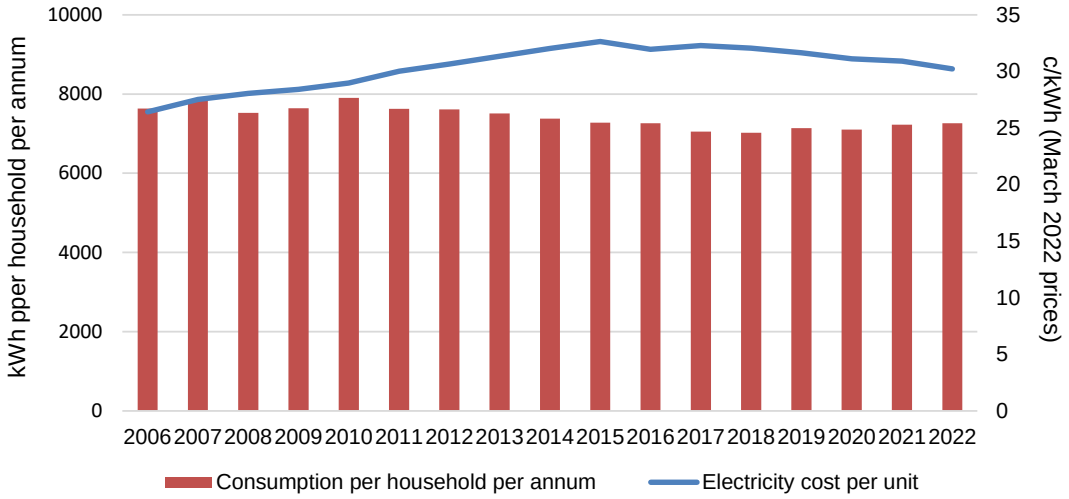
Source: Ministry of Business, Innovation and Employment (2022)

It is important to note that wholesale electricity prices are not passed directly to most consumers. However, they influence the forward price curve for electricity which may be an input for bilateral strike prices and retail prices, particularly for the small electricity consumers, who get charged a cost usually based on averaging the marginal costs of electricity supply or bilateral prices. With little time-of-use information on when electricity is most costly to generate and convey, small electricity consumers lack the ability and incentive to adjust their demand during peak times. This directly impacts their wellbeing, especially those on low incomes who already find it difficult to pay their power bills.

Interestingly, MBIE's electricity cost data reveals that households' average annual electricity consumption in the recent decade has generally been lower than the levels pre-2011 – the period when the cost of electricity to households was lower (see Figure 10). In the short-term households have limited ability to adjust their electricity consumption during times of peak demand. Over time, they may intentionally reduce their total consumption of electricity by, for example, restricting the use of lighting, hot water or electric heating (K. C. O'Sullivan 2019) or reducing spending on other essential items to afford their power bills (Ministry of Business, Innovation and Employment 2021). However, this would be challenging for many households, especially large families, who often have inflexible schedules for electricity consumption. It would be difficult for them to adjust their pattern

of electricity use to reduce their total consumption – for example, cooking dinner and turning on the heating at other times. Overall, households could still pay more for their total consumption than if they were charged differently for peak and non-peak times.

Figure 10 Electricity consumption per household and real electricity cost per unit, years ended March 2006 to March 2022



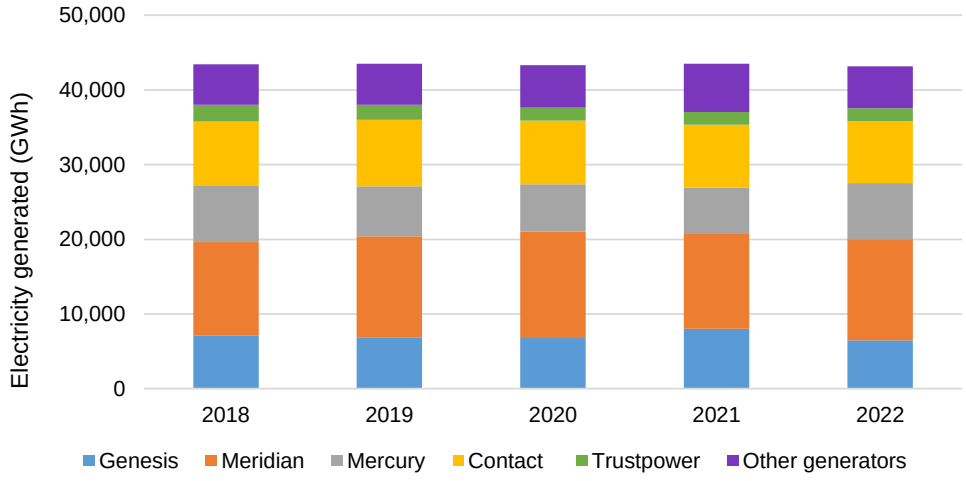
Source: Ministry of Business, Innovation and Employment (2022)

3.3 Trends across the gen-tailers

We used information from annual reports and financial statements of the five gen-tailers and the EA's data to assess trends in their electricity generation, earnings, dividends and market position to help identify potential issues concerning their competitive behaviours.

