The Determination of Retail Prices in the NZ Electricity Market

eranz

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1 Executive summary

On 21 September 2021, The Electricity Authority (the EA or the Authority) released the Consultation Paper: *Supporting reform to efficient distribution pricing: a refreshed Distribution Pricing Practice Note* (the Consultation Paper).

TDB Advisory Ltd (TDB) has been asked by the Electricity Retailers' Association of New Zealand (ERANZ) to investigate the justification for continued discretion by electricity retailers on the extent to which they directly reflect the structure of distribution prices in their retail prices.

The challenge of responding to the imperatives of climate change we consider to be an underlying key concern for the electricity sector. Reducing reliance on carbon-based technologies will see both an increase in the demand for electricity and considerable changes in electrical devices used (particularly electric vehicles), the means of generation (such as increased wind and solar generation), and more complex distribution systems (with increases in two-way flows such as vehicle to grid systems) and the phase out of fossil fuels as a means of managing peak load.

Although these trends present significant challenges for the sector, meeting these challenges will also allow the sector to transition to a more sustainable and efficient electricity system, with potentially lower peak-load pressures. The combination of managed appliance tariff systems and the storage capacity of electric vehicles could greatly improve the sector's ability to manage peak loads.

A critical factor in managing the transition is to ensure that price signals encourage efficient responses that minimise decision regret. A focus of the EA's Consultation Paper is on increasing the transparency of price signals from the distribution segment of the electricity industry. Equally as important is for the distribution sector to receive transparent signals about customer preferences. Prices are a two-way signal, transmitting information from suppliers to consumers and from consumers to suppliers. A well-functioning retail sector is important, not only to transmit signals to households, but also to respond to their preferences.

Security of supply when required is a genuine demand of electricity customers, and this demand provides a legitimate price signal back to the electricity market to encourage innovation and/or an expansion of capacity

The imposition of variable pricing on customers will potentially come at a welfare cost for society.

The feed through of distribution price signals does not require comprehensive pass through to retail customers, competition amongst retailers will encourage some to use variable pricing. Allowing market forces to operate will better allow for these signals to influence behaviour with groups who are best able and/or willing to respond, without imposing costs on groups who are less willing/able to respond.

Market forces are more likely to stimulate the types innovation that will ultimately be required for peak load management (eg the use of managed appliance tariff systems in EVs and hot water storage and vehicle to grid systems, retail specialisation) and the shift to more efficient appliances.

Concerns that the retail sector is likely to excessively shield electricity consumers from distribution sector price signals are likely to be overstated. With no obvious market failure in the retail sector, with active levels of consumer switching and company entry and exit, caution about mandating price pass-through should be applied. The diverse nature of electricity consumers mean that it is likely to be very difficult to design regulations that do not impose significant unintended consequences, and which do not inhibit desirable electricity industry innovation and investment.

2 Introduction

The Electricity Authority (the EA or the Authority) has released a Consultation Paper: Supporting reform to efficient distribution pricing: a refreshed Distribution Pricing Practice Note. In its Consultation Paper, the EA notes its desire that distribution prices provide better signals about the costs of electricity supply and how those costs can vary by location and by time of day.

TDB Advisory Ltd (TDB) has been asked by the Electricity Retailers' Association of New Zealand (ERANZ) to investigate the case for retailers directly reflecting the structure of distribution prices in their retail prices.

This report is structured as follows:

- following the Executive Summary (Section 1) and this Introduction (Section 2), Section 3 of this report provides a brief overview of the nature of electricity and of the electricity sector in New Zealand;

- the next section, Section 4 discusses the context of the EA's Consultation Paper on distribution pricing practice;

- Section 5 considers the commercial basis for retail pricing of electricity and notes that prices are a two-way signal, transmitting information from suppliers to consumers about the costs of supply and from consumers to suppliers about consumers' costs (including their search and transaction costs) and about consumers' preferences;

- Section 6 of the report considers whether there may be a case for government intervention in retail pricing to require retail prices to directly reflect distribution prices; and

- Section 7 provides the conclusions of this report.

3 Electricity market characteristics

3.1 Particular nature of electricity

Electricity as a commodity has several particular characteristics: it requires a constant balance between production and consumption, it is costly to store, it is dependent on weather (both on the demand and supply sides), and it is also dependent on the intensity of time-of-day activity levels (on-peak vs. off-peak hours) (Weron and Ziel 2018).

(Sayers et al. 2001) note that electricity has a number of other distinguishing characteristics, namely:

Essential service — many of the conveniences and equipment of twenty-first century life require electricity to function (for example, artificial respirators, personal computers and household appliances).

Derived demand —electricity is not required in itself as a good but as an input to production of the goods and services consumed as a final product. This results in demand for electricity that is not as price sensitive as the demand it is derived from.

Volatility of demand — demand varies over each day and over the year. Demand may also fluctuate randomly in a way that is unpredictable and outside the forecast demand patterns.

