



Oakley Greenwood

Causes of residential electricity bill changes in Victoria, 1995 to 2017

prepared for:
Victorian Electricity Distribution
Businesses



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1. Background

Residential electricity prices- which had been fairly stable in real terms across the National Electricity Market (NEM) from the mid-nineties through to about 2006¹ - began increasing significantly in 2007 in some jurisdictions and in 2008 in others. By 2012, after four to five successive years of increases that in several jurisdictions were 10% or more annually, electricity prices had become a topic of national political concern. In much of the media commentary about these increases, network charges - the costs included in consumers' bills for the physical delivery of electricity and related services² - had been identified as the main cause of the increases.

As part of the discussion about electricity prices, the Victorian electricity distribution companies asked Oakley Greenwood to provide an independent analysis of the various charges that make up the bill of an average residential electricity consumer in Victoria, and how that has changed over time. The results of that analysis were published in March 2013. That analysis demonstrated that the amount by which the price of electricity had increased - and what had driven the increase - varied significantly from state to state.

A follow-up study was published in April 2014 that updated the information in the first study through 2013. That study went beyond the earlier report in two ways:

- It identified the impact of government policies on the retail portion of the bill as well as on the network portion³, and
- It extended the timeframe considered by including 1995⁴, the year before the Victorian electricity distribution businesses were privatised, and 2013, one additional year to the timeframe addressed in the previous report.

A third study, published in December 2014, updated results through 2014 and provided one additional bit of information to what had been presented in earlier reports: It disaggregated the category labelled *Wholesale energy and retails costs* that was presented in the earlier versions into

- Wholesale electricity costs, and
- Retail operating costs and margin.

1 In Victoria, the amount paid by the average residential consumer actually declined in real dollar terms between 1995 and 2001, and between 2001 and 2006. Further detail is presented in Section 3.1.

2 The term 'networks' refers to both electricity transmission and distribution companies. Transmission companies transport electricity in bulk (at high voltage) from major generators directly to very large customers, and to the start of distribution networks. The voltage is then reduced and distribution companies deliver electricity directly to industrial, business and residential consumers.

3 The March 2013 report only identified those policy costs associated with environmental impacts and metering that affected the network portion of the bill. By also separating out the policy costs that affect the wholesale/retail portion of the bill, the April 2014 report treated the network and wholesale/retail components of the bill equally, and also allowed the full impact of government policies on residential electricity prices to be seen.

4 Note that all years are expressed as calendar years.

2. Purpose and approach

This report provides updated information on the same topics through early 2017; namely, the extent to which residential retail electricity prices have changed in Victoria, and what has driven those changes.

Section 3.1 of this report presents information on the composition of and changes in the annual electricity bill of the average residential customer who does not use off-peak electric water heating in 1995 and from 2001 through 2017. This is the first time the report has presented information on prices in the current year. Doing so required the use of some additional data sources and analysis approaches.

Appendix A provides further detail on how the component costs were derived for 1995, 2001 through 2016, and for 2017. In undertaking the analysis presented in this study we have relied on publicly available data. Two of the primary sources used were:

- The Annual Pricing Proposals lodged by each of the Victorian electricity distribution companies with the Australian Energy Regulator (AER) - These documents provide information on the charges that the Victorian electricity distribution companies make to electricity retailers related to their residential customers. The amount charged is broken down into the following categories: transmission services, distribution services, metering charges and charges to recover the costs of the Premium Feed-in Tariff that was put in place by the Victorian government commencing on 1 November 2009 and the Transitional Feed-in Tariff that commenced on 1 January 2012, and which continued, though at a lower feed-in rate until 31 December 2016⁵.

5

Note that this does not include any other feed-in tariffs or other incentives offered by electricity retailers or the Commonwealth or local governments. Note also that the Transitional Feed-in Tariff closed to new customers on 31 December 2012, and the Premium Feed-in Tariff closed to new customers on 29 December 2011. Customers on the Transitional Feed-in Tariff were transferred to the current feed-in tariff, which is now administered by the Essential Services Commission (ESC) as at 1 January 2017. That tariff was set at \$0.05 per kWh for calendar year 2016; the 2017 tariff level will be announced at the end of February 2017. The Transitional Feed-in Tariff closed to new customers on 31 December 2012, but customers who entered that tariff prior to that date will continue to receive \$0.60 per kWh through 31 December 2023. The distribution businesses remain responsible for paying customers on the current feed-in tariff and the Premium Feed-in Tariff the applicable per-kWh amounts (see:

<http://delwp.vic.gov.au/energy/electricity/victorian-feed-in-tariff>)

- Information compiled by the Victoria Essential Services Commission (ESC) regarding the size of the average residential electricity bill in Victoria⁶. Starting in 2007, the ESC has published annual reports regarding the standing offers⁷ and market offers⁸ available in each of the distribution service areas within the state. This source was used for the years 2007 through 2016, but has not been published for 2017. Rather, for 2017, the average residential electricity bill was derived by interrogating the ESC's Victorian Energy Compare website and calculating the arithmetic average of the lowest market offer⁹ provided by each retailer in each distribution area.

Section 3.3 of this report includes a comparison of the components of residential electricity bills across the NEM states. The comparison provided in this report, like the December 2014 report, differs from the earlier versions due to the fact that retail electricity prices were fully de-regulated in South Australia on 1 February 2013, in NSW on 1 July 2014, and in southeast Queensland on 1 July 2015.

A full discussion of all of the sources of information and how they were used in the analysis is presented in Appendix A.

3. Findings

3.1. Changes in Victoria residential electricity prices from 1995 to 2017

In this analysis, we have assessed the components of the annual bill that would be incurred in each year by the average residential electricity customer (annual consumption of 4,000 kWh) who does not have off-peak electric water heating.

The components used in the analysis were as follow:

- Distribution charges, which are the charges for the use of the local distribution 'poles and wires' network;

⁶ The ESC provides information for two kinds of residential customers: customers on a single-rate tariff who do not use off-peak electric water heating (and with an annual average consumption of 4,000 kWh), and customers with off-peak water heating (with an annual average consumption of 4,000 kWh plus 2,500 kWh off-peak for water heating). The analysis presented in this paper is for single-rate consumers without electric water heating as this is by far the larger of the two groups.

⁷ 'Standing offers' are the gazetted retail tariffs that are available in each distribution service territory. From 2002 through 2008 these tariffs were set by the Essential Service Commission (for the first year or two) and subsequently by the Victorian Government. In both cases the regulated tariff was set based on the estimated costs incurred by electricity retailers in serving residential customers. Retail electricity prices were fully de-regulated as of 1 January 2009. After that time, while electricity retailers have still been required to provide a 'standing offer' to any customer who has not previously taken up a market contract, that offer is no longer reviewed nor does it need to be approved by the government or the regulator.

⁸ 'Market offers' include all electricity contracts offered by electricity retailers to residential consumers other than standing offers. There are generally a number of market offers available within each distribution service area, and a single electricity retailer will often provide more than one choice of market offer. In addition to the price to be charged for the electricity purchased by the customer, market offers often include a fixed term, in some cases an exit fee if the contract is terminated early, various types of discounts (e.g., for paying the bill on time) and other features and conditions.

⁹ Only market offers with flat (single-rate) prices were considered; market offers using time-of-use prices were not considered.

- Transmission charges, which are the charges for the use of the high-voltage transmission network
- Policy costs that are recovered in the network charges and include:
 - the costs required to comply with the Victorian government’s mandate that the distribution businesses roll-out advanced metering infrastructure (AMI) to all residential and small non-residential electricity consumers¹⁰
 - the costs of the Premium Feed-in Tariff that was put in place by the Victorian government commencing on 1 November 2009 and the Transitional Feed-in Tariff that commenced on 1 January 2012, and which continued, though at a lower feed-in rate until 31 December 2016
- The cost of purchasing electricity from the wholesale market at spot price,
- The charge for retail services, which includes¹¹
 - the cost of billing customers, processing their payments and answering their questions,
 - the cost of marketing to retain existing customers (including ongoing information activities) and to acquire new ones (including credit checks), acquiring information activities,
 - the retailer’s net margin (i.e., profit); and
- Policy costs that are recovered in wholesale or retail charges, including the costs associated with complying with relevant government policy initiatives such as
 - the Victorian Energy Efficiency Target (VEET), which commenced in January 2009 and requires retailers to achieve specified targets for improving the energy efficiency of their customers,
 - the Commonwealth Government’s Renewable Energy Target, which commenced in 2001 and requires retailers to ensure that a specified proportion of the electricity consumed by their customers comes from renewable sources, and
 - the carbon price that was levied on wholesale electricity generators from 2012 to 2014 as a result of Commonwealth government policy.