Over the last five financial years, between 85 and 88 percent of electricity in New Zealand was generated by the five gen-tailers, with Meridian contributing the largest share (29–33 percent) (see Figure 11).

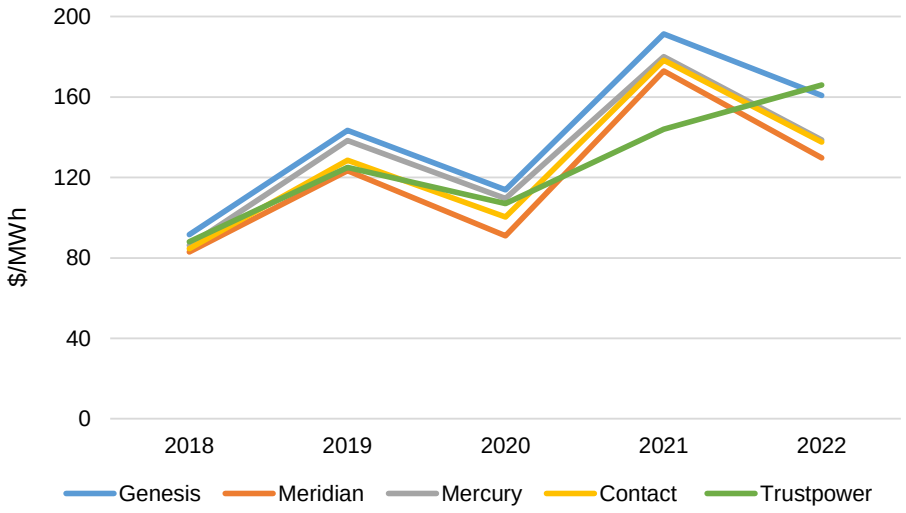
Figure 11 Total electricity generation by generator company, FY2018 to 2022



Source: NZIER's estimates based on data from the gen-tailers' annual reports

Almost 100 percent of Meridian, Mercury and Trustpower's electricity generation was renewable, and Contact also had a renewable share of above 80 percent over the last five financial years. Unlike Genesis, a large proportion of its electricity generation was thermal, with renewable only making up around 30–40 percent of its total generation. However, Figure 12 shows little difference across the average prices of electricity generation received by the gen-tailers. This points to a major flaw in the uniform marginal cost pricing method the New Zealand wholesale electricity currently adopts. It uses the highest cost dispatched generation to determine the wholesale spot price, which is received uniformly by all generators in the market despite how much total electricity and renewable electricity they were prepared to generate. This results in significant extra returns to the gen-tailers if they can generate over high-priced periods – e.g. peak load or residual load when intermittent renewables cannot cover.

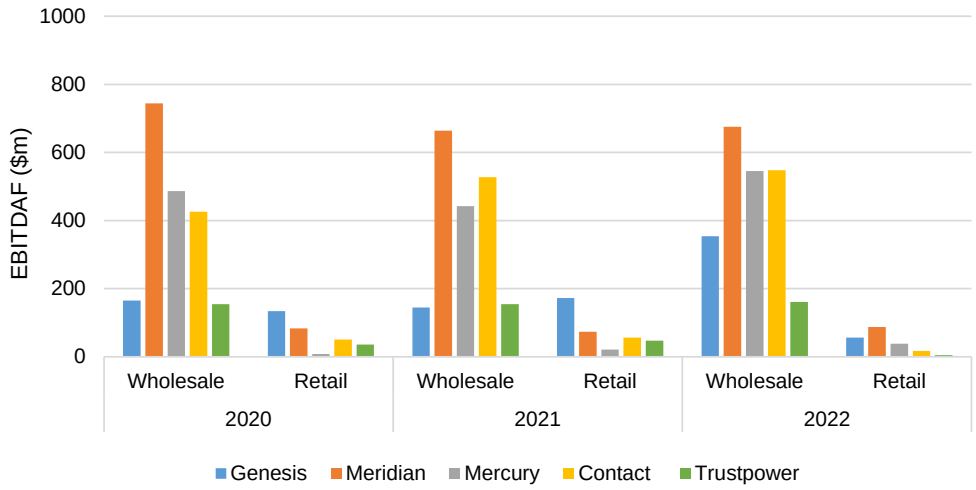
Figure 12 Average generation price by gen-tailer, FY2018 to 2022



Source: The gen-tailers' annual reports

Earnings before interest, tax, depreciation, amortisation and finance costs (EBITDAF) provides a good indicator for how much the gen-tailers earn from their business operation. Over the last three financial years, the wholesale market segment has offered Meridian, Mercury, Contact and Trustpower – whose electricity generation is mostly renewable, substantially higher earnings than the retail market (see Figure 13). Note that in the most recent financial year, Genesis also obtained significantly higher earnings from wholesale than retail. Meanwhile, its renewable generation increased by just under 9 percent from the previous financial year (from 2526 to 2743 GWh), but its total generation reduced by 20 percent. These trends point to gen-tailers benefitting from the high short-term returns in the wholesale electricity market.