Homogeneity — electricity is a homogeneous commodity that is not easily amenable to product or brand differentiation. It can be supplied at differing voltages, frequencies and reliability levels, but the source of its production is immaterial to its form. Although customers cannot physically distinguish electricity from different sources, some are willing to pay higher prices for electricity generated in environmentally-preferred plants (for example, those using renewable sources of energy such as solar and wind).

Complex flow — it is not possible to define a specific flow of electricity to particular supply points. The laws of physics determine flows of electricity, whereby it follows along the path of least resistance. Consequently, the operation of the electricity system in a given service area can affect and be affected by operations in other service areas.

Near-continuous consumption — in most cases, customers do not generally consider the price of electricity before they consume it, but receive a bill for a period of consumption. Further, there are transaction costs associated with monitoring prices continuously. Consequently, most customers pay a bill that reflects the average cost over the period, often over the year. This weighs against the use of short-term demand management options based on cost-reflective prices.

There are three elements to the quality of service of electricity — quality of supply (the flow of electricity in terms of voltage and frequency), reliability of supply (continuity of electricity supply) and customer services (handling of customers' inquiries and complaints).

3.2 New Zealand electricity market

The New Zealand electricity market currently consists of five main generating companies. Genesis Energy, Mercury and Meridian Energy operate under a mixed ownership model in which the government holds a majority stake, while Contact and Trustpower are private sector companies. The state-owned enterprise Transpower owns and operates New Zealand's national electricity transmission system. The system includes substations, high voltage cables, transformers and overhead lines for transmitting high voltage electricity from power stations to distribution (lines) companies.[1] There are in addition 29 distribution and around 40 retail companies. Four of the five main generators are also retailers (the exception being Trustpower which recently sold its retail operations).

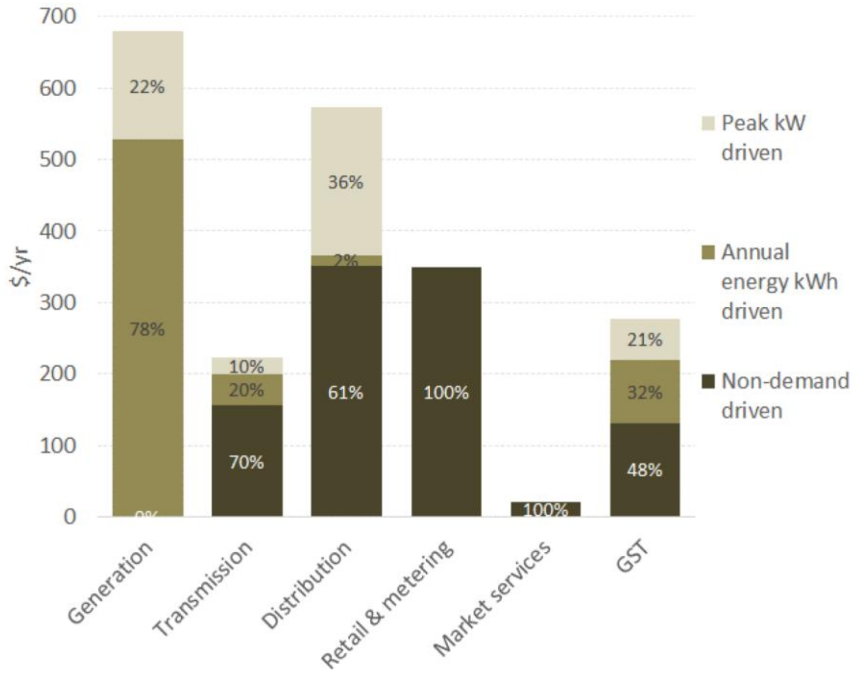
[1] Information sourced from: https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-generation-and-markets/electricity-market/electricity-industry/

Table 1: Summary of New Zealand electricity industry

Sector	Number of companies	% of average electricity bill*
Generation	5	32.0%
Transmission	1	10.5%
Distribution	29	27.0%
Retail	40	13.0%
Other (incl GST)		17.5%

* Sourced from Electricity Authority (2021), p4

Figure 1: Breakdown of average residential electricity bill



Source: Replication of Figure 20 from Concept Consulting Group Ltd and Retyna (2021)

Figure 1 presents a replication of Figure 20 from (Concept Consulting Group Ltd and Retyna 2021), which provides more detail about the sources of costs in the average residential electricity bill (year ending March 2021). Points to note include:

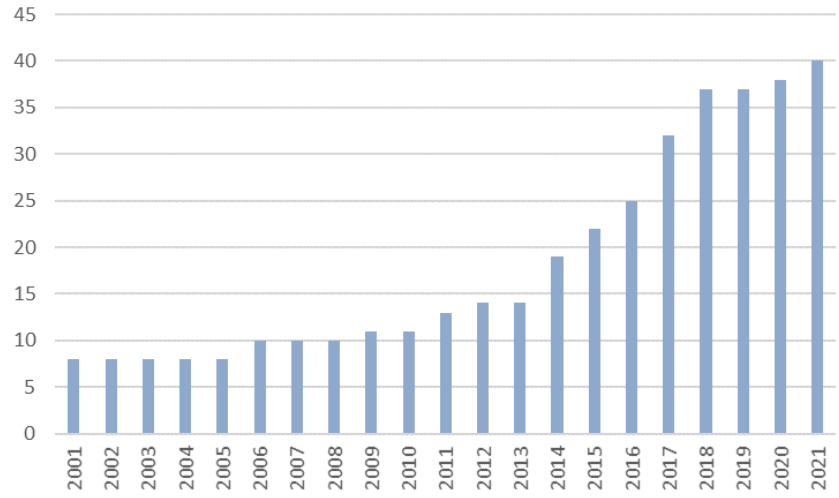
- The majority of transmission and distribution network costs are not driven by kWh of demand. Instead, coverage is the biggest long-term driver of network costs: There are significant fixed costs of building the towers, poles, trenches etc. to reticulate electricity to communities, plus there are significant economies of scale associated with cables and transformers.

- None of the costs of retail & metering or running the market are driven by the kWh of demand. Retail & metering costs are driven by the number of customers (not how much each customer consumes), and the costs of running the market are independent of how many kWh passes through the market.

- Overall 48% of the average electricity bill relates to non-demand driven system costs, 32% relates to the annual cost of generating and transmitting electricity, and 21% pays for the costs of managing infrequent but costly time-specific imbalances between supply and demand.

Although there is a degree of vertical integration in the New Zealand electricity market, with all five of the main generators being original retailers in 2001, there has been a steady inflow of new retailers over the last decade. Since 2001, 57 companies have set up as electricity retailers, which with 17 exits, has left 40 retailers in 2021.

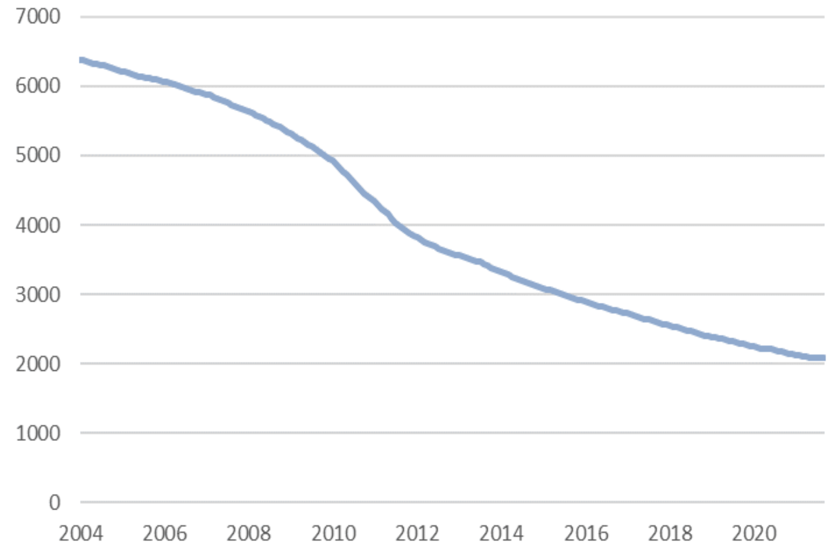
Figure 2: Electricity retailers, count



Source: https://www.emi.ea.govt.nz/Retail/Reports/3CL0V1?_si=tg|market-structure,v|3

The number of retailers in the New Zealand market has grown over time. The increase appears to be indicative of increases in effective competition. Measures of market concentration, based on the Herfindahl-Hirschman index of the share of connections (ICPs), have steadily declined (see Figure 3).

Figure 3: Retail market concentration, Herfindahl-Hirschman index on share of connections



Source: https://www.emi.ea.govt.nz/Retail/Reports/R_HHI_C?_si=tg|market-structure,v|3

Another positive indicator of the health of competition in the retail sector is the amount of customer switching that takes place between retail providers. ERANZ reports that each year more than 400,000 out of New Zealand's 1.8 million households switch retail provider (Electricity Retailers' Association of New Zealand 2019). In 2018, 61% of households (1.1 million) compared their electricity supply plan with alternatives. Of these, 500,000 switched plans, with 50,000 changing plans with the same provider and 450,000 selecting a new provider. Although, on one hand this amount of switching might indicate a degree of dissatisfaction with providers, it also indicates a generally active rather than passive approach by consumers. This willingness to change plans and providers reduces barriers to companies considering entering the retail market and reduces complacency amongst incumbents.[2]

[2] It is difficult to rely on summary observations of prices to assess the intensity of competition – conformity of prices might in some cases indicate strong price competition, in other areas a wide dispersion of prices might indicate strong levels on non-price competition, with consumers willing to pay higher prices for quality or innovative products. An investigation of the degree of symmetry in price movements through the electricity supply chain, as per (Szőke, Hortay, and

For many decades there has been a relatively stable environment of technology for electricity distribution and largely predictable demand growth for electricity. However, the EA notes that the future will not follow this stable path, and the sector will be a key part in shaping the success of New Zealand's low emissions journey.

