Memo

To	John Harbord and Ralph Matthes
CC	
From	Mike Hensen
Date	21 June 2018
Subject	Electricity price history in New Zealand

Purpose

This note describes electricity price changes over the period 1985 to 2017 and lists the key changes in the electricity market over this period and the data sources used in the comparison. The note is based on electricity price and consumption data published by the Ministry of Business, Innovation and Employment (MBIE), Electricity Authority (EA) and Transpower.

Overall trends

Total price for residential, commercial and industrial[1]

Figures 1 and 2 below show residential electricity prices have increased in both real and nominal terms over the period 1985 to 2017 while:

- commercial prices have remained flat in real terms
- industrial prices fell in real terms until 2002, increased over 2003 to 2004 and remained flat in real terms from 2005 to 2017.

The following table compares the compound annual growth rate (CAGR) in real[2] electricity prices over the periods 1985 to 2000 and 2000 to 2017 for residential, commercial and industrial consumers (a summary description of the price movements shown in Figure 2).

Table 1 Change in real electricity prices by consumer group

CAGR and total percentage change over the periods 1985 to 2000 and 2000 to 2017

Consumer group	CAGR		Entire period	
	1985 to 2000	2000 to 2017	1985 to 2000	2000 to 2017
Residential	2.05%	2.36%	36%	49%
Commercial	-1.65%	0.34%	-22%	6%
Industrial	-0.64%	0.78%	-9%	14%

Source: NZIER

Figures 1 and 2 also include a simple annual average of the wholesale electricity[3] prices from 1996 when the wholesale market was established. This simple average price is not weighted by demand

1 Source: 'Energy Prices', Energy & Building Trends, Ministry of Business, Innovation & Employment, available at http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/prices

2 For residential electricity prices 'real' means adjusted for inflation as measured by the Consumer Price Index. For commercial and industrial electricity prices 'real' means adjusted for inflation as measured by the Producers Price Index (Inputs).

and therefore understates the effect on consumers of the higher electricity prices in peak demand periods. Appendix A compares the simple average wholesale price from 2009 to 2018 with the demand weighted wholesale prices data published by the EA.

Retail electricity price components – lines and energy

Figure 4 below shows steady increases in both energy and lines prices in nominal terms for the model[4] residential consumer surveyed by MBIE. Figure 5 shows the drivers of residential electricity price movements (adjusted for inflation). In 'real' terms:

- total residential electricity prices increased at a CAGR of 2.08 percent over the period February 2000 to February 2018 (45 percent over the entire period) comprising increases in:
  - lines prices at a CAGR of 1.25 (25 percent over the entire period)
  - energy prices at a CAGR of 2.74 (63 percent over the entire period)
- energy price increases were the main driver of residential price increases over the period 2001 to 2009, line prices increased more quickly than energy prices over the period 2010 to 2014 and since 2014 they have increased at about the same rate.

Retail and wholesale prices – apples and oranges

A simple comparison of the price indexes summarised above and graphed in the Figures 1 and 2 overlooks important differences between the structure and drivers of electricity prices for these consumer groups:

- industrial and some commercial consumers are less exposed to expensive peak generation than retail consumers because they tend to have more stable and predictable demand for electricity and more ability to limit electricity usage in expensive peak periods. (Figure 3 shows the difference between the simple average of wholesale prices at 'residential peak' periods only and for 'all trading' periods)
- nearly all retail consumers are charged a pre-agreed flat rate per unit of electricity[5] but are not exposed to short term volatility in wholesale electricity prices while large commercial and industrial consumers are exposed to short-term fluctuations in wholesale electricity market prices which are reset every half hour
- industrial and commercial consumers are not exposed to costs associated upgrading the low voltage distribution network because they do not use this part of the network.

The pricing review starting point for the comparison of retail, commercial and industrial electricity prices (2000) roughly coincides with the end of excess hydro generation capacity and the need to construct new thermal capacity to meet peak demand.