Figure 13 EBITDAF by business segment, FY 2020 to 2022

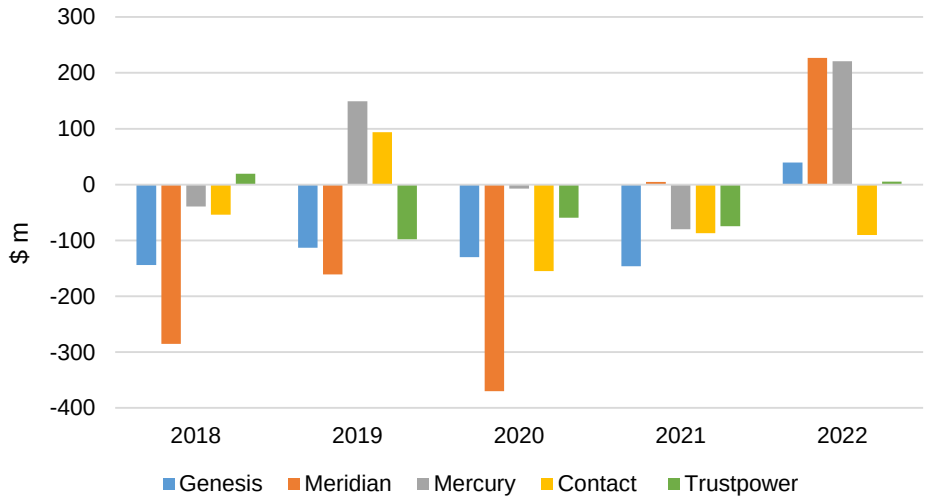


Note: the wholesale and retail segments also include other forms of energy, for example, gas and oil. Contact and Trustpower also provide broadband services.

Source: Companies' annual reports

Comparisons between net profit and dividends paid indicate how much surplus is available for reinvesting in capital and other infrastructure for the gen-tailers' business-as-usual activities and new generation capacity. Information from the last five financial years reflects a general trend that dividends paid by the gen-tailers to their shareholders significantly surpassed their net profits. This is similar to what the New Zealand Council of Trade Union (2022) has found in their recent study released in November (see Figure 14) – the gen-tailers have been making short-term profits to pay dividends to their shareholders instead of reinvesting in new generation. This suggests the possibility that investment in new generation by gen-tailers is made on borrowing.

Figure 14 Dividends paid in excess to net profit, FY18 to 2022

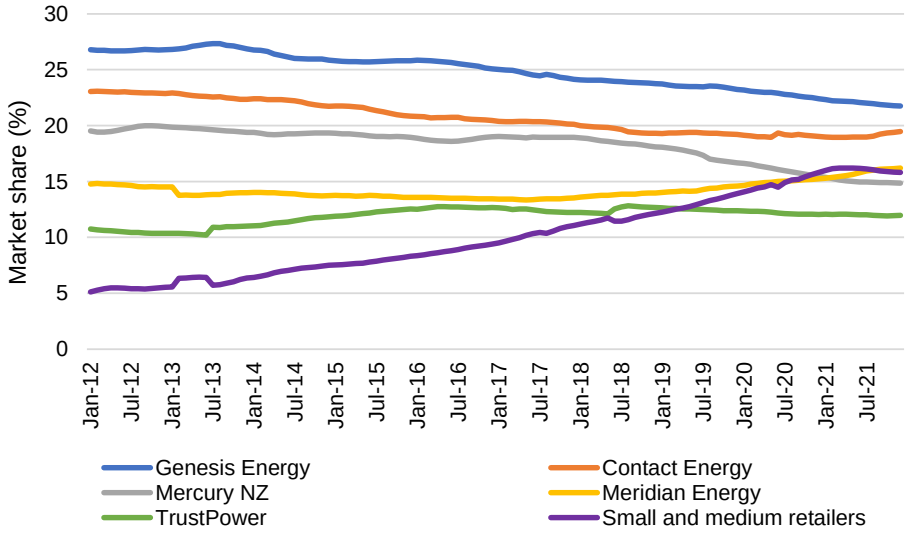


Source: NZIER's estimates based on data from companies' annual reports

We use the EA's data on market share trends and vertical integration to look at the gen-tailers' competitive position in the electricity market.

The five gen-tailers accounted for over 80 percent of the market share in the retail electricity market (see Figure 15). Of those, Genesis has the highest market share, though it has declined over time. Meanwhile, small and medium retailers have been steadily growing their market share since mid-2013, despite being exposed to high spot prices and having issues obtaining bilateral hedges. However, it wasn't until 2021 that the share of small and medium retailers started to stagnate and slowly decline.