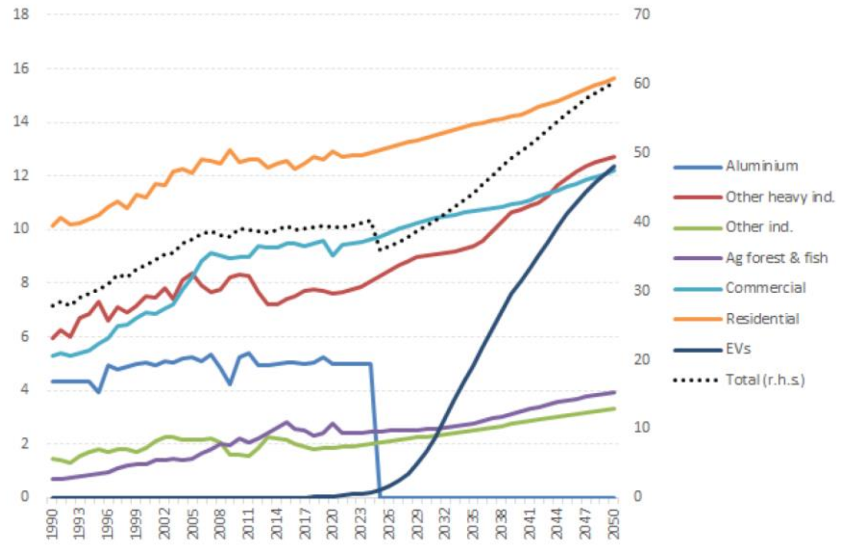
As illustrated in Figure 4, strong growth in electricity demand is expected, with the Climate Change Commission projecting annual electricity consumption to increase from current levels of around 40 TWh to around 60 TWh in 2050. There is also likely to be a large change in the nature of electricity use with almost two-thirds of the growth in electricity demand expected to be due to the expansion of electric vehicles (EVs). Further, the transition to low emissions will influence generation, with increases in renewables energy sources such as wind and solar generation. The complexity of distribution systems is also likely to increase, with more two-way flows such as vehicle or house-to-grid activity, and with the phase out of fossil fuels as a means of managing peak load.

On 21 September 2021, the EA released the Consultation Paper: *Supporting reform to efficient distribution pricing: a refreshed Distribution Pricing Practice Note*. In the Consultation Paper the EA states that supporting reform towards more efficient distribution prices is a priority for the Authority, but that they consider distribution pricing reform is moving too slowly. Efficient distribution pricing is seen as playing a critical role in reducing network upgrade and expansion costs; offering more choice and flexibility for consumers; enabling consumers to make prudent technology investment decisions and helping to deliver New Zealand's target of a low emissions future (p2).

The focus of the Consultation Paper is on distribution sector prices. Our focus in this report is the implications of distribution price reform for the retail sector. In particular, should retailers be obliged to directly pass on the structure of distribution prices to consumers? The Consultation Paper notes that:

> *Distributors' clear view is that changes to distribution pricing will be more effective if clearly reflected in retail prices. (p9)*

Figure 4: Climate Change Commission electricity demand projection for its Demonstration Path, TWh



Source: (Concept Consulting Group Ltd and Retyna 2021)

However, the Consultation Paper also states:

> *the critical concern the Authority has is for the ultimate decision maker,* ***or someone acting on their behalf****, to be influenced by pricing signals being sent from the distribution sector (p9, our emphasis).*

The Paper also notes:

> *In a competitively operating retail market, the argument (around whether retail prices should directly reflect the structure of distribution prices) should in time be moot. (p9)*

As

Balogh 2019) study of the Hungarian electricity market, would extend our understanding of competitive pressures in the New Zealand electricity market.

If the issue is significant enough for customers then a retailer would emerge that passes through distribution price signals directly, and if sufficiently demanded then would enjoy a competitive advantage. (Footnote 5 on p9)

It is the view presented in this report that the retail market is workably competitive. As a result, sufficient market response can come from the proportion of the retail market that is most willing to respond to such price signals without requiring the price signals to be conveyed directly to all consumers. Allowing competitive pressures in the retail sector to reveal who this group is, is likely to be more effective than mandated approaches, and will also result in higher benefits accruing to consumers and the economy over time.

4 Retail pricing: the commercial perspective

In this section we examine commercial factors relevant to retail pricing of electricity. Costs are one aspect of pricing and many retailers may well choose to reflect directly the structure of distributors' prices in their retail prices. But there are other aspects to pricing. In particular, there are the customers and their preferences that will impact on the optimal levels and structure of retail prices.

Customers have diverse backgrounds and different preferences and retailers will wish to take these into account in setting their prices.

In Section 4.1 below we examine the way retailers segment the market to reflect consumers' diverse backgrounds and preferences.

A segmented market is conducive to price discrimination strategies. In Section 4.2 we discuss how matching pricing plans to different preferences is likely to be welfare enhancing.