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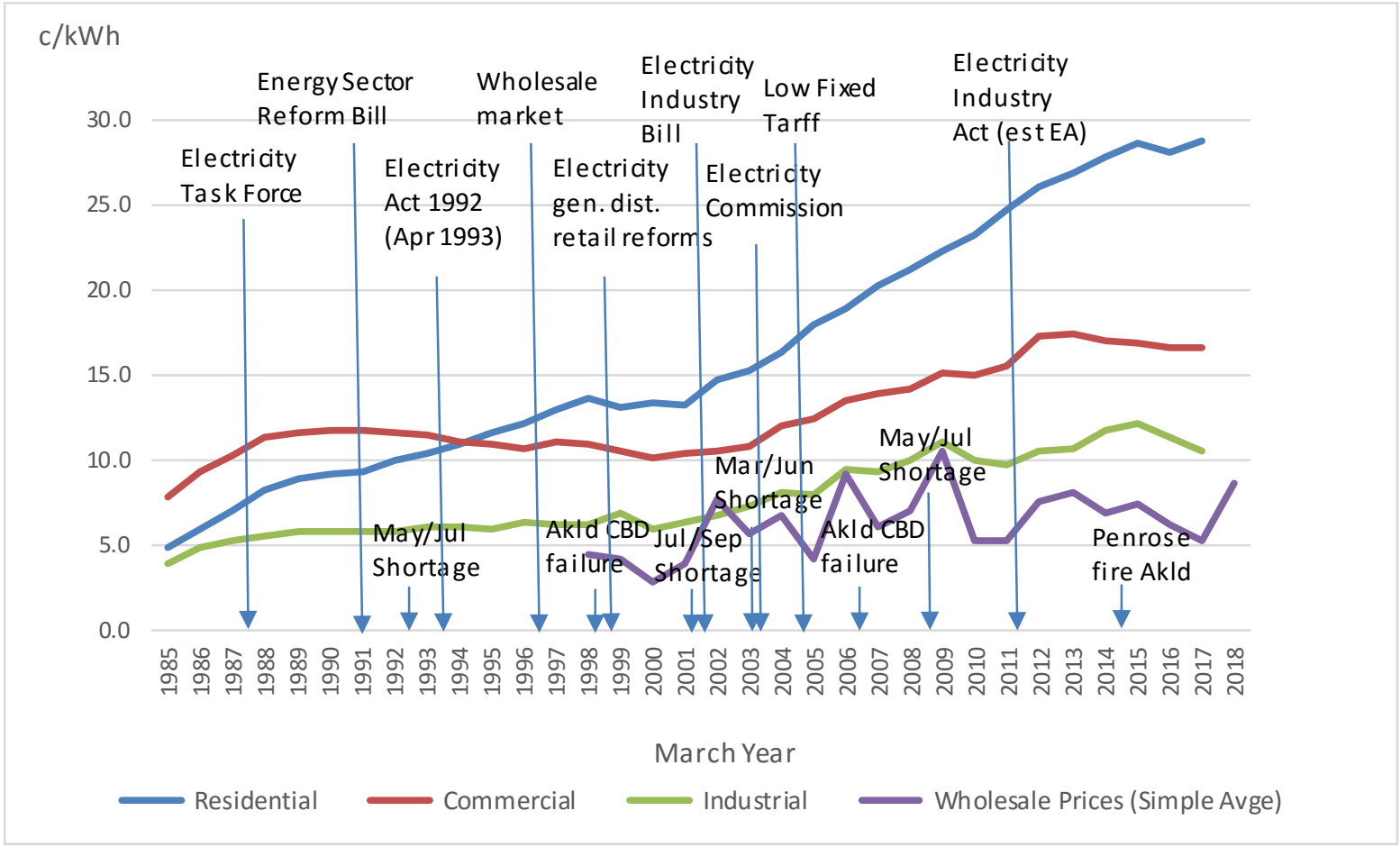
3 The source for the price data is the 'Final' wholesale electricity prices published by the Electricity Authority available at https://www.emi.ea.govt.nz/Wholesale/Datasets/Final_pricing/Final_prices. The final price files provide the wholesale electricity price for each grid exit point measured once every half hour. The simple annual average is the sum of all those half hourly price observations for every node over each year ending 31 March divided by the number of observation over the same period.

4 The model residential consumer uses 8000 kWh in a year, on a 'low user' plan with low fixed charges, receives any available prompt payment discounts (including electronic or online only discounts) and is on the most common, controlled, retail metering configuration in their town. The prices include GST. The lines component includes transmission and distribution costs. The energy component includes metering costs.

5 Flick Electric which has about 1.1 percent of retail consumers (measured by number of 'Installation Control Points') as at 30 April 2018 gives its customers direct exposure to wholesale electricity prices. After retail consumer reaction to spikes in wholesale prices last in 2017, Flick has introduced 'Volt' - a product to help consumers to 'save' for unusually high prices.