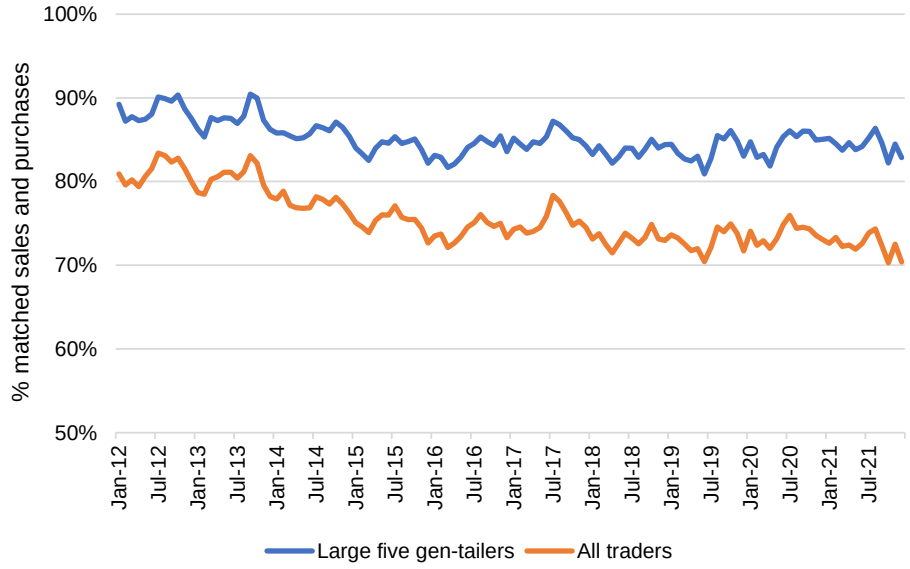
Figure 15 Market share of electricity retailers, 2012 to 2021



Source: Electricity Authority (2022)

Vertical integration is the combination of two or more stages of production or distribution (or both) that are usually separate under a single ownership (Buzzell 1983). In the context of the New Zealand electricity market, this can be measured by the EA's data on the percentage match between sales and purchases in the wholesale electricity market. By integrating generation and retail, the five gen-tailers have shown consistently higher percentage matches between sales and purchases than all other traders in the wholesale market, indicating a significant competitive advantage over other small and medium competitors (see Figure 16) as their self-hedge with their own generation reduces the impact of spot market volatility.

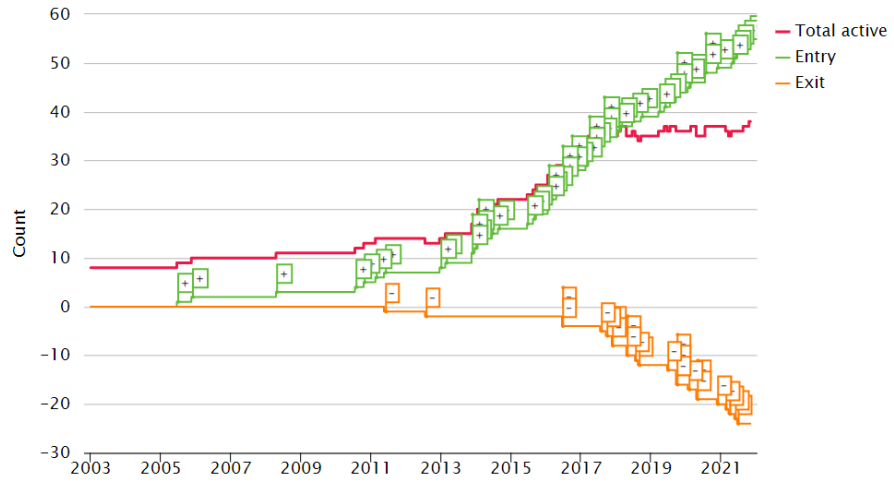
Figure 16 Vertical integration as measured by the percentage of matched sales and purchases, 2012 to 2021



Source: Electricity Authority (2022)

Furthermore, the wholesale market volatility and the resulting lift in the futures price (see Figure 2 and Figure 3 earlier) may have negatively affected new entrant retailers who could not obtain suitable bilateral arrangements to enable them to compete against the five vertically integrated gen-tailers. Analysis of EA's data on trends in retail market share and entry and exit shows that 14 retailers have left the electricity market since late 2018,[4] and several other new entrant retailers have either not increased customer numbers or have reduced customer numbers.

Figure 17 Electricity retail market entry and exit



Source: Electricity Authority (2022)

[4] These are: Body Corporate Power, Energy Club NZ, EMHTrade, Electrica, Hunet Energy, ID Power, Lighthouse Energy, NextGen Energy, Power Direct, Payless Energy, Platinum Power Retail, Secure Power Ltd, Supercharged Energy, Wise Prepay Energy.