Finally in Section 4.3 we discuss the implications that new technologies are likely to have on pricing in the electricity retail market.

4.1 Market segmentation

As noted in Section 3.2 above, there is evidence of strong, active engagement by New Zealand households in the electricity market, with 61% of households in 2018 reviewing their electricity plan, and as a result some 500,000 households changing their plan. If the people reviewing their plans were typical, then this statistic would imply that New Zealand households are likely to change their electricity plans every four years on average.[3] Of course, not every household will be as willing to change or even review their plans. For others, the change made this year might not work out as well as hoped, leading to a further change of plans in coming years. The key point being that there is likely to be a wide range of different customer behaviours. These differences will stem from a number of aspects:

- First although electricity has the appearance of a homogenous commodity its intermediate-product nature means that people want different things from their electricity use at different times and places. The requirement for charging an EV will differ from someone wanting to heat their house on a cold day, someone wanting a hot shower, and so on.

- Personal circumstances and capabilities will also differ. For some, their electricity bill may be relatively small compared with their wealth and so they may not be very aware of their electricity costs. As noted by Fletcher (2020) disengagement can be a conscious decision – the reward from engagement might not be worth the effort. For others on tight budgets there might be a very keen focus on managing their electricity costs.

- The intermediate nature of electricity demand also means that electricity use is dependent on appliances. The long life and relative expense of appliances means that transitions in energy use can be slow. The shift to LED light bulbs is likely to take place as bulbs are gradually replaced. For other devices the pace of change will be even slower; one does not expect to change hot-water systems each year but maybe every other decade.

The implication is that there is likely to be considerable market segmentation in retailers' pricing. Such segmentation is likely to encourage suppliers to either target specific market segments and/or use price discrimination strategies to target multiple market segments.

4.2 Price discrimination

Price discrimination is a selling strategy that charges customers different prices for a similar product or service based on what the seller thinks they can get the customer to agree to. In pure price discrimination, the seller charges each

[3] Such levels of switching are not seen in all countries. For example, in a study of switching behaviour in Sweden, (Vesterberg 2018) found that 96%of Swedish households were likely to stay with their existing supplier.

customer the maximum price they will pay. In more common forms of price discrimination, the seller places customers in groups based on certain attributes and charges each group a different price.[4]

Rascher and Schwarz (2010) note that although to "discriminate" simply means to separate or differentiate, the term now carries a more common negative meaning related to the unfair treatment of a person based on the group or class to which that person belongs. Economists, though, still use the word "discrimination" in the term "price discrimination" to mean charging a different price for the same or similar product to different market segments or customers, without any negative undertones.

Price discrimination is only feasible if the following conditions are satisfied:

- firms must have some market power; otherwise the law of one price applies;
- firms must be able to segment consumers, either directly or indirectly (i.e. through the use of self-selection mechanisms); and
- firms must be able to prevent resale or, equivalently, arbitrage across differently priced goods must be prevented. If arbitrage between the different segments cannot be prevented, price discrimination will not be a sustainable strategy.

Importantly, price discrimination, as practiced, typically does not involve identical goods, but rather goods or services which may be identical on many core dimensions, but which differ with respect to ancillary features. Indeed, price discrimination must often go hand-in-glove with some form of product differentiation for it to endure.

Although there can be a perception that price discrimination is about charging higher prices for those who are willing to pay more, it can as much be about providing discounts in order to increase utilisation and lower average costs. As Hal Varian notes:

> *Lowering the price to all customers may well be unprofitable, but lowering the price for the marginal consumer alone will likely be profitable.*
>
> (Varian 1989, p599).

A classic example is airlines offering cheap airfares for stand-by passengers; obtaining some revenue from last-minute bookings helps to increase the profitability of a flight and in so doing spreads fixed costs across a larger number of customers, thus enhancing welfare by reducing the fares charged to all passengers and/or increasing the willingness of airlines to offer more frequent flights. As a result, any industry where marginal cost is less than average cost will tend to price discriminate where possible.

In a study of attitudes to price discrimination (Leibbrandt 2016) found that customers are not generally antagonised by price discrimination: while they are less likely to buy if they are charged a higher price than that charged to another customer, they are also more likely to buy if they are charged a lower price. Indeed, Leibbrandt noted that customers do not prefer to buy from sellers who avoid price discrimination, and that advantageous price discrimination nudges overpriced customers to purchase in competitive markets.

4.2.1 Application to electricity

There is a natural tendency for electricity retailers to respond to the variability of customers by offering a range of plans with different product attributes and prices Rather than symbolising market power, a range of plans is just as likely to reflect non-price competition (ie, the matching of plans to the preferences of households). Effective markets require two-way information flows, it is not just about sourcing the lowest priced goods, but also matching product attributes to demand. The focus of (Electricity Authority 2021b) is primarily on establishing pricing systems that inform consumer behaviour. Just as important is for production decisions to be informed by customer preferences. Creating extra electricity capacity or storage facilities typically adds to the average cost of electricity systems ((Nyamdash and Denny 2013), but if customers are more willing to pay this cost than spend time managing complex price systems, then

[4] https://www.investopedia.com/terms/p/price_discrimination.asp

this is important market intelligence that should inform the strategic plans of generators, retailers and distributers.