Figure 1 Electricity prices (nominal) – residential, commercial and industrial

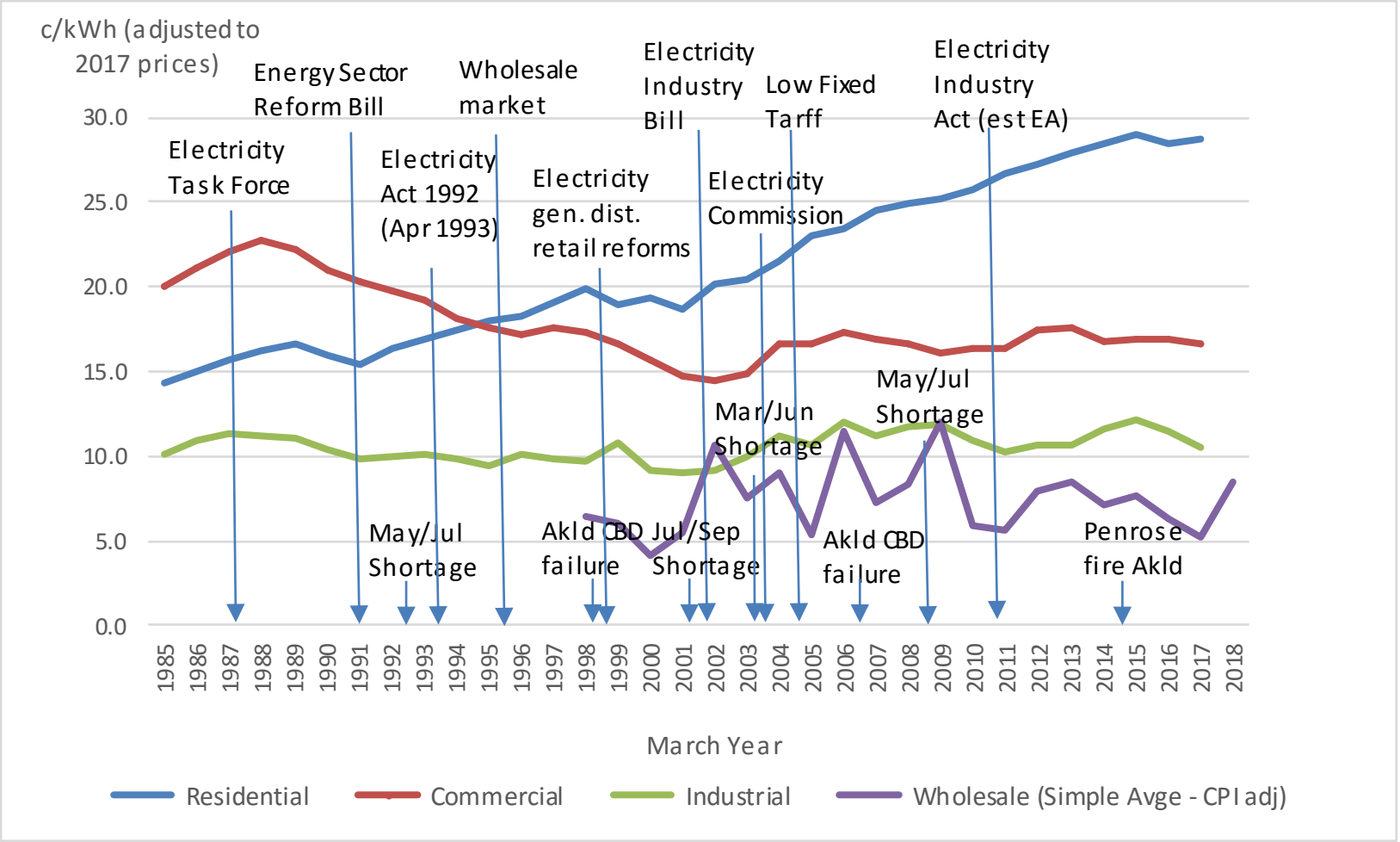
Nominal cents per kilowatt hour (kWh)



Source: NZIER analysis of MBIE energy price data

Figure 2 Electricity prices (inflation adjusted) – residential, commercial and industrial