4 Potential concerns and recommended areas for further analysis

Drawing on the analysis presented in section 3 and our desktop research on the electricity market literature, this section discusses the potential concerns with the current market and recommends areas requiring further work.

4.1 Concern 1 – current market design relies on a pricing method that does not sufficiently incentivise new renewable generation capacity

A main drawback of the uniform marginal cost pricing method that New Zealand currently adopts for setting the wholesale electricity market price is that generators receive similar prices for their electricity generation, regardless of how much electricity they are prepared to generate and how much is via renewables (refer to Figure 12). This creates significant bonuses to generators which would have generated at their offer price but instead have received the market clearing price for the highest generator's offer that is dispatched. As the high volatility in wholesale spot prices eventually impacts the futures and retail prices, it is probable that consumers, especially those small consumers who have little scope to adjust their peak consumption requirements, are ultimately subsidising the excessive dividends beyond what is fair that generators pay to its shareholders (shown in Figure 14).

The comparison against gas prices suggests that cost of fossil fuels is still reflected in the spot price to some extent (refer to Figure 4). However, this does not appear to justify that the persistent price spikes and high forward prices are caused by global developments related to gas and coal. In BCG's recent article (Hirschhorn et al. 2022), they note that wholesale electricity prices may decouple from the price of gas and fluctuate between extremes when those generators who remain in the market are to set the price and would generate electricity at times when prices are the highest. The strong association between carbon and wholesale electricity prices (refer to Figure 5) also incentivises large generators to take advantage of the high prices at generation-constrained times and generate using their existing capacity and earn significant extra earnings, instead of investing in new renewable generation.

There is also empirical evidence in the literature showing generators have been earning significant extra gains from the wholesale market. Browne et al. (2012) and Poletti (2021), after incorporating water value function[5] in their simulation model, found significant market rents – revenues earned under actual prices compared to a counterfactual under which generators would behave competitively and offer to generate at their true marginal costs. The issue underpinning this is that there is no price cap in the New Zealand electricity market (Philpott et al. 2019). The high uncertainties over wholesale prices halt new generators, retailers and investors from entering the electricity market as they face high risks of not being able to cover their fixed costs if exposed to the volatile spot prices, limiting the expansion of renewable generation capacity. This ultimately adds to increased costs for consumers and further risks concerning the security of supply, especially during peak demand times.

[5] It is a function of national lake storage, based on the rationale that marginal costs for hydro generators vary depending on the opportunity cost of water. The cost of using water is zero if the storage lake is full, but when inflows to the lakes are low, the cost would be the price the hydro generator could have received had it held the water until the demand spike.

In an energy-only market setting like New Zealand, new generation investment and entry are solely incentivised by prices (Philpott et al. 2019, 9). This presents a challenge for New Zealand to achieve its decarbonisation and the 100 percent renewable generation goals, especially regarding whether the current model would deliver the adequate capacity required for meeting the increased electricity demand and reliance on intermittent renewable generation. The EA's recent consultation document on "Driving efficient solutions to promote consumers interests through winter 2023" has also expressed concerns about the risk of insufficient generation capacity in the New Zealand electricity sector for meeting demand and reserve requirements (Electricity Authority 2022f).

Some jurisdictions such as the UK, Western Australia and parts of the US and Europe have set up capacity markets to operate in parallel with their electricity markets to provide better signals and incentives for new generating capacity (Boston Consulting Group 2022; Concept Consulting 2020; Liu, Wang, and Cardinal 2022; Cramton 2017). In capacity markets, a central party, usually the government or the regulator, specifies an explicit target level of capacity, and places physical or financial obligations on generators and consumers to achieve this target. This is to provide better assurance that there will be sufficient capacity for meeting future demand (baseload, peak load and residual load). Capital markets provide an additional revenue stream for generators to cover their fixed costs and better certainty for investing in new capacity, which helps suppress the spot price volatility in the wholesale electricity market (Boston Consulting Group 2022, 174). Capacity markets also ensure that capability to meet demand is present when required as generation capacity is planned in advance, rather than waiting for economic drivers to encourage investors to invest (which lags demand). However, for New Zealand, the effectiveness of such a mechanism would depend on how accurately the regulator factors in different types of capacities meet both peaking and dry year needs when forecasting the associated capacity requirement. Thus, a capacity market for New Zealand needs to be carefully designed to avoid any over-procurement of new generation which could ultimately add to more costs for consumers.