The average annual bill was calculated somewhat differently for different years in analysis period, as follows:

10 To accurately represent the incremental cost of this policy decision, the average annual cost incurred by the Victorian distribution businesses in providing standard metering services prior to the AMI decision was determined. That cost, \$20 per customer (in 2013 dollars), was removed from the costs of the AMI rollout, and added to DUOS charge (adjusted for inflation) in each year of the analysis. This recognises that, in the absence of that policy, the distribution businesses would still have incurred the cost of delivering standard metering and metering services, provides an accurate representation of the incremental costs of the government’s decision to rollout AMI, and ensures that the sum of the costs of the individual bill components equals the actual average bill of a residential customer that uses 4,000 kWh and does not have off-peak electric water heating.

11 These components of the retail charge are listed out for information purposes only. There is no readily accessible source of information about retailers’ operating costs or margins. The approach used in this analysis estimates retail charges by subtracting the other cost components (for which information is available), from a calculation of the retail bill based on the details of the market offer and the assumed annual consumption of 4,000 kWh.

- In 1995 the electricity industry in Victoria was vertically unbundled, and the five distribution businesses that had been created the previous year were privatised. Full retail competition had not yet been introduced and residential electricity prices were still fully regulated. The annual bill that would have been incurred for the consumption of 4,000 kWh (without electric water heating) was calculated with reference to the then applicable Maximum Uniform Tariff (converted to 2016 dollars). The same procedure was used in calculating the annual bill through 2001, as full retail competition was not introduced until 2002.
- From 2002 through 2016 the average annual residential electricity bill for a customer consuming 4,000 kWh without electric water heating was calculated with reference to the straight arithmetic average of the lowest market offer available from each retailer in each distribution area in the year in question¹². We used the market offers within each distribution area because significantly more residential consumers in Victoria purchase their electricity under a market offer as compared to a standing offer contract¹³. We then calculated a state-wide average annual bill by weighting the results in each distribution area by the number of customers in that distribution area.
- This same approach was used to estimate the 2017 annual electricity bill for the average residential electricity bill, but with one change: the ESC publication that provides market offers is not published until June, so the market offers for January 2017 were taken from the ESC's Victorian Energy Compare website.

Figure 1 on the following page shows the component and total costs of the average annual residential bill in 1995, 2001, 2002 and 2007 through 2017. The figures are shown in 2016 dollars to remove the effect of inflation.

Figure 2 presents the same information, but in percentage terms. That is, it shows the proportion of the average annual residential electricity bill that each component accounted for in each year. Table 3 in Appendix A presents the actual numbers that underlie both Figure 1 and Figure 2.

As can be seen in Figure 1, the annual bill of the average Victorian residential electricity consumer on a single rate tariff using 4,000 kWh per year has increased by \$391 (in 2016 dollars) from 2001 to 2017, which represents an increase of 37.8%¹⁴. However, as can be seen in Figure 2, the different components of the bill have not changed at the same rate over that timeframe.

Further detail on how the residential bill changed in several different time periods between 1995 and 2017 is provided in Section 3.2, which follows Figure 2.

12 It should be noted that, while the lowest market offer from each retailer operating in each distribution service area was used, this does not mean that the resulting set of market offers was the lowest set of market offers available in the service area

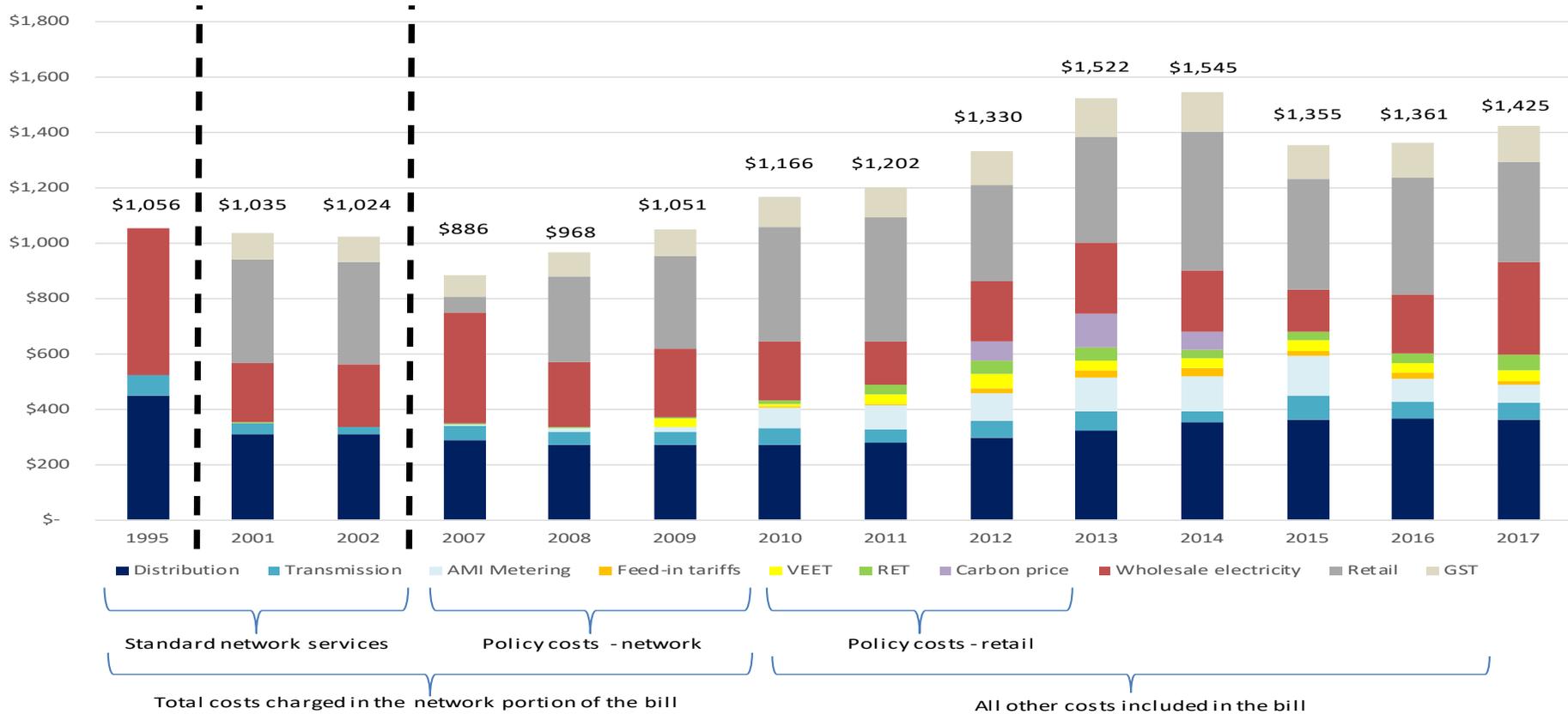
A simple arithmetic average of the undiscounted outcome of these market offers in each distribution area was used because no statistics are available regarding the number of residential consumers on each of the different market offers. Undiscounted offers were used because the availability of the discount often depends on actions the consumer may or may not have taken – such as paying their bill on time - and therefore we cannot say that the discounted price will always be received by the consumer.

13 Figures from the (then) Department of State Development, Business and Innovation indicated that by 2012 around 75% of the residential electricity customers in Victoria had moved from standing offers to market offers.