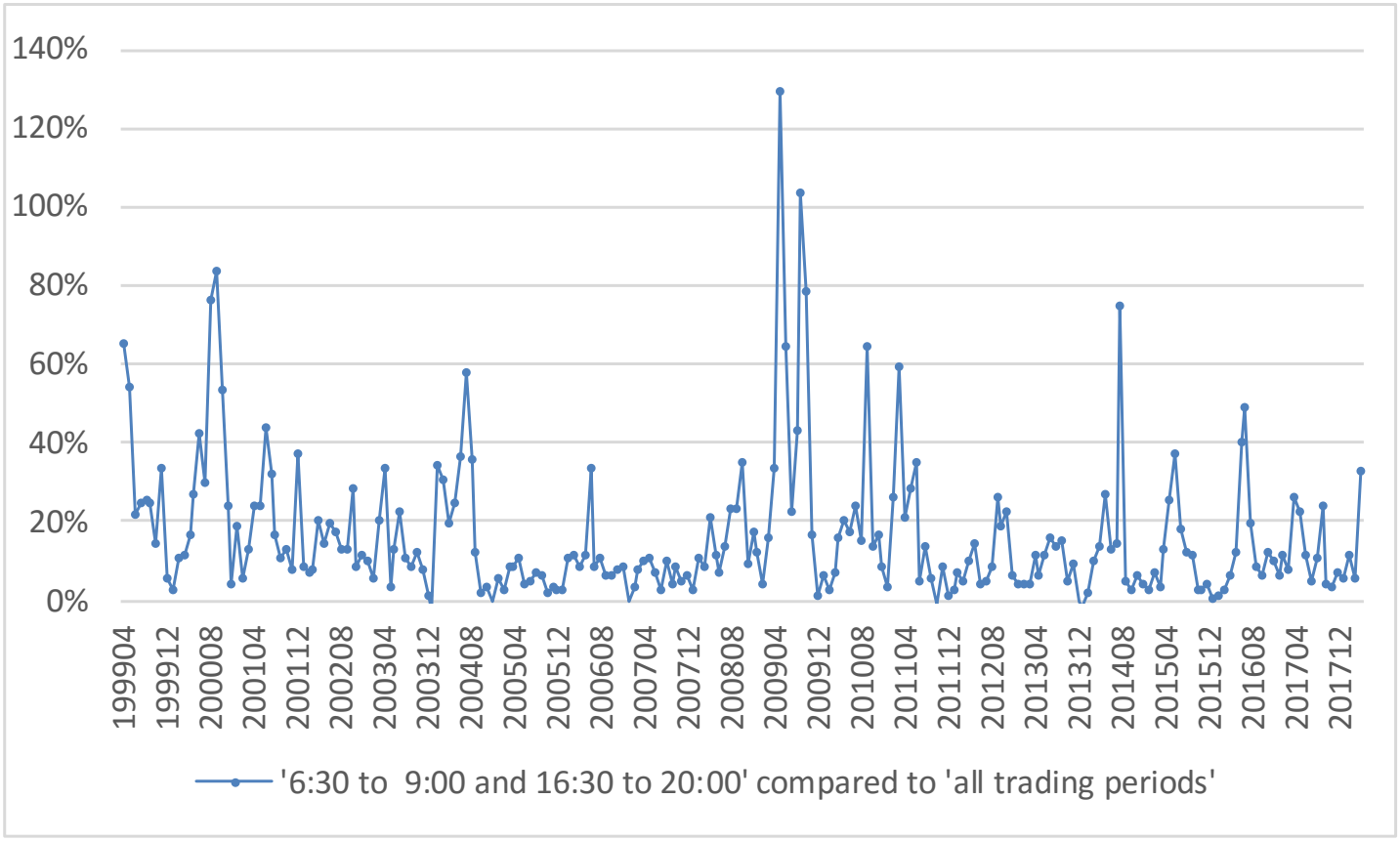
Cents per kWh adjusted to 2017 consumer prices for residential consumers and 2017 producer prices (inputs) for commercial and industrial consumers



Source: NZIER analysis of MBIE energy price data

Figure 3 Wholesale prices -residential peak 'premium' over all trading periods

Difference between the simple average of wholesale prices over 6:30 to 9:00 and 16:30 to 20:00 and simple average over all trading periods as a percentage of the average over all periods