The use of feed-in tariffs (FITs) has also been widely used across EU member countries and in the US to incentivise new renewable generation (Hu et al. 2018; Kilinc-Ata 2016; White, Lloyd, and Wakes 2013; Jenner, Groba, and Indvik 2013). It is a policy scheme which essentially pays a fixed rate for each unit of renewable electricity generated by a generator connected to the grid. Kilinc-Ata (2016) carried out an econometric analysis and showed that FITs have effectively stimulated renewable generation capacity deployment in EU countries and in the US. Jenner, Groba, and Indvik (2013) also provided empirical evidence that FITs have driven development in solar photovoltaic (PV) and onshore wind power capacity in Europe. White, Lloyd, and Wakes (2013) considered the applicability of FITs for increasing solar PV generation in New Zealand at a city level and their findings suggest that such policy could be implemented at rates comparable to those successful FIT schemes internationally. However, this would require streamlining of the process involved in connecting to the national grid.

4.2 Concern 2 – Small consumers are more vulnerable to high electricity prices

Our analysis in the previous section on electricity demand and costs highlights that small consumers of electricity (households and small businesses) have more variable demand across times than larger businesses and industrial consumers. Electricity for small

consumers is typically more expensive to supply due to their poorer load factor, especially during peak demand times. Although wholesale electricity prices are not directly passed onto small consumers, they influence the ultimate bilateral and retail prices they pay, which is usually a flat cost per unit that averages out the marginal costs of both generation and conveyance. In addition, with little information on how the costs of their electricity consumption are calculated, small consumers lack the incentive and ability to adjust their consumption requirements, especially during times when peaking generation is required. This makes them more vulnerable to increased cost of electricity, especially for those who already face energy hardship and find it difficult to afford their power bills.

Demand response is a widely acknowledged way for alleviating the electricity spot price volatility and pressures for additional generation capacity or conveyance capacity, which ultimately helps reduce the costs of electricity for consumers. Many smart demand response technologies are available for New Zealand – such as battery storage, independent solar PV solar generation, smart EV charging (Boston Consulting Group 2022; Philpott et al. 2019). However, O'Sullivan and Viggers (2021) pointed out that these would only benefit the wealthier households, who tend to be more able to afford the costs of those smart technologies. Connecting those small-scale renewables to the national grid may add further costs for consumers who already face energy hardship.

An alternative approach to demand response is to establish effective, flexible load provisions that could increase large-scale demand response from larger commercial and industrial consumers – who have greater capability to adjust their demand and afford demand response technologies so that they can cross-subsidise for those small consumers who have limited ability to contribute to demand reduction during peak times.[6] Having a flexible load could alleviate issues caused by intermittent generation injection (e.g. smaller scale non-dispatched solar, capacity for EV chargers and increased residential solar).

A real-time wholesale market pricing mechanism would also help with large-scale demand response. In this mechanism, a settlement price for each trading period will be revealed immediately at the end of the actual trading period, allowing buyers in the wholesale market to make real-time decisions on prices that they will actually pay. Poletti and Wright (2020) found that an increase in consumers on real-time pricing contracts reduces the gap between peak and off-peak prices and increases the welfare for switching and non-switching consumers, even when there is some presence of market power. This is because real-time pricing makes the demand for electricity more elastic as consumers on those pricing contracts can smooth out their consumption over time. In fact, the New Zealand wholesale electricity market moved to real-time pricing from 1 November 2022, to reduce the risks associated with spot price volatility (Electricity Authority 2022e).

To incentivise demand response from small electricity consumers, measures should provide them with better information on how their electricity costs are calculated. In the US, smart meters have increasingly been rolled out to residential consumers. Jessoe and Rapson (2014) showed households who were informed on usage and prices cut their consumption more in responding to higher prices than those who did not receive real-time information. However, the effectiveness of such a tool would be undermined if the rollout rate is low[7]

[6] Innovation and Participation Advisory Group (2019) recommended a flexibility market in its draft advice to the EA Board at https://www.ea.govt.nz/assets/dms-assets/26/26593IPAG-Draft-Access-to-input-services-04-December-2019.pdf.

[7] Data from EA's EMI website (Electricity Authority 2022b) shows that approximately 90 percent of NZ residential ICP identifiers have AMI metering operational.

and/or the information is not delivered in a timely and accurate manner to consumers, third-party providers, distributors and load aggregators.

A shift to a time-of-use pricing mechanism, which sends some price signals to small consumers to indicate when electricity is most costly to generate, also allows them to shift some load away from peak times, and this helps reduce the need for additional peaking generation (K. O'Sullivan and Viggers 2021). However, this may also present some challenges for larger families, who often have inflexible schedules for electricity consumption - e.g. laundry, dinner etc. Thus, time-of-use pricing initiatives should be coupled with supplementary policy programmes that help increase small consumers' literacy around electricity consumption, for example, requiring weekly billing from electricity retailers or prepay metering, which gives pricing signals closer to real-time (K. O'Sullivan and Viggers 2021, 71).