14 Appendix A provides the dollar values underlying the bar graphs in Figures 1 and 2.



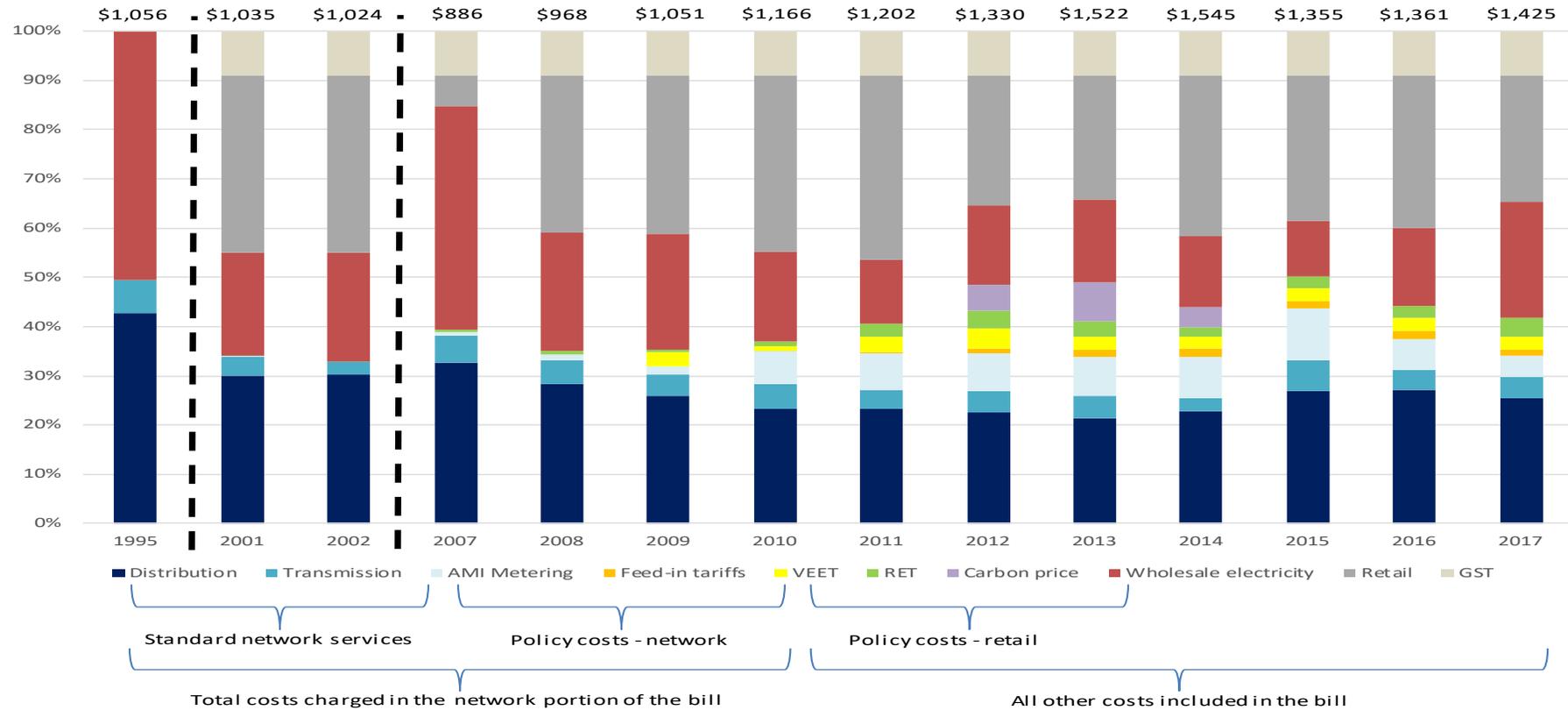
Figure 1: Composition (2016\$) of the annual residential electricity bill in Victoria (4,000 kWh; no electric off-peak hot water), 1995, 2001 & 2002, and 2007 to 2017



Note: The figures at the top of each bar show the total annual bill for a residential electricity customer in Victoria without electric off-peak water heating that uses 4,000 kWh over the course of the year.



Figure 2: Composition (%) of the annual residential electricity bill in Victoria (4,000 kWh; no electric off-peak hot water), 1995, 2001 & 2002, and 2007 to 2017 (2016\$)



Note: The figures at the top of each bar show the total annual bill for a residential electricity customer in Victoria without electric off-peak water heating that uses 4,000 kWh over the course of the year.

3.2. Changes in the bill in different time periods

Figures 3 through 7¹⁵ summarise the magnitude of the changes in the composition of the average residential electricity bill over four timeframes:

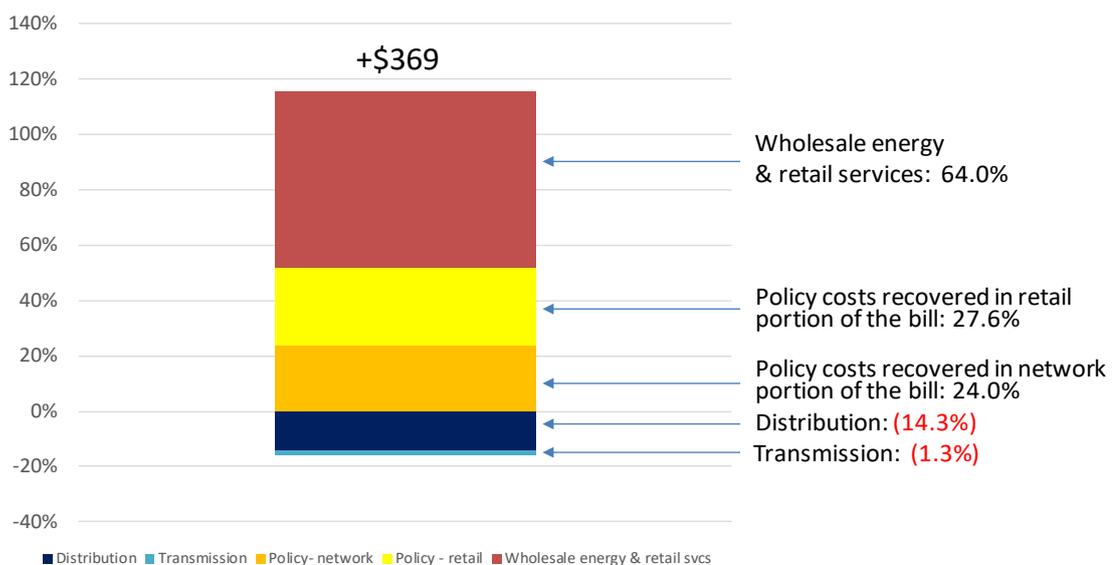
- 1995 to 2017, which represents the entire span of time since the distribution businesses were privatised;
- 2001 to 2017, which represents the entire span of time over which retail competition has existed in the residential electricity market;
- 2001 to 2008, which represents the period during which the Victorian government set a standard retail electricity price in each distribution area, but retailers were free to make market offers at different prices;
- 2008 to 2016, which represents the period during which the Victorian government no longer set a standard retail electricity price in each distribution area, but retailers were required to publish a gazetted tariff each year that would apply to customers who had never taken a market offer; and
- 2008 to 2017, which extends the time period above to include the gazetted tariffs and market offers available in January 2017.

Further detail on the drivers of the change in the average residential electricity bill in each of these timeframes is presented in the paragraphs that follow.

3.2.1. 1995 to 2017

Figure 3 shows the contribution of various factors to the change in the average residential electricity bill in Victoria from 1995, when the electricity industry in Victoria was vertically unbundled and the five distribution businesses were privatised, to the present (January 2017).

Figure 3: Contribution to change in the average residential electricity bill in Victoria from the privatisation of the distribution businesses to present, 1995 to 2017 (2016\$, inclusive of GST)



¹⁵ Figures 3 through 7 are inclusive of GST. The applicable GST has been allocated to each of the other bill components in order to illustrate the impact of increases in each component on the customer's total bill. It should be noted that the GST did not apply in 1995.

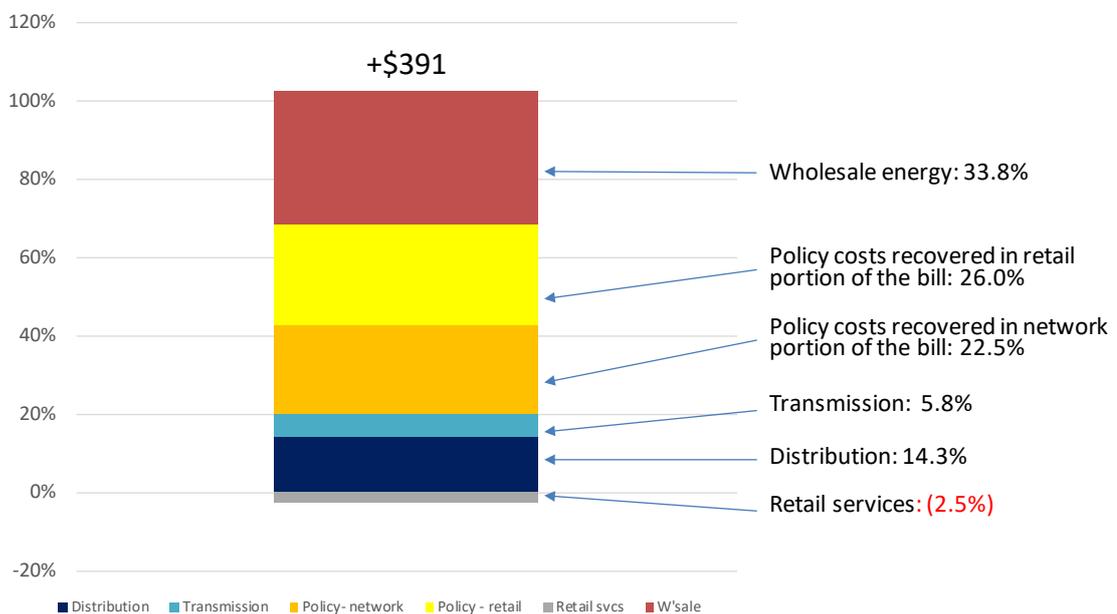
Figure 3 shows that:

- While the average residential bill has increased by \$369 between 1995 and 2017 - an increase of 34.9% -- the cost of distribution and transmission services have decreased in constant dollar terms;
- More specifically:
 - The cost of distribution services decreased by \$72 in constant 2016 dollars, a decrease of 11.7% over the period, and
 - The cost of transmission services decreased by \$5 in constant 2016 dollars, a decrease of 6.8% over the period;
- The cost of energy and associated retail services accounted for the largest portion, 64.0%, of the change in the average residential bill between 1995 and 2017; and
- The introduction of various policies - concerning energy efficiency, renewable energy and the rollout of advanced metering infrastructure (smart meters) - has also added a significant amount to the cost to the average residential bill.