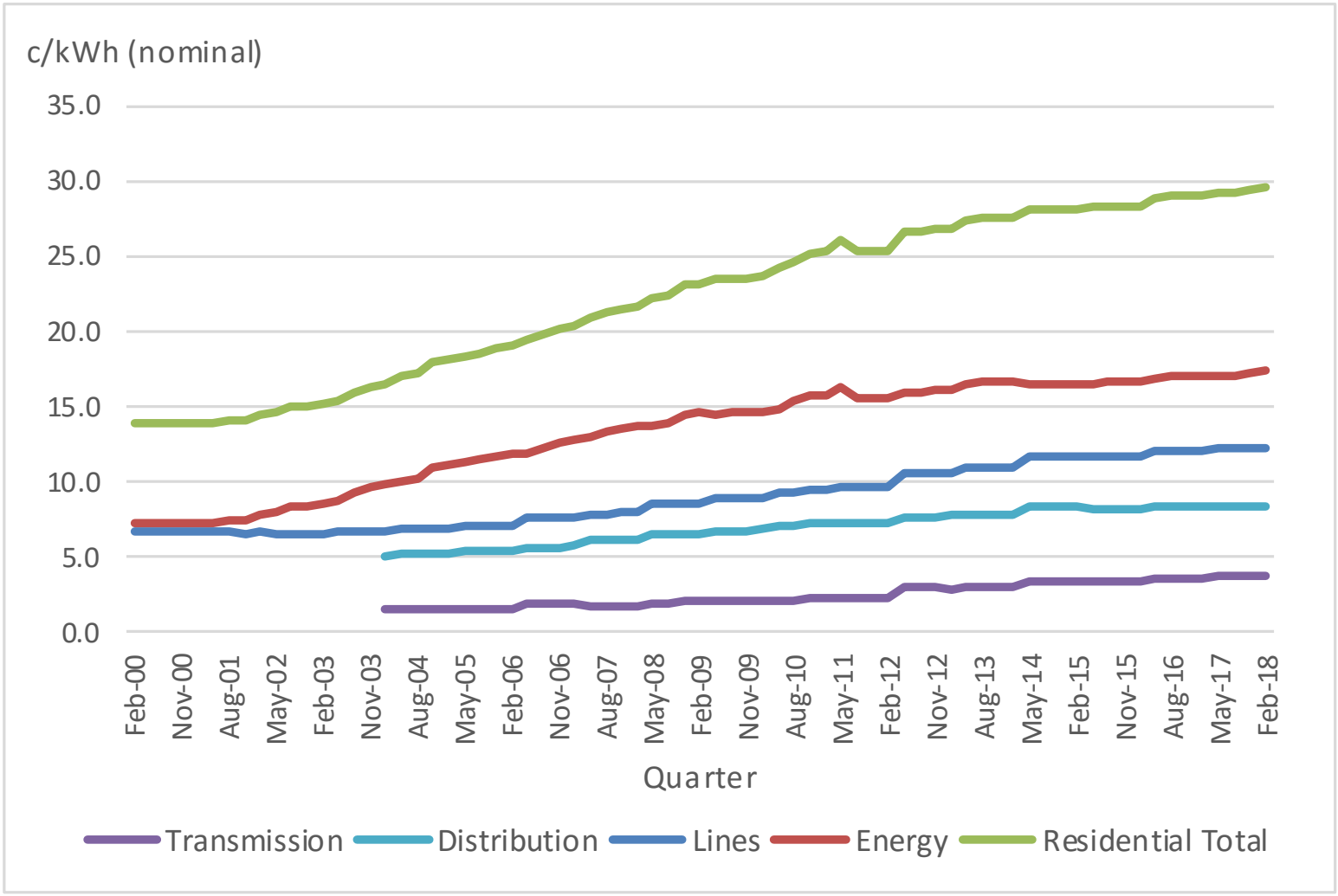


Source: NZIER

The monthly simple average of wholesale prices for peak residential periods was on average 16 percent higher than the monthly simple average for 'all trading' periods over April 1999 to April 2018 (the time shown in Figure 3). This difference gives a very rough starting point for a low side estimate of the wholesale electricity price 'premium' that residential consumers pay to have 'on demand' access to electricity at peak times. A better estimate of the impact of the peak usage premium on total residential electricity costs would be based on the average of wholesale prices weighted by electricity demand in each wholesale price period and allowance for a proportion of residential demand that is met overnight.

Figure 4 Residential electricity prices (nominal) attributable to 'lines' and 'energy'