The encouragement of priority pricing systems might offer a way for the market to “talk” through the retail sector to the distribution sector. Priority service refers to an array of contingent forward delivery contracts offered by a seller. Each customer's selection of one contract from the menu determines the customer's service order or priority. In each contingency, the seller rations supplies by serving customers in order of their selected priorities until the supply is exhausted or all customers are served.

Priority service can be viewed as a special form of product differentiation in which the market is segmented into a spectrum of priority classes. Those customers willing to pay higher prices are assigned higher priority in receiving the product or service.

Chao and Wilson (1987) show that priority service with only a few priority classes can realise most of the potential gains from efficient rationing. Thus, the fine differentiation of spot prices that is necessary to balance demand and supply continually is not essential to attainment of efficiency, given that some transaction costs are associated with either market organisation. In contrast to spot pricing, priority service leads to a market organisation in which only a relatively few standardised contracts are traded. These contracts supplant the implicitly infinite variety of spot prices, and the continual intertemporal variation, with only slight efficiency losses and appreciable savings on the costs of implementation.

In essence, this implies that obtaining the critical reaction of the retail market to potential supply-demand mismatches does not require a full pass through of spot process to all retail customers to be effective. For example, although peak load issues impose significant costs onto consumers, equivalent to 21% of the average annual electricity bill, incidents are quite rare, meaning that it might only require the responses of a subset of customers to reduce the prevalence of critical peak loads. As long as some people have the incentive to adapt behaviour this can be enough. Thus, as long as retailers receive clear price signals from the distribution sector, they then should be allowed to innovate so as to allow customers to self-select and so demonstrate what their preferences are in terms of either signaling a willingness to pay for more capacity or to minimise their cost exposure.

Finally, it should be emphasised that there are fundamental differences with the non-price competition underpinning price discrimination in the retail sector and the issues being addressed by the EA in (Electricity Authority 2021a) with respect to electricity supply arrangements with New Zealand Aluminium Smelter (NZAS). Key differences include:

- the strong bargaining power of NZAS due to its scale (using 13% of national electricity production);
- the priority position given to NZAS, effectively excluding competitive bids for the electricity used by NZAS from other electricity consumers; and
- the explicit restraint on on-selling rights (the “use-it or lose-it” contract provision[5]).

4.3 Role of technology

In a recent paper, (Concept Consulting Group Ltd and Retyna 2021) consider that electric vehicles (EVs) and hot water will provide almost 90% of the potential for flexibility in net demand from consumer appliances. Their assessment is that these appliances will potentially offer the flexibility required to meet all New Zealand’s network flexibility requirements, and also some proportion of the country’s generation flexibility requirements. Although they note that EVs and hot water can’t contribute to providing dry-year flexibility, neither can any of the other consumer flexibility resources such as other smart appliances and batteries.

Concept Consulting Group Ltd and Retyna (2021) considers EVs and hot water will dominate the market for flexibility because of their scale of energy use and because they are both storage technologies. They are both capable of re-charging outside of peak periods without compromising the quality of service

[5] We note that restricting on-selling rights is one of the critical pre-requisites for price discrimination, therefore it is highly likely that the prohibition of “use-it or lose-it” clauses would be sufficient to protect the market from the concerns expressed in (Electricity Authority 2021a).

they deliver – ie, consumers can still have hot water when they need it and can drive their car when they want to. Other technologies, such as space heating or fridges, are much more limited in their ability to reduce demand without impacting service quality – especially for the extended control hours needed to manage peak demand on the very coldest days.

Concept Consulting Group Ltd and Retyna (2021) finds that:

- access to flexibility for relatively small amounts of time (typically less than 1% of the year) can deliver significant cost savings, with rapidly diminishing returns from further access;

- most of the benefit is from avoided network costs (mostly distribution), with avoided generation costs accounting for just over one-third of the benefit;

- although there are some periods of the year when flexibility is generally more important (ie, predominantly in winter, and never overnight) there is significant randomness as to which days require flexibility, and how much flexibility for how long is required on different days; and

- there is significant geographical variation as to when and where flexibility is required to avoid distribution network costs. Also, the location will change over time as network investments are made to address capacity shortages. In contrast, there is little geographic variation as to where flexibility is required to avoid peak generation costs.

Hot water ripple control is currently widely used within New Zealand, with consumers enjoying a lower price which is intended to reflect the avoided peak network costs associated with networks being able to manage these appliances.

However, ripple technology cannot provide the highly granular control that would be most useful for managing large-scale EV charging. In contrast, internet-based communications can deliver appliance-specific control, with a growing number of trials in New Zealand and overseas successfully demonstrating the potential for this technology. Such appliance-specific control can also readily enable flexibility to be provided for network and generation purposes – something that is not feasible at scale with ripple technology.