3.2.2. 2001 to 2017

Figure 4 shows the contribution of various factors to the change in the average residential electricity bill in Victoria from the introduction of competition (2001) to the present (January 2017).

Figure 4: Contribution to change in the average residential electricity bill in Victoria from the introduction of FRC to present, 2001 to 2017 (2016\$, inclusive of GST)



Key observations from Figure 4 are that:

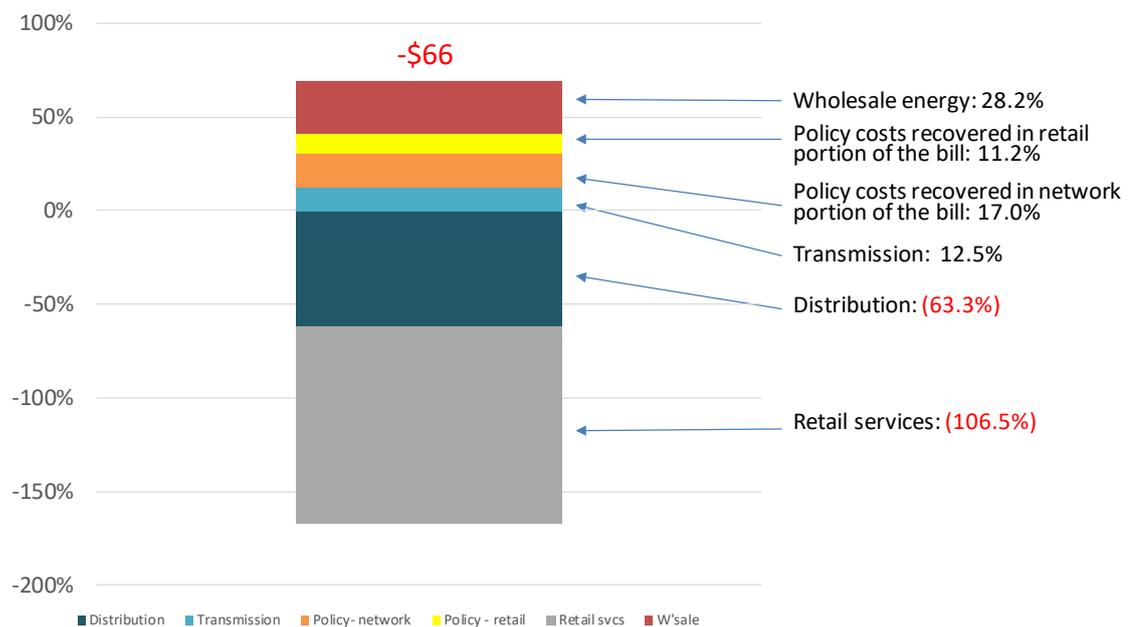
- The average residential bill - inclusive of GST - increased by \$391 (37.8%);
- Policy-related costs were the largest component - accounting for just under half (48.5%) - of the increase;
- Wholesale energy price increases accounted for the next largest share at 33.8%;
- Network costs - transmission and distribution combined - accounted for 20.2% of the increase; and

- The cost of retail services declined slightly over this period, which put a modest amount of downward pressure on the average annual residential bill over this timeframe.

3.2.3. 2001 to 2008

Figure 5 shows the contribution of these same factors to the change in the average residential electricity bill in Victoria during the period the government set regulated retail tariffs and retailers could offer different prices in their market offers (2001 to 2008).

Figure 5: Contribution to change in the average residential electricity bill in Victoria during the period the government set regulated retail tariffs and retailers could offer different prices in market offers. 2001 to 2008 (2016\$, inclusive of GST)



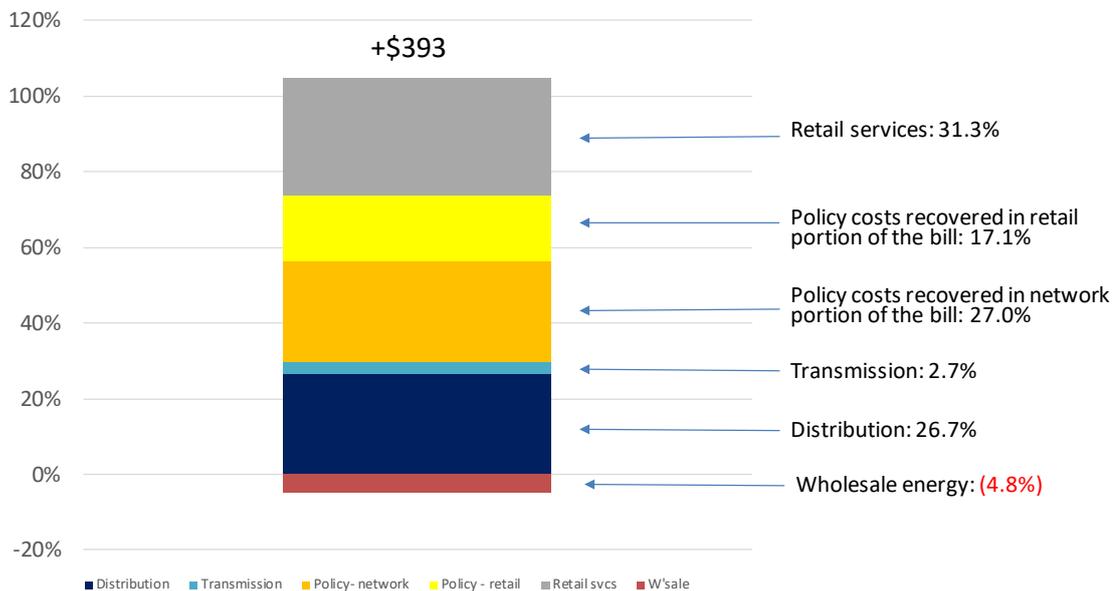
The results of this analysis indicate that:

- The average residential electricity bill decreased by \$66, a decrease of 6.4%;
- The biggest drivers of the decrease were significant falls in the retail services and distribution portions of the bill (decreases of \$64 and \$38 respectively); and
- These decreases were offset to some degree by increases in
 - Policy related costs (\$7), and
 - Wholesale energy costs (\$17).

3.2.4. 2008 to 2016

Figure 6 on the following page shows the contribution of the factors to the change in the average residential electricity bill in Victoria from the time the government ceased regulating retail tariffs through the end of 2016.

Figure 6: Contribution to change in the average residential electricity bill in Victoria since the full deregulation of retail tariffs, 2008 to 2016 (2016\$, inclusive of GST)



Examination of Figure 6 reveals that from the time electricity prices were fully de-regulated, starting in 2009, through 2016, the average residential bill increased by \$393, and that:

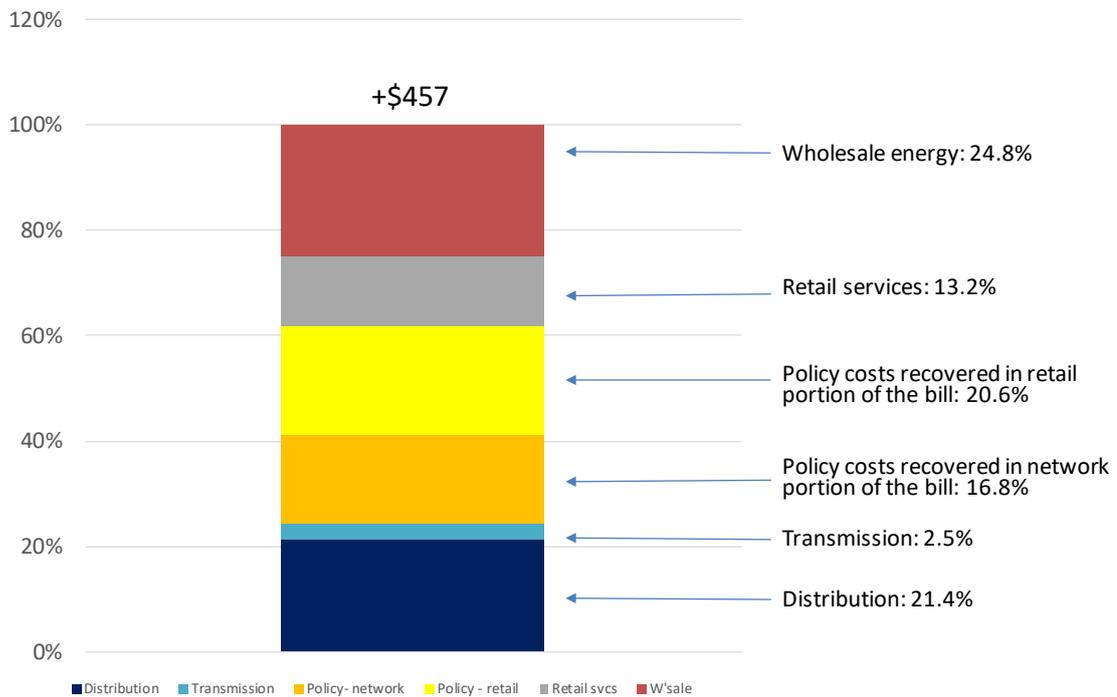
- Policy-related costs accounted for the largest source (44.1%) of this increase, of which:
 - Policy costs recovered in the network portion of the bill (for AMI and feed-in tariffs) accounted for 27.0% of the bill, and
 - Policy costs recovered in the retail portion of the bill (for VEET and the RET) accounted for 17.1% of the bill¹⁶;
- Retail services was the second largest contributor to the increase over this period at 31.3%;
- Network services accounted for almost as much at 29.4% (26.7% distribution and 2.7% transmission); and
- Wholesale energy prices declined and provided an offset to the increases noted above equivalent to 4.8% of the overall increase.

3.2.5. 2008 to 2017

Figure 7 on the following page extends the analysis shown in Figure 6 to early 2017.

¹⁶ Note that the carbon price, which was recovered in the retail portion of the bill, was not introduced until 2012 and was removed by 2015, so does not contribute to the change in bills as calculated by comparing the bills of 2008 and 2016.

Figure 7: Contribution to change in the average residential electricity bill in Victoria since the full deregulation of retail tariffs, 2008 to 2017 (2016\$, inclusive of GST)



In this period - which contains one more year than analysed in Figure 6, the average residential bill has increased by an additional \$64 to a total of \$457 since 2008. Of that total increase:

- Policy-related costs accounted for the largest source (37.4%) of this increase, of which:
 - Policy costs recovered in the network portion of the bill (for AMI and feed-in tariffs) accounted for 16.8% of the bill, and
 - Policy costs recovered in the retail portion of the bill (for VEET and the RET) accounted for 20.6% of the bill;
- Wholesale energy was the second largest contributor to the increase over this period at 24.8%¹⁷;
- Network services accounted for almost as much at 23.9% (21.4% distribution and 2.5% transmission); and
- Retail services accounted for the remaining 13.2%.

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This represents a significant change from the contribution of wholesale energy costs in the 2008 - 2016 timeframe, which is only one year shorter. There are at least two possible and related reasons for the magnitude of this change. For the 2008 to 2016 period, outturn wholesale energy costs were available at the time the analysis was undertaken. That was not the case for 2017. As a result, forward contract prices for 2017 were used to provide an estimate of wholesale energy costs. This represents a change in data source that could affect the outcome. In addition, forecast wholesale prices have, over the past six months or so, significantly increased relative to historic outturn charges due to a slight increase in energy demand and the withdrawal of generation capacity in response to the low wholesale market prices that have characterised the last several years. The most notable example of this in Victoria was Engie's announcement in November 2016 that the Hazelwood plant would close in March 2017.

3.2.6. Summary observations

Table 1 below summarises the changes that have taken place in the average annual residential retail electricity bill in several different time periods, and what drove those changes.

Table 1: Summary of the changes and causes of changes in average annual residential electricity bills in different timeframes

Bill component	Contribution to the change in the bill				
	1995 -2017	2001 -2017	2001 - 2008	2008 - 2016	2008 - 2017
Total change in the bill (2016\$)	\$369	\$391	(\$66)	\$393	\$457
Total change in the bill (%)	34.9%	37.8%	(6.4%)	40.6%	47.2%
Distribution	(14.3%)	14.3%	(63.3%)	26.7	21.4%
Transmission	(1.3%)	5.8%	12.5%	2.7%	2.5%
Policy costs recovered in network charges	24.0%	22.5%	17.0%	27.0%	16.8%
Policy costs recovered in wholesale or retail charges	27.6%	20.6%	11.2%	17.1%	20.6%
Wholesale energy costs		33.8%	28.2%	(4.8%)	24.8%
Retail charges	64.0%	(2.5%)	(106.5%)	31.3%	13.2%

As can be seen:

- The average residential electricity bill in January 2017 has significantly increased:
 - by 34.9% since 1995, when the industry was disaggregated and privatised, and
 - by 37.8% since retail competition was introduced.
- The major contributors to the change in the average annual residential bill since the industry was disaggregated and privatised (1995 to 2017) have been:
 - The cost of wholesale energy and retail services, which in combination contributed 64.0% of the increase;
 - The cost of policy measures associated with energy efficiency, renewable energy and the rollout of smart meters, which in total accounted for 51.6% of the increase; while
 - By contrast, the cost of network services has declined over the period with the contribution of distribution charges to the average annual residential bill showing a dramatic decline - from 42.7% of the bill in 1995 to 25.4% in 2017.
- The major contributors to the change in the average annual residential bill since competition was introduced (2001 to 2017) have been:
 - Policy-related costs, which were the single largest contributor, accounting for just under half, 48.5%, of the increase;

- Wholesale energy price increases, which accounted for the next largest share at 33.8%¹⁸;
- Network costs - transmission and distribution combined - which accounted for 20.2% of the increase.
- By contrast, the cost of retail services declined slightly over the period, which put a modest amount of downward pressure on the average annual residential bill over this timeframe
- The story differs, however, for different time periods:
 - From 2001 to 2008 - that is, from just before retail competition and during the period that the Victorian government set regulated tariffs - the average annual residential retail bill decreased by 6.4%;
 - By contrast, from 2008 to 2017 - that is, during the period residential electricity prices were fully de-regulated -- the average annual residential retail bill increased by 47.2%.
 - In particular, the results for any period are very sensitive to the values at the start and end points of the period. Where a particular cost component does not appear at either the start or end point, it has no effect on the change in the bill over the period. The carbon price is an example of this - it was introduced in 2012 and withdrawn in 2014, and therefore does not affect the absolute or percentage change of any of the time periods assessed in the analysis.
- Distribution costs have tended to contribute less to the increases in the bill than the share of the bill they represent.
 - Distribution charges actually decreased over the 1995 to 2017 and 2001 to 2008 time periods - by 14.3% and 63.3% respectively.
 - In all the other periods analysed (2001 to 2017, 2008 to 2016 and 2008 to 2017) distribution charges accounted for a lower than proportional increase in the annual bill of a residential customer using 4,000 kWh on a single-rate tariff¹⁹.
- Transmission charges have remained a minor and relatively stable part of the bill throughout the period.
- Wholesale energy prices have shown significant volatility over the 2001 to 2017 period, and this is reflected in their impact on the changes observed in the average annual residential bill across the various time periods analysed. For example, while changes in the wholesale price accounted for (4.8%) of the change in these bills between 2008 and 2016, they accounted for 24.8% of the change between 2008 and 2017.
- Retail charges have had an even more varied effect on the average residential bill. While retail charges have had a modest downward impact of (2.5%) on bills from 2001 to 2017, they showed a dramatic downward impact (106.5%) in the 2001 to 2008 period, followed by a contribution of 31.3% to the increase between 2008 to 2016, but only 13.2% in the 2008 to 2017 period.

¹⁸ As noted in footnote 16 above and further discussed in the next dot point, this result may be influenced by the fact that (a) a different approach was used to assess wholesale energy costs for 2017, and (b) 2017 is an endpoint in this timeframe, and as such has significant impact on the calculation of the relative change in bill components.

¹⁹ That is, while distribution charges accounted for 33.1% of the bill in 2001, 28.2% in 2008 and 25.4% in 2017, they accounted for only 14.3% of the change in the bill between 2001 to 2017 and 21.4% of the change in the bill between 2008 and 2017.

- By contrast, the cost of government policy initiatives associated with improved environmental outcomes, energy efficiency and advanced metering have shown a relatively consistent and positive impact on the increase in the annual electricity bill of residential customers. They have contributed about half of the increase observed between 1995 and 2017, and 2001 and 2017 (51.6% and 48.5% respectively), and have contributed between 28.2% and 44.1% of the increase in each of the other three periods analysed.