Additional considerations need to be given to those consumers living in rental properties. This group of electricity consumers are more disadvantaged in terms of their demand-response capability due to their lack of ability to improve the quality of their rented dwellings (K. C. O'Sullivan 2019), limited control over electricity retail plans (Ministry of Business, Innovation and Employment 2021) and insufficient information on the efficiency of energy services in the properties they dwell in (K. O'Sullivan and Viggers 2021). Some legislative intervention would be required to help alleviate this disadvantage. As suggested by O'Sullivan and Viggers (2021), one way is to have a legislative requirement of an energy performance certificate on rental properties to provide tenants more information on the energy use and performance of the dwelling so that they are better informed on the costs of electricity inherent in living there. However, this would require substantial modelling using dwelling-specific information.

4.3 Concern 3 – Current market design weakens the degree of competition which hinders investment

Our analysis of the five gen-tailers has highlighted that the vertical integration between electricity generation and retailing weakens competitiveness in the New Zealand electricity market. The vertically integrated gen-tailers can generate close to their own contracted position, creating effective self-hedges against the impact of spot price volatility and spikes. However, independent retailers do not have the same protection and are exposed to the risk associated with volatile spot prices and difficulty in obtaining bilateral hedges, which hinders competition in the retail market. In fact, our analysis indicated that the market share of small and medium retailers has declined in recent years, and a considerable number of new entrant retailers have either exited the market or are unable to increase or maintain their customer numbers.

The views on the impact of vertical integration between generators and retailers on the competitiveness of the electricity market in the literature are mixed. Wolak (2009) specified the high degree of vertical integration with no formal retail price regulation as a dimension contributing to the likelihood of the generators exercising market power. When Australia's National Electricity Market (NEM) was first formed, some regulators and policymakers in the NEM considered vertical integration anti-competitive because it may reduce forward market liquidity (Simshauser 2019). On the other hand, Browne, Poletti, and Young (2012) and Poletti (2021) both viewed that vertically integrated firms have fewer incentives in the short run to drive wholesale prices up as they are in hedged contracts. Hugh and

Constantin's (2018) review of wholesale power markets in developing countries noted that the lack of vertical integration between generators and retailers might result in significantly higher electricity prices as it enables the firms to vest in contracts to avoid substantial increases in wholesale prices.

Philpott et al. (2019) stated that under perfect competition, vertical integration would yield investments closer to socially optimal outcomes as it enables self-hedges against wholesale spot price risk. However, our analysis showed some signs of market power across the vertically integrated gen-tailers as they have a significant competitive advantage over other competitors (refer to Figure 16) through self-hedging contracts and have limited new entry of electricity retailers (refer to Figure 15 and Figure 17). This has consistently enabled them to obtain substantial earnings from the wholesale market. However, the increased number of grid emergency notices in the recent winter (*NZ Herald* 2022b; RNZ 2022a) and Transpower's concerns about constrained generation capacity for the next two winters suggest that the gen-tailers are incentivised to make short-term profits and pay excessive dividends to shareholders rather than investing in new renewable generation. Ultimately, this comes at the cost of higher electricity bills for small consumers and potentially reliability events.

Given the complexity of New Zealand's electricity market, it is important to acknowledge that imperfect competition will always exist – just a matter of how much. Electricity demand is expected to double in 30 years as New Zealand decarbonises (RNZ 2022b). The goal of 100 percent renewable electricity by 2030 adds further challenges to the security of electricity supply, given the intermittency of renewable generation. This will require significant investment and outbuild of new generation capacity (Boston Consulting Group 2022). As large infrastructure for electricity supply is very expensive and takes a long time to build, more forward planning for investment is needed to ensure that there will be sufficient capacity to meet the increased demand. Thus, the electricity market regulator needs to ensure a market design that provides sufficient investment incentives ensuring security of supply and long-term benefits for consumers.

Australia also has an 'energy-only' market as New Zealand, and it is facing similar challenges in terms of security of supply as it moves toward higher penetration of renewable electricity. Abbott and Cohen (2019) suggested that ensuring the security of supply requires regulatory intervention in the electricity market design, and potential policy responses can be broadly categorised into:

- direct facilitation of new generation and transmission capacity, for example, through subsidies to private sector operators, direct investment from the government
- adjustment to market designs to provide more incentives for market participants to invest in new capacity – e.g. capacity markets in parallel to the spot market, which pay generators if they can ensure a specified level of generation capacity over a time horizon
- centralised decision-making in managing demand and capacity and how prices are determined.

In determining an appropriate policy approach for maintaining the security of supply in the transition, Abbott and Cohen (2019) also pointed out the extent of vertical integration and its effect on the efficacy of market design as one of the issues that policy makers should take into account.

In recent years, the policy option of re-nationalising the electricity sector has been brought back to the discussion in Australia and the UK as electricity costs for households continue to soar (Nepal 2022; Ambrose 2019). The intention behind this is to increase government intervention as the persistent price spikes indicate the markets' failure to provide adequate security of supply. One form of nationalising the sector is through a single-buyer model, in which a state-owned single buyer buys electricity from a number of competing generators at regulated prices (Hugh and Constantin 2018). This could promote more competition across the generators and reduce the volatility of the wholesale prices, as well as helps alleviate supply shortages and provides incentives for private investment in new generation capacity. However, this model transfers the revenue risk from the private investors to the state-owned single buyer, as it must ensure that the prices paid to the generators cover the fixed cost of new investment.