Cents per kWh

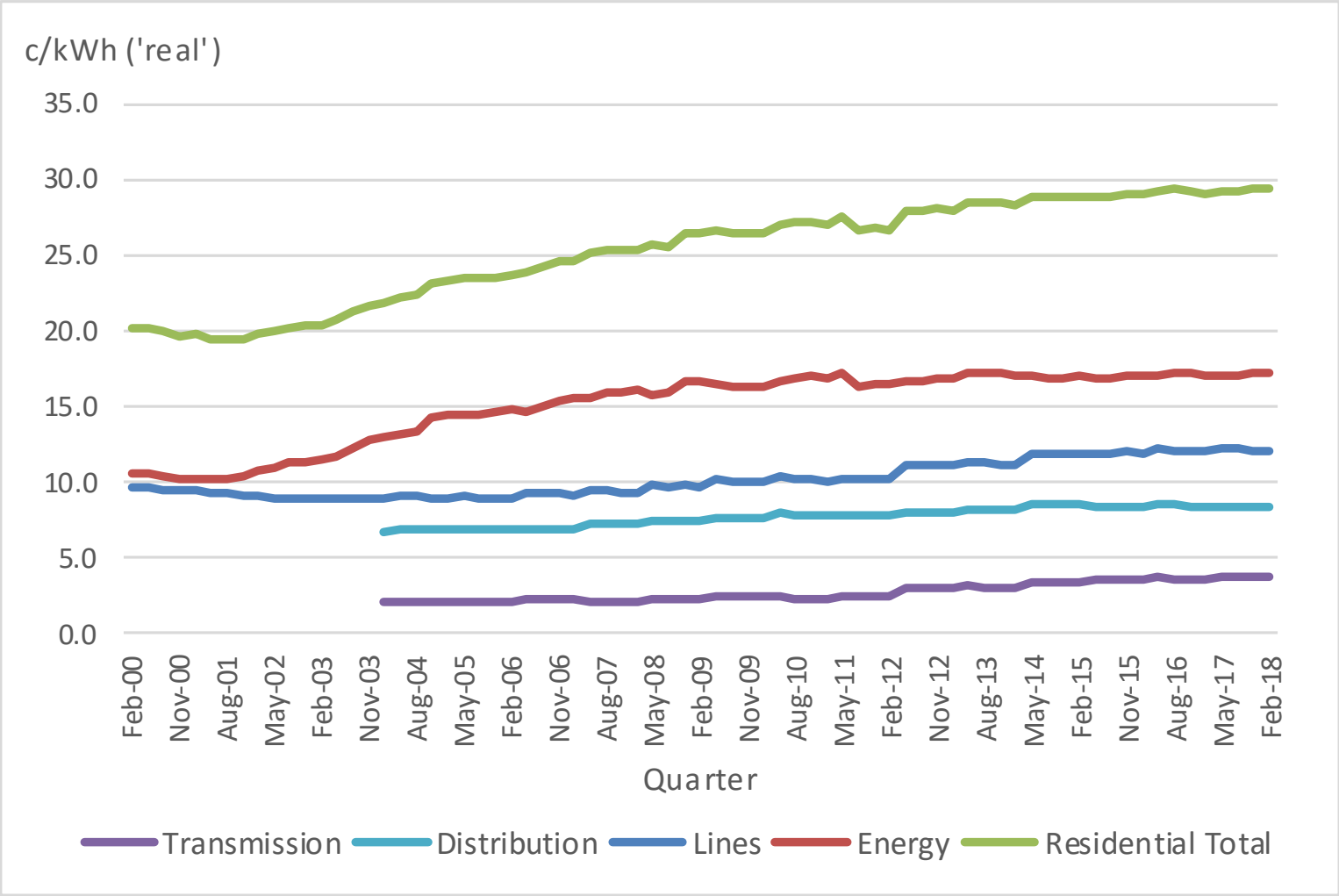


Source: NZIER analysis of MBIE electricity price survey data

'Transmission' and 'Distribution' are MBIE estimates of the two components of 'Lines'.

Figure 5 Residential electicity prices (real) attributable to 'lines' and 'energy'

Cents per kWh adjusted to March 2017 consumer prices



Source: NZIER

'Transmission' and 'Distribution' are MBIE estimates of the two components of 'Lines'.

Data sources

The three main sources of electricity price information are MBIE sales based information and electricity price surveys which report average annual:

- 'residential', 'commercial' and 'industrial' electricity prices – 1975 to 2017[6]
- 'Sales-based Electricity Costs (QRSS)'- 'residential' electricity prices separated into 'lines' (transmission and distribution) and 'energy and other' based on sales data– 2005 to 2017[7]
- 'Quarterly Survey of Domestic Electricity Prices (QSDEP)' - 'residential' electricity prices separated into lines (with estimates of transmission and distribution as separate charges) and 'energy and other' based on survey data – 2000 to 2017 [8]

In addition, we have used the EA data on 'Final' wholesale market electricity prices by trading period for each grid exit point to calculate monthly and annual averages of wholesale prices across all grid exit points by trading period.

The MBIE data does not provide information on the separation of residential electricity bills into lines and energy components before 2000 or any information on the separation of electricity bills for commercial and industrial users into 'lines' and 'energy' components at all. This is an important aspect in explaining the drivers of the differences between residential commercial and industrial electricity prices as:

- industrial and some commercial consumers tend to have more stable and predictable demand for electricity and more ability to limit electricity usage in expensive peak periods than residential consumers which means they are less exposed to high priced peak generation than residential consumers
- industrial and commercial consumers incur a share of transmission (national grid) and none or only part of the increase in distribution charges as they may be directly connected to the national grid or if they are consumers of a distribution company may only use the high voltage part of the distribution company network. Residential consumers are fully exposed to transmission costs and distribution company costs for both high and low voltage networks. As these are long-lived large-scale assets, capacity has[9] to be increased in much larger steps than the increments in short-term consumer demand and with a strong bias to ensuring security of supply – which can require price increases in the early life of the assets.