However, in considering the impact of policy costs on the bill it must also be remembered that a primary function of government is to identify and enact policies and programs that achieve governmental objectives, and deliver benefits to society - and this was certainly true of the policies and programs that have been taken into account in this analysis. The carbon price was acknowledged as increasing the cost of electricity generated from fossil fuels, but was enacted to reflect the environmental cost of carbon emissions and improve the competitiveness of less carbon-intensive forms of electricity generation. Government policy associated with the carbon price also included compensation payments to lower income households in order to mitigate the impacts of the carbon price on their electricity bills. That compensation is not reflected in this analysis.

The RET and the Premium Feed-in Tariff were implemented for a similar reason - to encourage the competitiveness of alternative energy sources and thereby reduce the carbon intensity of the electricity sector and global warming. As noted previously, the RET (and the LRET) and the VEET (which was implemented to reduce greenhouse gas emissions and assist end-use customers in reducing their electricity bills) have also been shown to put downward pressure on wholesale electricity prices. Those impacts are reflected in the wholesale electricity prices that have been used in this report, but they have not been separately quantified. Other benefits that these policies may have produced - and especially any benefits that do not affect electricity price - have not been quantified or otherwise captured in this analysis. In short, while we have been explicit about the costs of these policies and programs, their benefits have not been made explicit.

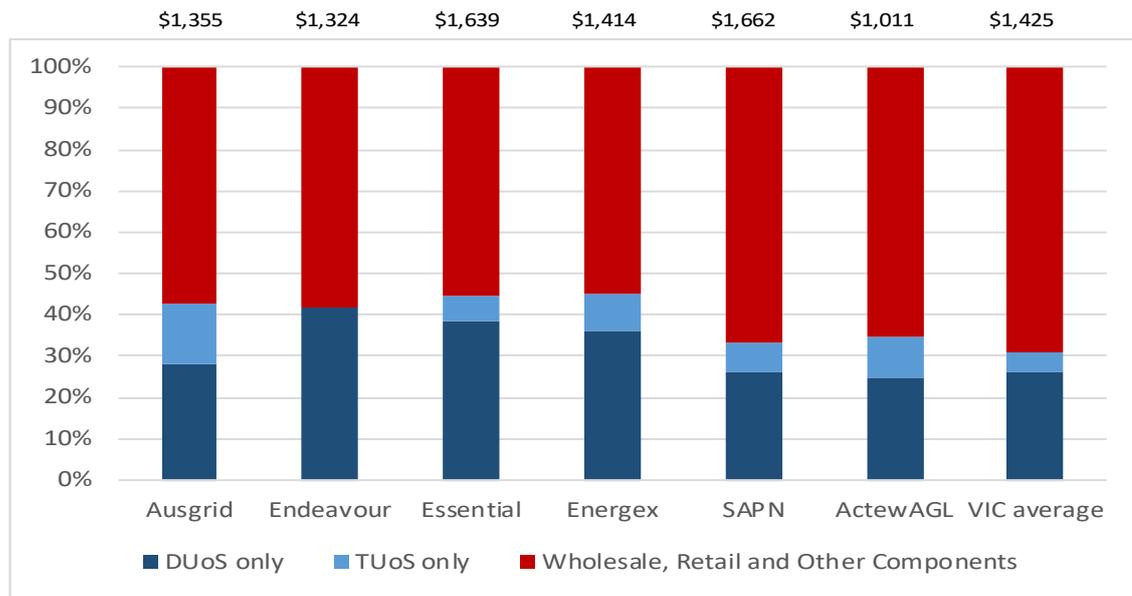
There is also a question of timing. In many cases the costs associated with the implementation of a policy or a program will be largely incurred upfront while the benefits accrue over time. The AMI roll-out is a good example of this. The costs of the meters and associated IT and communications systems required under the roll-out had to be paid up front, while most of the benefits are expected to be obtained over time, with a relatively smaller proportion of them occurring in the early years. As a result, the program will put very little downward pressure on prices in the early years to offset the costs incurred in their implementation. And, as in the case of the VEET, while the costs of the AMI roll-out have been explicitly identified in this analysis, the benefits of the program will be subsumed within changes observed in distribution charges and possibly wholesale energy prices²⁰.

20 Further information on the realised and anticipated benefits of the AMI program have been documented by the Department.

3.3. Comparison with other states

This section of the report compares the composition and size of the annual electricity bill of a residential customer that uses 4,000 kWh in Victoria with the composition and size of the bill of a residential customer using the same amount of electricity in the other NEM states²¹. In all cases, the comparison is for customers on single-rate tariffs (i.e., customers without controlled electric water heating). Figure 8 compares the composition of the bill of an average residential consumer in each of the NEM jurisdictions in January 2017.

Figure 8: Composition of the annual bill of a single-rate residential customer that uses 4,000 kWh (inclusive of GST²²) across the NEM states²³, January 2017²⁴



21 A constant annual consumption of 4,000 kWh has been used to compare the level of charges in each state, rather than comparing the average residential bill within each state. This is because there are a number of factors that affect total consumption, including climate, which affects heating and cooling loads, and the availability of other energy sources including gas (and, increasingly, solar energy), which affects the extent to which electricity is used to meet the annual energy needs of households in different areas. Use of a constant consumption volume shows what the bill – and its component charges - would be in each state.

Previous versions of the report included consideration of policy-related costs in the comparison across states. This information was readily available from the determinations that set the regulated residential electricity tariffs in other states. However, retail electricity prices were fully de-regulated in South Australia on 1 February 2013, in NSW as of 1 July 2014, and in southeast Queensland as of 1 July 2015. Without the one-stop source in information in each state that was provided in the determination of the regulated tariff, the only way to develop a disaggregation of the typical residential bill would be to recreate the analyses undertaken in the regulatory processes in each state. This was not possible within the time and budget available for this project.

22 The applicable GST has been allocated to each of the other bill components in order to illustrate the impact of increases in each component on the customer's total bill.

23 Note that no information was available regarding the breakdown of Endeavour Energy's NUoS charges. As a result, the distribution component shown for Endeavour Energy also includes the charges for the other network components of a 4,000 kWh annual residential retail bill in its service area:

24 Note that the figures for SAPN, the NSW networks, Energex and ActewAGL are based on the arithmetic average of the market offers available from the NEM's three largest retailers (AGL, Origin Energy and EnergyAustralia) in each of the respective distribution service areas.

The primary purpose of Figure 8 is to compare the proportion of the annual bill of a residential customer in different distribution service areas that is on a single-rate tariff and uses 4,000 kWh over the course of 2017. As such it presents the proportion of the bill represented by:

- Distribution use of system (DUoS) charges, which cover the costs of all prescribed services that the distribution business is required to provide by applicable regulations,
- Transmission use of system (TUoS) charges, which cover the costs of all prescribed services that the distribution business is required to provide by applicable regulations,
- All other charges, which include standard metering charges (the responsibility for which will transfer from the relevant distribution business to the retailer serving the customer beginning in December 2017), all costs for the wholesale energy used by the customer and all charges associated with the services provided by the retailer, and all costs associated with government policy (regardless of the level of government involved) concerning energy efficiency, renewable energy use, and advanced metering infrastructure.

As can be seen, the proportion of the annual bill of such a residential customer in Victoria is very close to the lowest of the distribution businesses shown in Figure 8. Only ActewAGL and SAPN DUoS charges are a lower proportion of residential bill, and they are only marginally lower than in Victoria. However, it should be noted that in the case of SAPN this is primarily the result of the very high wholesale energy costs pertaining in South Australia and their impact on the retail bill, rather than a reflection of SAPN's distribution charges being low in absolute terms.

It is also the case that the proportion of the bill represented by the combination of DUoS and TUoS charges is lower in Victoria than in any of the other distribution service areas analysed.

Table 2 below provides a comparison of the absolute cost of the distribution charges that would be paid by a single-rate residential electricity customer using 4,000 kWh in Victoria and other NEM distribution service areas. As can be seen, the annual bill of such a household would vary significantly across the distribution companies in the NEM, with the average bill in Victoria being the second lowest in absolute terms.

Table 2: Distribution charges in different NEM areas for a single-rate residential electricity customer that uses 4,000 kWh in January 2017 (inclusive of GST²⁵)

Distribution Area	Total Annual Bill (2016\$)	Distribution Portion of the Bill (2016\$)	Distribution Portion of the Bill (%)
VIC average	\$1,425	\$376	26.4%
Ausgrid	\$1,355	\$381	28.1%
Endeavour Energy	\$1,324	\$553	41.8%
Essential Energy	\$1,639	\$634	38.7%
Energex	\$1,320	\$511	36.1%
South Australia Power Networks	\$1,662	\$436	26.2%
ActewAGL	\$1,011	\$250	24.7%

²⁵ The applicable GST has been allocated to each of the other bill components in order to illustrate the impact of increases in each component on the customer's total bill.