Evidence in the literature shows the importance of regulation in improving electricity market outcomes. Steffen, Karplus, and Schmidt (2022) combined regression and qualitative analyses on the EU and found that state-owned utilities have a higher tendency to invest in renewables, particularly in countries with stringent climate policies and when the general quality of regulation is high. In Nepal and Foster's (2015) review of economic performance between the privately and state-owned electricity networks (including generation, transmission and distribution) in Australia, they found that privately owned networks are not worse off than state-owned networks in terms of price, quality and investment. However, the success of privatisation is strongly linked to the regulatory regime and underlying institutional framework. Putting this to the New Zealand context, this means regardless of whether the electricity market is re-nationalised or not, the top priority for a well-performing market should always be ensuring a robust regulatory in the first place.

4.4 Recommended areas for further work

Committing to decarbonisation and moving toward 100 percent renewable electricity by 2030 presents significant challenges to the New Zealand electricity sector as we expect increased reliance on intermittent renewable generation and phasing-out of thermal generation plants while electricity demand continues to accelerate (Boston Consulting Group 2022; Electricity Authority 2022d; 2022f). Transition in the interim should lead to a system of 100 percent renewables that promotes the long-term benefits of consumers – ensuring the security of supply at a fair cost.

As highlighted in our analysis and discussion, the New Zealand electricity sector is complex, comprising interactions among participants across the wholesale market, transmission and distribution and retail market. Those interactions influence outcomes across the four dimensions of our analytical framework of a well-performing electricity market – equity, security of supply, market efficiency and sustainability. Because new infrastructure for electricity supply (generation and conveyance) requires significant investment and a long time to build (Boston Consulting Group 2022; RNZ 2022b), there is an urgency to develop a clear roadmap or master plan now to ensure that the New Zealand electricity sector delivers sufficient capacity for meeting the increased demand for electricity without adding extra costs for consumers. This is especially true for households and small businesses with limited capability to adjust their peak demand and are already facing higher electricity bills.

As Dodd, Rai, and Caught (2020) stressed, failure to adequately address equity and fairness can undermine the performance of the electricity sector in delivering benefits for

consumers even under an economically-efficient market design. Our analysis suggests that the New Zealand electricity sector currently provides weak incentives for increasing new generation capacity, resulting in high electricity costs for small consumers. Given the tight outlook for electricity supply over the next two winters (Transpower 2022a; 2022b; Electricity Authority 2022f), there is a greater sense of urgency calling for necessary reforms in the New Zealand electricity sector. Cross-agency leadership is required to ensure the sector delivers a smooth transition for households and small businesses, mitigating the risks of a deterioration in the security of the electricity supply and energy poverty.

Drawing on the findings from our analysis, we recommend that the EA:

- Within its statutory purpose and functions outlined in the Electricity Industry Act 2010, demonstrate and adopt a wider view of the *total* costs and *total* benefits in their regulatory strategy by integrating the different parts of the electricity sector (generation, transmission, distribution and retail) and evaluating the sector against the four dimensions of performance with a stronger focus on consumer equity, taking into account the greater intermittent mix and the technology that will exist in the future.
- Provide leadership in connecting the electricity sector to other government policy objectives to mitigate adverse impacts on climate change, health, poverty alleviation, and economic development.

More specifically, we recommend that the EA should work with MBIE, MfE, CCC and MSD to:

- Outline, model and assess a set of plausible energy generation scenarios that rebalance efficiency, security and sustainability in relation to equity by March 2023
- Identify options and assess the most cost-effective interventions to improve demand response and alleviate energy poverty among small consumers (e.g. price caps, subsidies, benefit payments, home insulation, smart metering, time-of-use pricing initiatives) by June 2023.
- Develop a discussion paper by 30 June 2023 on options for:
    3 Creating a market setting which incentivises investment in new renewable generation to ensure demand capacity and reserves can be reliably met at all times – for example, limiting vertical integration of gen-tailers, introducing a capacity market, initiatives to streamline the use of smart generation technologies; drawing on overseas experiences from Australia, the US, UK and EU who are also moving toward zero-carbon economies.
    4 Developing a Code to ensure that smart meter data can be used for the maximum consumer benefit while not impacting consumers' privacy.

On a further note, to develop more targeted and effective policies and interventions for alleviating energy poverty risk in New Zealand, the EA and its partnering agencies need to understand the scale of the socio-economic impact of energy poverty and how this varies across different sub-groups. This could involve an IDI research project that can be undertaken over the next year. The research can look at individuals, households, and small businesses to assess how their spending on electricity and other essentials has shifted from time to time as their costs of electricity change and the likely impacts on their health, disposable incomes and business profitability.

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