The EA data does not classify demand as residential, commercial or industrial by grid exit point. The demand met at many of the high volume urban grid exit points is a blend of these consumer groups.

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6 'Energy Prices', Energy & Building Trends, Ministry of Business, Innovation & Employment, available at http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/prices

7 'Residential sales-based electricity cost data March year 2005 to March year 2018' available http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/prices/electricity-prices. For this analysis we have used the survey data rather than the billing data as the survey data covered a longer period and estimated the separation of the lines price into transmission and distribution components.

8 Two MBIE data series are used for this analysis. The primary series covering the period 2004 to 2017 is 'Quarterly Survey of Domestic Electricity Prices', 15 February 2018,MBIE, available at http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/prices/electricity-prices.The secondary series covering the period 2000 to 2004 is 'Quarterly Survey of Domestic Electricity Prices to 15 February 2013' MBIE, available at www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/prices/electricity-prices/archive-electricity-price-surveys.

9 The word 'has' is extremely terse shorthand for a very complex balancing of minimizing the construction cost of long-lived assets while meeting projected demand growth over a 20 to 30-year period. Once investment in transmission and distribution assets is made the regulated rate of return on these assets plus costs is recovered from consumers irrespective of how fully the capacity is used.

Appendix A Wholesale electricity price data

Introduction

Wholesale electricity price and demand data is published by the EA in separate files (with different formats) from 1996 to now while demand weighted prices are published by the EA from July 2009 to now. The demand weighted data is a better comparator for the MBIE price data shown in Figures 1 and 2 but only covers about half the period considered by the pricing review. (In the time available, it was not possible to combine the pre-2009 price and demand files to calculate demand weighted prices from 1996 to 2009.)

As a starting point for the analysis of the drivers of differences between residential and wholesale energy prices the following charts compare the:

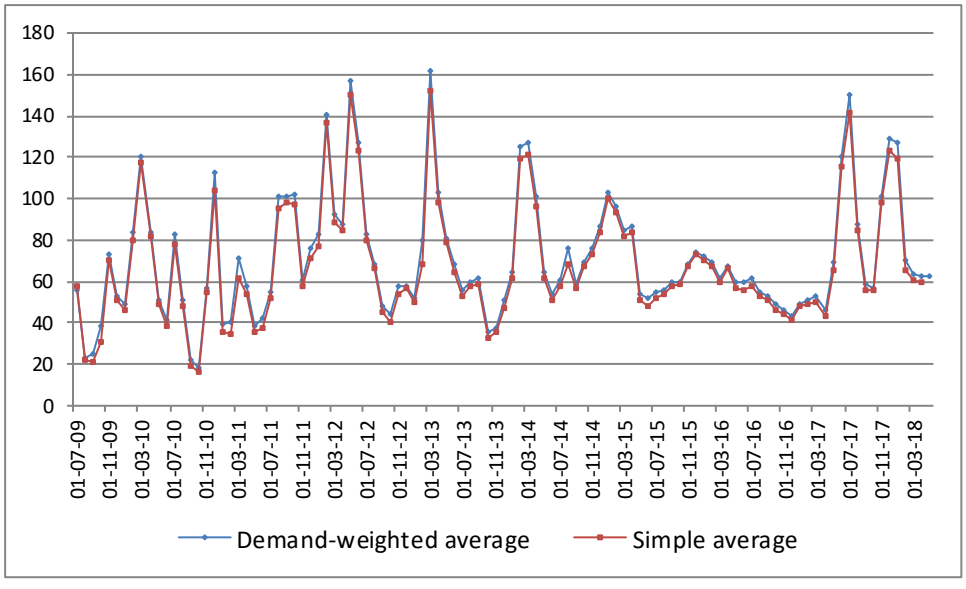
- simple average and demand weighted average wholesale prices to illustrate the effect on peak prices
- the simple average wholesale price for all trading periods and peak periods (which are the main times when residential consumers are using energy).

Demand weighted vs simple average

Monthly average wholesale prices (shown in Figure 6) are volatile with the peak monthly price up to four to six times that of the trough within a three to four-month band. Demand weighted prices during the peaks are 10 to 20 percent above the simple average but the demand weighted and simple average prices are much closer for troughs.