Appendix A: Detail of residential electricity price changes in Victoria, 1995 - 2017

A.1 Changes in the average residential electricity bill in Victoria from 1995 to 2017

Table 3 on the following page presents the data on which Figure 1 and Figure 2 are based. It shows the component and total costs of the annual bill from 1995 to 2017 for a residential electricity consumer in Victoria on the average market offer who uses 4,000 kWh annually and who does not have electric off-peak water heating. The dollar values are shown in 2016 dollars to remove the effects of inflation. It also shows the total increase and percentage increase of each component of the average residential bill between 1995 and 2016.

The market offer figures for 2017 are based on analysis of non time-of-use offers from the ESC's energy comparator website²⁶ assuming a 4000kWh residential customer. A large list of market offers (over 100) were downloaded for each distribution business. Each listed Retailer's best market offer was used to form an average market offer for that distribution region. Each distribution business' average market offer was then weighted by the number of residential customers used elsewhere in this report to determine the Victorian average market offer.

The market offer figures used for 2007 through 2016 are the straight arithmetic averages of the market offers included in the ESC's annual reports on retail electricity (and gas) prices and performance. It is our understanding that these market offers represent the lowest market offer available from each retailer in each distribution area. No such organised source of information is available regarding the market prices offered in the years 2002 through 2006. For those years, we calculated the straight arithmetic average discount that was offered in the market in 2006 from the information available for that year from the ESC. This was approximately 5%. This discount was then applied to all years from 2002 through 2006. The discount was calculated on the total bill, but the amount of the discount was subtracted from the wholesale energy and retail services component of the bill in each year. This reflects the fact that these are the only components of the bill that the retailer can reduce on its own.

Notes regarding how the cost of each of the components of the bill was calculated follow the table.

²⁶ , <https://compare.switchon.vic.gov.au/> -, accessed on 24th of January.



Table 3: Composition of the annual bill of a residential electricity customer in Victoria using 4,000 kWh (w/o electric off-peak hot water) 1995, 2001, 2002 and 2007 to Jan 2017 (2016 dollars)

Bill component	1995	2001	2002	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Jan 2017	% of bill		Total change	
															Jan 2017	2016\$	2001 to 2017	2016\$
Network related charges																		
Distribution (including std metering)	\$451	\$311	\$309	\$289	\$273	\$272	\$271	\$280	\$299	\$323	\$354	\$364	\$369	\$362	25.4%	\$51	16.3%	
Transmission	\$72	\$40	\$28	\$50	\$48	\$45	\$60	\$47	\$60	\$70	\$40	\$87	\$57	\$61	4.3%	\$21	51.5%	
<i>Subtotal 'standard' network svcs</i>	<i>\$523</i>	<i>\$351</i>	<i>\$337</i>	<i>\$339</i>	<i>\$321</i>	<i>\$317</i>	<i>\$330</i>	<i>\$327</i>	<i>\$358</i>	<i>\$393</i>	<i>\$394</i>	<i>\$451</i>	<i>\$426</i>	<i>\$423</i>	<i>29.7%</i>	<i>\$71</i>	<i>20.3%</i>	
Feed-in tariffs	\$0	\$0	\$0	\$0	\$0	\$0	\$1	\$3	\$15	\$24	\$28	\$19	\$23	\$16	1.1%	\$16	NA	
AMI metering	\$0	\$0	\$0	\$6	\$11	\$18	\$78	\$89	\$100	\$121	\$127	\$142	\$85	\$65	4.5%	\$65	NA	
<i>Subtotal network policy costs</i>	<i>\$0</i>	<i>\$0</i>	<i>\$0</i>	<i>\$6</i>	<i>\$11</i>	<i>\$18</i>	<i>\$78</i>	<i>\$92</i>	<i>\$115</i>	<i>\$146</i>	<i>\$155</i>	<i>\$162</i>	<i>\$107</i>	<i>\$81</i>	<i>5.6%</i>	<i>\$81</i>	<i>NA</i>	
Subtotal all network related costs	\$523	\$352	\$337	\$456	\$541	\$584	\$629	\$604	\$564	\$639	\$724	\$552	\$636	\$699	35.3%	\$152	43.2%	
All other charges																		
Wholesale electricity costs	\$533	\$216	\$226	\$402	\$233	\$246	\$213	\$156	\$215	\$257	\$223	\$154	\$215	\$336	23.6%	\$120	55.6%	
Retail services		\$373	\$367	\$54	\$309	\$338	\$416	\$449	\$349	\$382	\$501	\$399	\$421	\$364	25.5%	-\$9	-2.4%	
<i>Subtotal wholesale and retail costs</i>	<i>\$533</i>	<i>\$588</i>	<i>\$593</i>	<i>\$456</i>	<i>\$541</i>	<i>\$584</i>	<i>\$629</i>	<i>\$604</i>	<i>\$564</i>	<i>\$639</i>	<i>\$724</i>	<i>\$552</i>	<i>\$636</i>	<i>\$699</i>	<i>29.1%</i>	<i>\$111</i>	<i>18.9%</i>	
VEET	\$0	\$0	\$0	\$0	\$0	\$30	\$12	\$37	\$54	\$38	\$36	\$35	\$34	\$36	2.5%	\$36	NA	
RET	\$0	\$0	\$1	\$4	\$7	\$7	\$10	\$33	\$48	\$49	\$31	\$32	\$34	\$57	4.0%	\$56	NA	
Carbon price	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$71	\$120	\$64	\$0	\$0	\$0	0.0%	\$0	NA	
<i>Subtotal retail policy costs</i>	<i>\$0</i>	<i>\$0</i>	<i>\$1</i>	<i>\$4</i>	<i>\$7</i>	<i>\$37</i>	<i>\$23</i>	<i>\$70</i>	<i>\$172</i>	<i>\$207</i>	<i>\$131</i>	<i>\$67</i>	<i>\$68</i>	<i>\$93</i>	<i>6.5%</i>	<i>\$92</i>	<i>NA</i>	
Subtotal non-network related costs	\$533	\$589	\$595	\$460	\$549	\$621	\$651	\$674	\$736	\$845	\$855	\$620	\$704	\$792	55.6%	\$203	34.5%	
GST	\$0	\$94	\$93	\$81	\$88	\$96	\$106	\$109	\$121	\$138	\$140	\$123	\$124	\$130	9.1%	\$36	37.8%	
Total	\$1056	\$1034	\$1024	\$886	\$968	\$1051	\$1166	\$1202	\$1330	\$1522	\$1545	\$1355	\$1361	\$1425	100.0%	\$391	37.8%	

A.2 Calculation of the bill components - 1995

Distribution and Transmission

Distribution and transmission charges, collectively referred to as Network Use of System (NUoS) charges, for 1994/95 were calculated on a per-kWh basis from the schedule of prices for each Victorian electricity distribution business as outlined in Attachment 10 of the 'Victorian Electricity Supply Industry Tariff Order' ('Tariff Order'), dated Friday 30 June 1995. Multiplication by 4,000 kWh provided the annual NUoS cost for an average residential customer in Victoria that does not use off-peak hot water.

The underlying tariffs have been cross-checked against a document entitled 'Network Tariffs for Use of Each Distributor's Distribution System for the Financial Year Ending 30 June 1995', which was supplied by Citipower and Powercor. To derive a Victoria-wide weighted-average NUoS charge we applied the same weightings that have been used in all other parts of this report (that being, the proportion of residential customers in each distribution business' area).

We then calculated the Victoria-wide weighted-average transmission charge on a per-kWh basis based on PowerNet's overall revenue requirement, as outlined in Attachment 6 of the aforementioned Tariff Order, plus VPX's fees relating to the 'operation and planning of the Transmission system', as outlined in Clause 4.2.1(a) of the aforementioned Tariff Order. This revenue requirement has been converted to a per-kWh charge, based on the volumes outlined on page 57 of that 'Tariff Order'. This per-kWh TUoS charge was then multiplied by 4,000 kWh to estimate the total cost of transmission services delivered to the average residential electricity customer in Victoria.

The weighted average annual Victoria-wide distribution charge was then calculated simply as the weighted-average Victoria-wide NUoS charge *minus* the weighted-average Victoria-wide transmission charge.

All figures were converted from nominal dollars to 2016 dollars.

Note that all costs associated with electricity meters and metering were included in the distribution charges in 1994/95.

Wholesale electricity costs and retail services

The cost of wholesale electricity and retail services was calculated by determining the total bill that would have been incurred for the consumption of 4,000 kWh under the then applicable Maximum Uniform Tariff (converted to 2016 dollars) and subtracting the NUoS cost as calculated above.