Whereas ripple control requires a single control infrastructure across each network, internet-based control does not need all appliances in a network to be using the same system – it is entirely feasible to have adjacent households whose appliances are controlled by two different systems.

Types of electricity tariffs that can be used to help manage system peak loads include

- *Time-of-use* (TOU) *pricing* where peak and off-peak periods are defined in advance with different price levels for each period.

- *Coincident peak demand* (CPD) pricing, which involves applying a $/kW rate for consumption during actual periods of system peak demand, whenever they may be. Typically, the CPD rate would be applied during the top 50 or so hours of system peak in the year.

- *Managed appliance tariffs* allow for specific tariffs for appliances that an electricity supply company can control at times of stress on the network. In return for granting the electricity company the rights to control the appliance, consumers are typically offered a discounted price, reflecting that such appliances make a much smaller contribution to capacity investment pressure.

Issues with these tariff systems include:

- Managed appliance tariffs will typically apply to a subset of electrical appliances, ripple control is already a common form in New Zealand used for hot water heating, but with added sophistication could be applied to electric vehicles. The rest of the property's consumption would still need to be charged via another tariff – eg, TOU, CPD or flat tariffs. The introduction of managed appliances could also lead to households having multiple retailers. For example, a household could use one retailer to manage specific appliances (eg, EV charging) and have another, more traditional, retailer organising other household electricity use.

- Both time-of-use and coincident peak demand tariffs place the onus on individual consumers to respond to the price signals and provide the flexibility response at the times and locations required, whereas managed appliance tariffs allow the supplier to call upon flexibility from the appliances when and where it is required.

- Time-of-use pricing can lead to new peak demand periods. For example, (Concept Consulting Group Ltd and Retyna 2021) noted that in San Francisco the introduction of post-midnight rates for EV charging led to surges in demand at midnight. This is because users are more likely to time their use at the beginning of the low-rate period so that everyone set timers to begin charging at midnight, rather than at staggered rates over the entire low-rate period.

The Lines Company (the network company serving the King Country) introduced coincident peak demand pricing in 2007. However, following significant public and political disquiet with its consequences, it dropped the approach in 2018. No New Zealand network company or retailer currently implements coincident peak demand pricing in a form that results in mass-market consumers facing such price signals. (Concept Consulting Group Ltd and Retyna 2021) argue that difficulty in understanding, coupled with the extreme prices during coincident peak demand periods and not knowing in advance which of the 50 or so hours in the year are going to be classed as system peak, can create significant uncertainty and fear among many consumers.

(Concept Consulting Group Ltd 2018) demonstrates that there is little to no difference between coincident peak demand and time-of-use pricing options in terms of the economic price signal regarding:

- what appliances to buy (eg, whether to convert to LED lighting, from gas to electric heating, or from a fossil-fuel to electric vehicle); and

- what regular patterns of use to encourage.

They argue that the only appliance where coincident peak demand is almost always going to send a stronger signal than a time-of-use structure is space heating. This is because space heating is the activity that is most strongly associated with extreme peak demands. However, this difference in signal between coincident peak demand and a ‘reasonably’ structured time of use is one of degree, rather than being fundamentally different. They also note adverse social consequences (including to human health) of having a tariff that gives rise to some consumers (generally the most vulnerable) being afraid to turn their heating on. Additionally, the EA’s review of The Lines Company’s experience with coincident peak demand pricing found that many consumers found it confusing resulting in them making the wrong appliance choice.

In summary, new technologies like the spread of electric vehicles, in combination with hot-water storage technologies and managed-appliance tariffs have the potential to allow automated systems to greatly improve peak-load management without needing direct pass through of distributor prices by all retailers. A further result is likely to be the arrival of retailers specialising in managed-appliance tariffs and an increasing number of households using more than one retailer.

5 Public-policy perspectives

Assessing the presence of market failure is a prerequisite (necessary condition) for considering the involvement of government. If a market failure can be established the follow-up requirement is that one also needs to establish that the involvement of government will not create a worse set of problems. The nature of proposed intervention needs to address the identified market failure.

It is not obvious that any material market failure is present in electricity retailing:

- as noted above, the retail electricity market is quite competitive. There are around 40 electricity retail firms in New Zealand;
- there has been a relatively free flow in and out of the industry since 2001, with 49 companies joining the original 8 retailers and 17 companies exiting the industry since 2006;
- there is a steady flow of retail customers reviewing and changing their retail plans, around one quarter of the market every year; and
- as a result the market has been getting steadily less concentrated each and every year since 2004.

As we have discussed, the diversity of circumstances and uses for electricity mean that there is a varied demand for electricity. Price discrimination is a common commercial response to market segmentation, and as long as there is flexibility in choice of plan and provider, price discrimination is usually welfare enhancing - it allows consumers to select the package that best suits their specific requirements.