Figure 6 Monthly average wholesale electricity prices

Simple and demand weighted ($ per MWh)



Source: NZIER

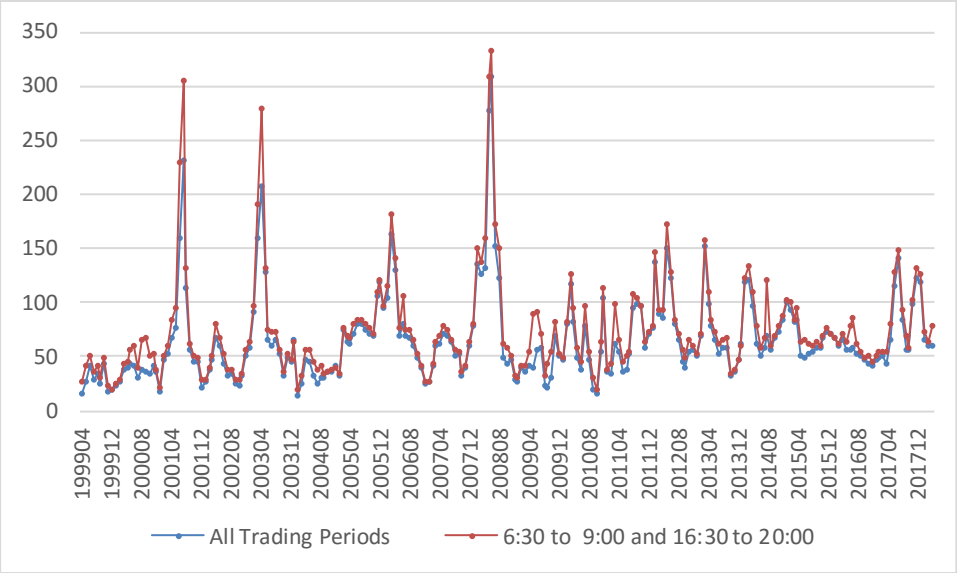
Residential peak vs all trading period averages

Simple average monthly prices for the 'residential peak' periods (shown in Figure 7) are:

- 10 - 15 percent above the average for ‘all trading’ periods for 40 percent of the trading periods over April 1999 to April 2018
- more than 15 percent above the monthly simple average for ‘all trading’ periods for one third of the trading periods over April 1999 to April 2018.

Figure 7 Monthly averageprices ‘peak’ and ‘all trading periods

Simple average ($per MWh)



Source: NZIER

Appendix B Transmission charges

Introduction

Figures 4 and 5 are based on a survey of residential consumers (QSDEP) and include an estimate of the transmission charges paid by residential consumers over the period February 2004 to February 2018. Over this period 'real[10]':

- transmission charges increased by 84 percent from 2.07 cents per kilowatt hour (kWh) to 3.81 cents per kWh – a CAGR of 4.4 percent
- distribution charges increased by 22 percent from 6.80 cents per kilowatt hour (kWh) to 8.29 cents per kWh – a CAGR of 1.4 percent.

Transpower data

Transpower has published data on transmission charge components for the period 2009 to 2018 but historical data on how these charges are allocated between electricity distribution businesses (EDB)[11] and direct connects or across EDB consumer groups is not readily available. Also data published by MBIE on electricity consumption[12] is not disaggregated by consumer group until 2013. An estimate of the average transmission cost per kWh of energy consumed is shown in the following table.

Table 2 Average transmission costs

Nominal cents per kWh

March Year	Transmission charges ($ million)				Electricity consumed (GWh)	Transmission cost (cents per kWh)
	Connection	Inter-connection	HVDC	Transmission total		
2009	122.8	385.8	83.0	**591.5**	38,433	**1.54**
2010	127.0	411.5	78.3	**616.9**	39,550	**1.56**
2011	126.2	413.6	84.8	**624.7**	39,996	**1.56**
2012	119.0	447.1	117.1	**683.2**	39,341	**1.74**
2013	128.7	547.0	128.8	**804.4**	39,136	**2.06**
2014	135.7	574.2	162.5	**872.3**	38,951	**2.24**
2015	138.1	661.1	145.0	**944.2**	39,166	**2.41**
2016	127.7	632.2	149.9	**909.8**	39,659	**2.29**
2017	128.6	662.1	152.3	**942.9**	38,802	**2.43**
2018	127.0	715.2	149.2	**991.4**		

Source: NZIER

[10] Nominal transmission charges adjusted for movement in the CPI so that they are all stated in March 2017 prices.

[11] Transpower has published transmission costs for EDB for 2014 and 2015 and the transmission pricing methodology papers published by the EA in 2016 included an indication of the allocation of interconnection and HVDC transmission charges across EDB, direct connects and generators. Only some EDB information disclosures (published by the Commerce Commissio) report transmission costs.

[12] 'Electricity graph and data tables' produced by Energy & Building Trends, MBIE, available at http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/electricity.