Note that the wholesale electricity market did not formally exist in 1994/95; all electricity was produced by the five state-owned generation companies that had been created in the break-up of the State Electricity Commission Victoria, and which were subsequently sold to private investors.

Other cost components

Note that there were no other material cost components in the residential electricity bill of 1994/95. The GST had not yet been instituted, and there were no material environmental or metering policy initiatives that were explicitly recovered in the electricity tariff.

A.3 Calculation of the bill components - 2001 through 2017

Distribution

Distribution costs have been based on the published Distribution Use of System (DUoS) tariffs for single rate customers, multiplied by the assumed average residential consumption of 4,000 kWh per annum. Where a tariff had a block or seasonal component to it, we used information provided by the businesses to split usage between those different charging parameters. Distribution costs include the estimated cost of providing single-element accumulation meters to customers - see the discussion below on AMI metering for information on how the costs of these meters were derived.

Transmission

Transmission costs are based on the published Transmission Use of System (TUoS) tariffs for single rate customers multiplied by the assumed average residential consumption of 4,000 kWh per annum.

AMI Metering

The costs associated with the deployment of interval and smart (AMI) metering is estimated based on the regulatory filings that the distribution businesses were asked to provide starting in 2006. These filings included all meter-related costs - both those related to the deployment of interval and smart meters and those related to the distribution businesses' on-going costs associated with accumulation meters. Information on the first years of this timeframe - when accumulation metering still represented the vast majority of all metering costs being incurred - were used to estimate the on-going costs of metering had the deployment of interval and smart metering not been undertaken. Those costs are included in the 'Distribution' cost line in the table, as they are part of the 'standard' network services. The remainder of the costs associated with metering in the distribution businesses' regulatory filings are assumed to reflect the costs of AMI and appear on this line.

Feed-in tariffs

The cost of feed-in tariffs is based on the published Premium Feed-in Tariffs (PFIT) tariffs for single-rate customers multiplied by the assumed average residential consumption of 4,000 kWh per annum.

Victorian Energy Efficiency Target (VEET)

The cost of the VEET is based on the reported volume of certificates created between 2009 and 2011, multiplied by the volume-weighted average monthly price of those certificates. This dollar value (converted to 2016 dollars) is then divided through by the number of residential customers in Victoria in each of those years, to determine the amount of money to be included in the retail portion of the bill of the average residential customer in order to recover the costs of the VEET in each year. For 2012, the cost is based on the VEET target of 5.4 million certificates per annum, multiplied by the volume-weighted average monthly price of those certificates.

This dollar value (converted to 2016 dollars) is divided by the total number of residential and small commercial customers in that year.

For 2013 and 2014, the cost is based on the VEET target of 5.4 million certificates per annum, multiplied by an estimate of the weighted average certificate price of \$17 per certificate. This total dollar value (which is in 2016 dollars) has been divided by an estimate of the number of residential and small commercial customers in 2013 and 2014, which in turn is based on each of the distribution business' RIN data. For 2015 through 2016, the cost is based on the VEET target of 5.4 million certificates per annum, whilst for 2017, is based on 5.9 million, with this based on information provided by the Department²⁷. The cost per certificate in these years has been estimated at \$17 per certificate. This total dollar value (which is in 2016 dollars) has been divided by an estimate of the number of residential and small commercial customers in 2015, 2016 and 2017, which in turn is based on applying the historical actual customer growth rate between 2014 and 2015.

The reason that small commercial customers are allocated a portion of costs from 2012 onwards is that prior to 2012 only residential customers were eligible to participate in the VEET, and we have therefore assumed that small commercial customers would not be allocated any costs in those years. In addition to the certificate costs, we have also estimated the retailers' administrative costs by multiplying the targeted number of certificates in each year by the estimated administrative costs per certificate (inflated to 2016 dollars). This administrative cost is based on information derived from *Analysis of Compliance Costs for a National Energy Savings Initiative*, Final Report for the Department of Climate Change and Energy Efficiency, December 2012) available at www.ret.gov.au/energy/efficiency/savings/nesi_consultant/Pages/index.aspx.

Renewable Energy Target (RET)

The RET has taken several forms. It commenced in 2001 as the Mandatory Renewable Energy Target (MRET). In 2011 it was split into two components, the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). The LRET encourages the deployment of large-scale renewable energy projects such as wind farms, while the SRES supports the installation of small-scale systems, including solar panels and solar water heaters.

For the period 2001 to 2012, we have estimated historical REC prices, which applied to the MRET and (are also used for the LRET) in each year based on information published in the AER's 2012 *State of the Market Report*. These prices, converted into 2016 dollars, have been multiplied by the Renewable Power Percentages that have been published by the Clean Energy Regulator that applied in each year, as well as the estimated average residential consumption used throughout other parts of this assignment to work out the annual cost per average residential customer. For 2013 through 2015, we used the same methodology, except that the price was based on the Clean Energy Regulator's published estimate (which is required under Regulation 22ZH) of the volume-weighted average market price for a large-scale generation certificate (LGC) in those years. For 2016 and 2017, we used information published by the Independent Competition and Regulatory Commission²⁸.

²⁷ <http://www.delwp.vic.gov.au/energy/legislation/energy-saver-incentive>.

²⁸ ICRC, *Final decision - Retail electricity price recalibration 2016-17, Standing offer prices for the supply of electricity to small customers, Report 2 of 2016*, June 2016, page 15.

The SRES cost in the average bill (for 2011 through 2014 only) is based on the Small-scale Technology Percentage (which is published by the Clean Energy Regulator on its website) for each year from 2011, multiplied by the estimated certificate price in each of those years, multiplied by the average residential consumption used throughout other parts of this assignment. Estimated average prices range from between \$32.50 per certificate (2012) to \$37.50 per certificate (2013) to between \$38.50 to \$40.00 per certificate between 2014 and 2017. A variety of sources has been used, depending on availability, with the 2016 and 2017 information based on published information from the ICRC²⁹, the 2013 information based on a sample of information sourced from a publicly available report on the EUAA's website (<http://www.euaa.com.au/green-market-prices/>) and the 2014 information based on published information from Green Energy Markets. The RET cost in 2011 through 2017 was calculated as the addition of the LRET and the SRES costs.

Carbon price

The carbon price first came into effect in July 2012. For the 2012 calendar year, the cost of the carbon price in an average residential bill is based on the sum of total emissions in the Victorian region between 1 July 2012 and 31 December 2012, multiplied by the applicable carbon price of \$23 per tonne. This total dollar figure (converted to 2016 dollars) was then divided through by the total amount of energy sent out in the Victorian region *across the entire year* (adjusted for an estimate of losses). This average per-MWh carbon cost has been multiplied by the average residential consumption used throughout other parts of this assignment. A similar process has been adopted for 2013 and 2014, except that for 2014, the impact of the carbon price ceases as at 30 June, 2014. The annual carbon price was then applied to the average residential consumption used throughout the remainder of this assignment. Total emissions have been derived from published AEMO data (<http://www.aemo.com.au/Electricity/Settlements/Carbon-Dioxide-Equivalent-Intensity-Index>), namely, the Carbon Dioxide Equivalent Intensity Index (CDEII), which combines sent-out metering data with publicly available generator emission and efficiency data to provide a National Electricity Market-wide Carbon Dioxide Equivalent Intensity Index. It is calculated on a daily basis under a formal framework contained within the National Electricity Rules.

Wholesale electricity costs

Wholesale electricity costs are based on published wholesale price information in Victoria for every half hour going back to 2001 (from NEO). This half hourly price is multiplied by the estimated proportion of the average residential consumption used through this assignment (4000kWh) in that half hour, with this then summated over the year. This summated cost is adjusted up by the loss factors applied in each region.

To allocate the average residential consumption to each half hour period of each year, we have calculated the proportion of each distribution business' Net System Load Profile that falls in that half hourly period. This percentage was multiplied by 4000 kWh to estimate the amount of load in that half hourly period.

For 2017, we used published information from the ASX regarding Calendar 2017 contract prices as at 24 January 2017.

29

ICRC, *Final decision - Retail electricity price recalibration 2016–17, Standing offer prices for the supply of electricity to small customers, Report 2 of 2016*, June 2016, page 16

Retail services

The cost of the retail services portion of annual bill was calculated by subtracting the sum of the other items above from the annual bill of the average residential customer as calculated from state-based regulatory determinations or other publications.

NA (not applicable)

Where there were no charges for a cost component in 1995, it is not possible to calculate a percentage increase (because the denominator of the calculation - that is, the level of charge in the initial year - is zero, and therefore the value of the calculation is undefined).