The EA's Consultation Paper is focussed on the role that cost-reflective pricing can be used to promote the efficient use of the network, both now and into the future. Network efficiency is a desirable goal. But this efficiency needs to be co-ordinated with customer preferences. Electricity is not produced and distributed for its own sake, but in order to meet the demand of customers. The retail market provides the interface between production and consumption. Markets have proved to be effective rationing mechanisms because they allow a matching between production realities and consumer preferences. Prices provide signals in both directions, about the costs of supply to consumers and about consumers' willingness to pay for different goods and services to producers.

Markets are where consumers reveal their preferences.

Different consumer circumstances and aspirations mean that it is likely to be very difficult (if not impossible) to design a regulatory framework that will meet all of these differences. As noted in (Oxera 2016):

> *It can be difficult to predict the consequences of interventions in a market, especially if consumers display particularly biased behaviour. Unintended consequences of policy changes can be severe. There is a risk of worsening consumer outcomes, decreased competition, and increased regulatory instability (e.g. when additional interventions take place to counteract an original, poorly designed policy). This could have knock-on effects on related industries—for example, increased regulatory risk in retail energy could increase risk in energy generation, leading to reduced investment, potential problems with generation capacity, or a greater carbon footprint.*

(Oxera 2016) also gives the interesting example of the US Federal Reserve considering a policy requiring mortgage brokers to disclose commission levels to potential customers. However, trials of this policy indicated that consumers were putting too much weight on information about commissions relative to the total cost of the mortgage (partly because commissions were displayed in dollars, whereas interest rates were presented as percentages, meaning that additional computation was needed to make the figures comparable). Consumers ended up paying more for their mortgages when commissions were made transparent than they would have done otherwise, and the policy was not implemented due to its adverse outcome for consumers.

In a similar vein, given 20-20 hindsight, what has been the cost of the Low Fixed Charge electricity pricing regulation experiment in New Zealand?

There is a risk that directly signalling the value of flexibility through dynamic and highly-locational tariffs will produce highly volatile and consumer-unfriendly tariffs that very few users would be able to monitor and respond to effectively. Like with the US mortgage broker initiative, outcomes might not be as intended. The experience of The Lines Company's past implementation of such tariffs recommends caution.

Finally, a potential risk is matching any regulatory response to the size of the problem – there is always the risk of using a regulatory mallet to smash a peanut-sized problem. For example, although peak-load management imposes significant costs on customers (21% of the average electricity bill in the year to March 2021 according to (Concept and Retyna, 2001)), these costs are borne to meet relatively rare peak load risks. Obtaining market responses does not necessarily require price signals and response to the entire retail market to mitigate peak load risk. As the EA notes:

> *If the issue is significant enough for customers then a retailer would emerge that passes through distribution price signals directly, and if sufficiently demanded then would enjoy a competitive advantage. (p9, Footnote 5).*

Allowing market responses like this will encourage retail sector innovation to allow customers to self-select between desires to either minimise electricity costs or other factors such as minimising price variability or the time that customers need to invest in managing their electricity use.

Potential innovations can come through:

- an expanded role of specialist flexi-traders;
- increased ability for consumers to segment their electricity supply arrangements (eg, using managed-appliance tariffs for EVs and hot-water and perhaps fixed-price contracts for other devices);
- reduced noise around household electricity prices giving consumers more certainty about electricity costs and thus more confidence about switching from fossil fuel to electrical devices; and
- the matching of tariffs to household preferences and circumstances. For example, there could be demand for fixed-sum tariffs for households who struggle coping with seasonal swings in electricity costs.

The implication of this is that the onus of proof for regulation should be expected to lie with the regulator, the default position with workably competitive markets like the electricity retail market should be no regulation. Robust analysis of the net impacts (eg through cost-benefit analysis), distribution impacts (ie, identifying potential winners and losers), and assessment of potential unintended adverse impacts (with associated contingency plans) are prerequisites for the imposition of sound regulation. (Oxera 2016) argues that policymakers should test the effects of a proposed policy before it is rolled out to the entire market. This can be done using field, laboratory or natural experiments.

6 Conclusions

Like all countries, New Zealand faces a number of challenges in moving its economy onto a carbon-neutral basis. However, the successful transition will also offer the electricity industry great opportunities. Electricity is well placed to be the dominant deliverer of renewable energy. This is expected to see a 20 TWh or 50% increase in annual electricity consumption over the next 30 years. At the same time, the expansion of electric vehicles and the introduction of appliance-management systems will greatly enhance the industry's ability to manage peak-demand fluctuations.

The EA rightly wants to continue seeing the management of the electricity sector evolve, to ensure that it is run as efficiently as possible and that the nation's transition to carbon neutrality is managed as smoothly as possible. Effective distribution sector price signals will be an important component assisting this transition.

Our analysis finds that the effectiveness of transparent distribution price signalling does not depend on a mandated pass-through to end-consumers of distribution prices by the retail sector. Sufficient market response can come from the proportion of the retail market that is most willing to respond to such price signals without requiring the price signals to be conveyed directly to all consumers. Allowing competitive pressures in the retail sector to reveal who this group is, is likely to be more effective than mandated approaches, and will also result in higher benefits accruing to consumers over time.

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